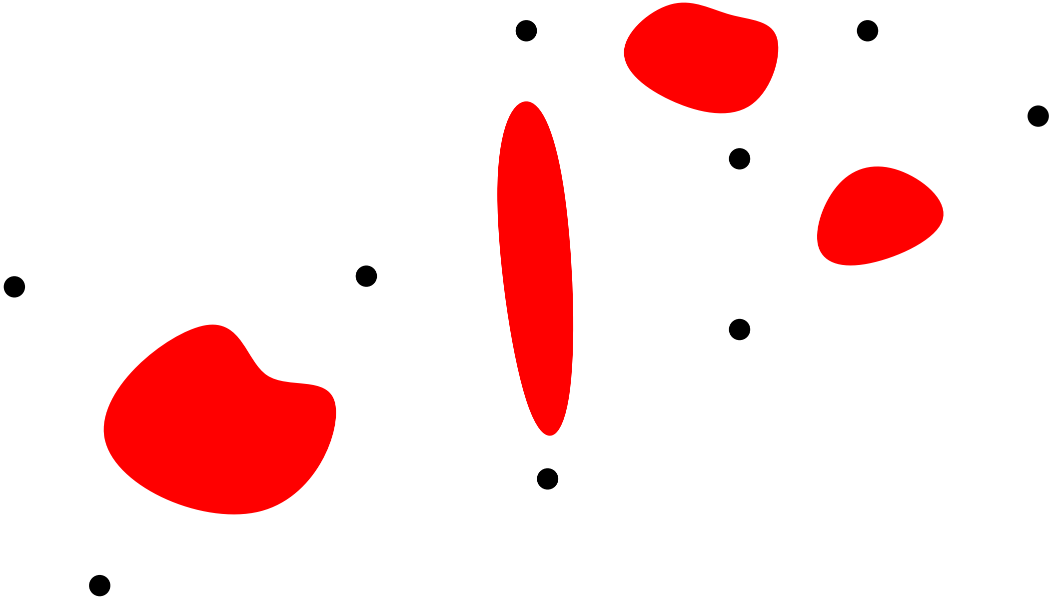
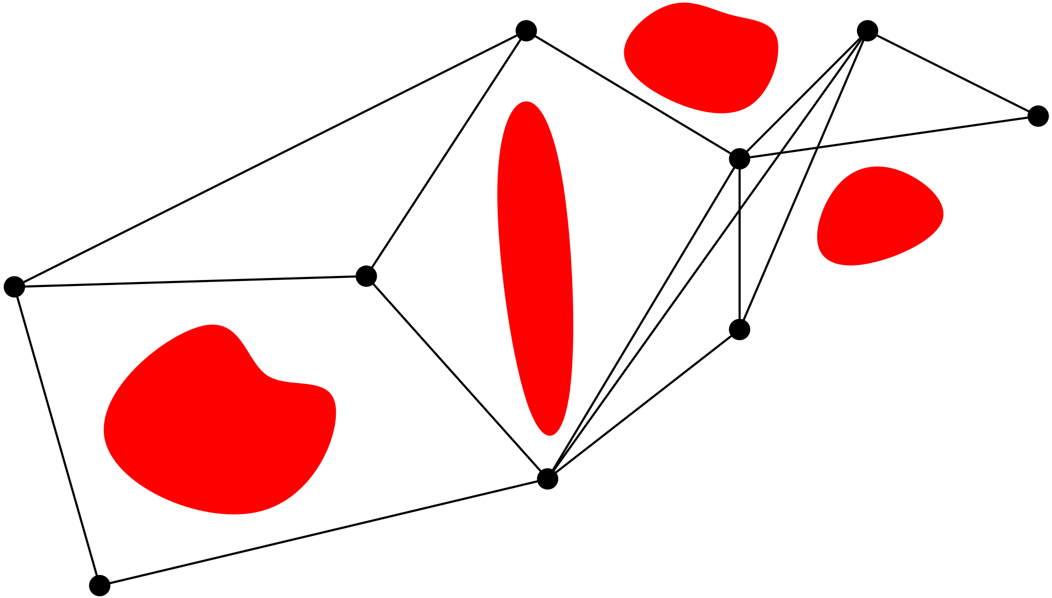
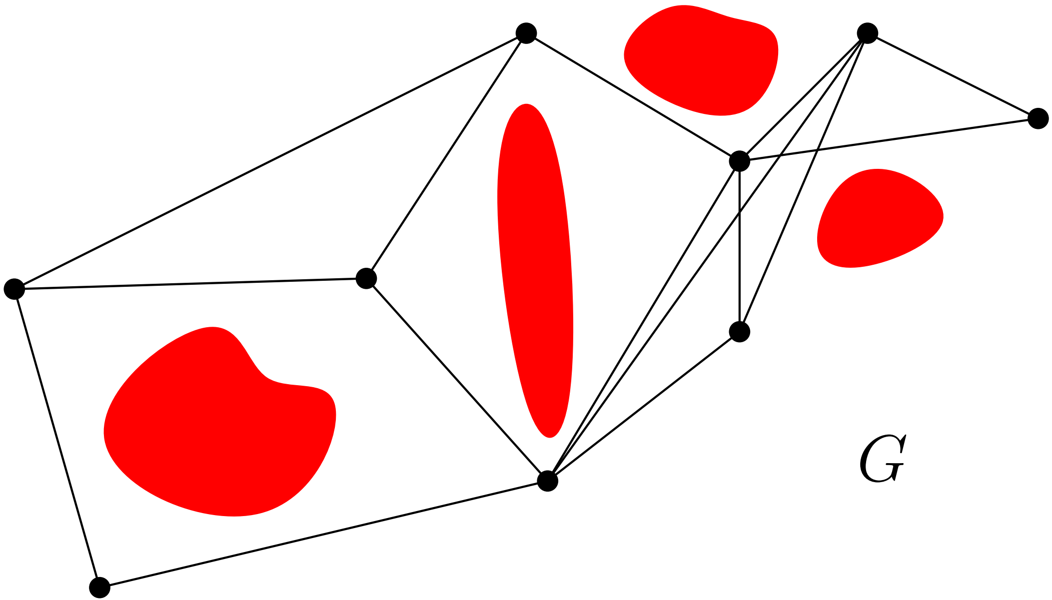
Obstacle Number

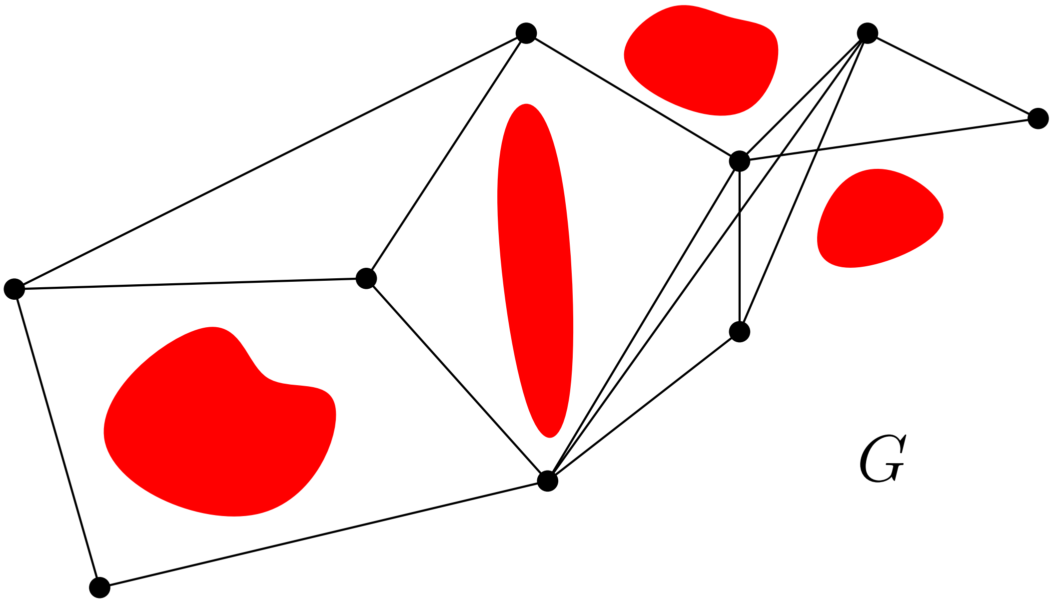
Jędrzej Hodor

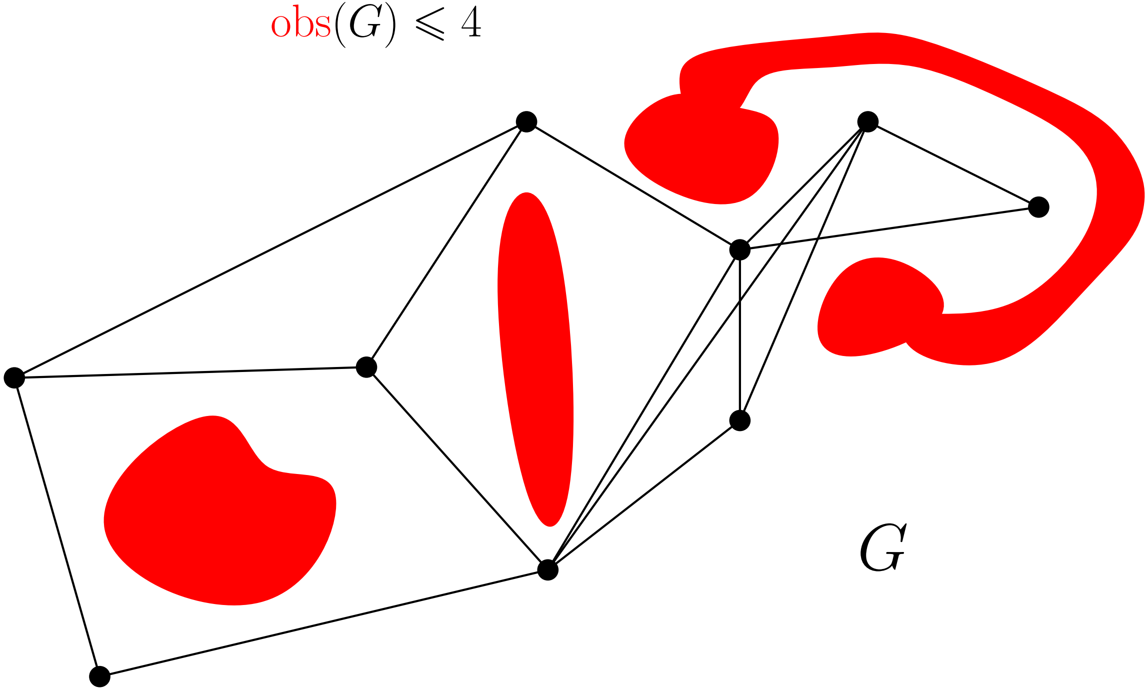


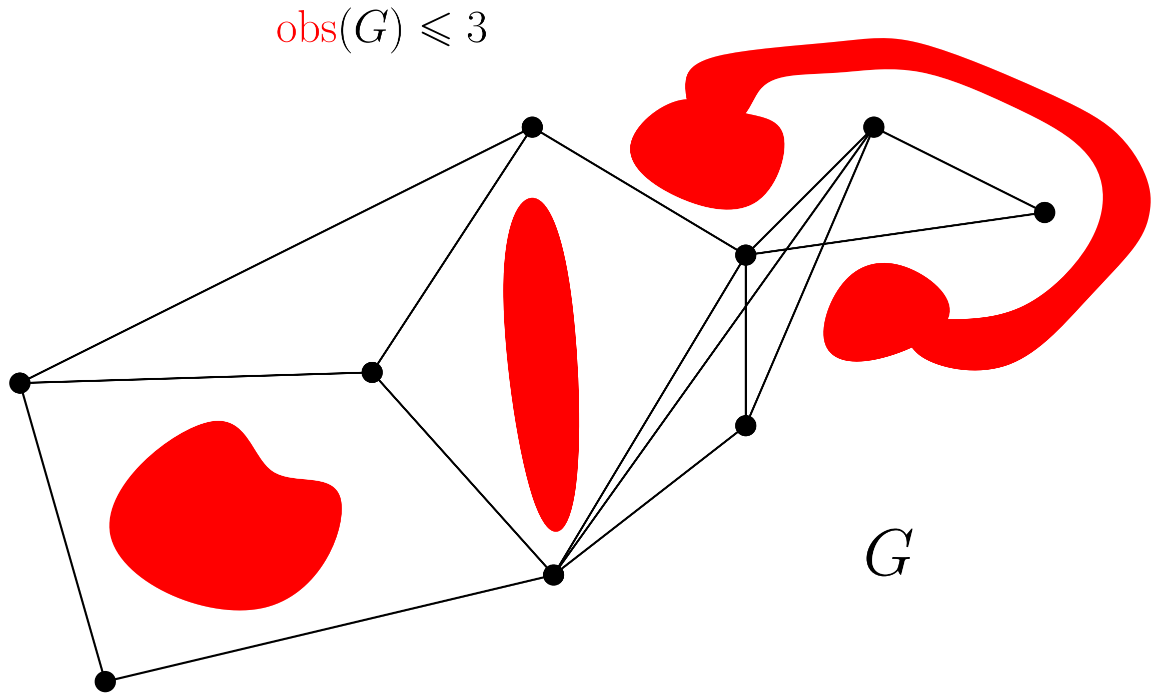



G

$\mathrm{obs}(G) \leqslant 4$

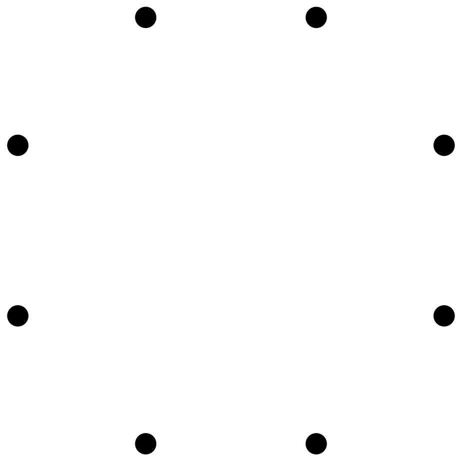



$\mathrm{obs}(G) \leqslant 4$
G

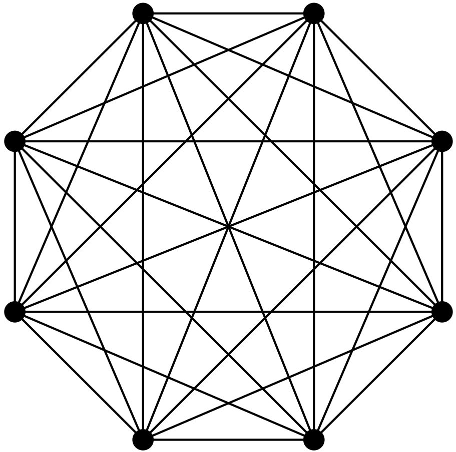

$\text{obs}(G) \leqslant 3$
G

complete graphs

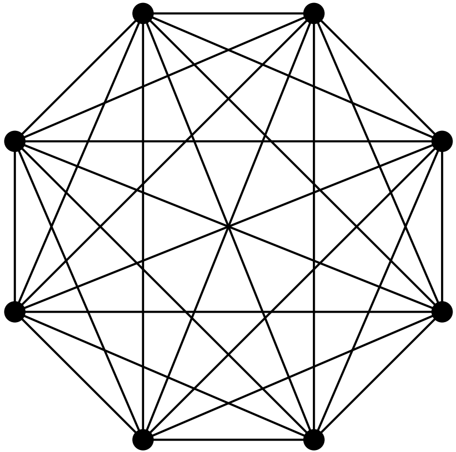
complete graphs



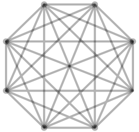
complete graphs



complete graphs

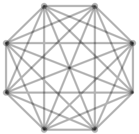


$\mathrm{obs}(K_n) = 0$

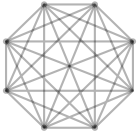


$\mathrm{obs}(K_n) = 0$

independent sets

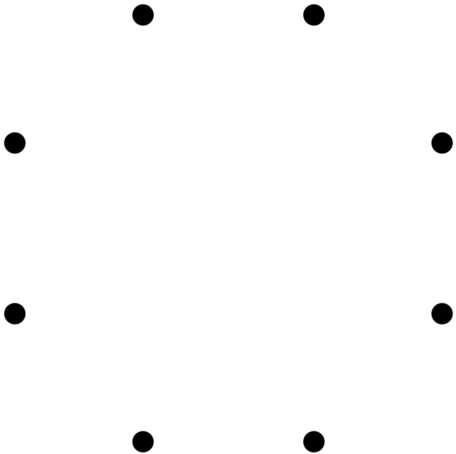


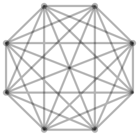
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(K_n) = 0$

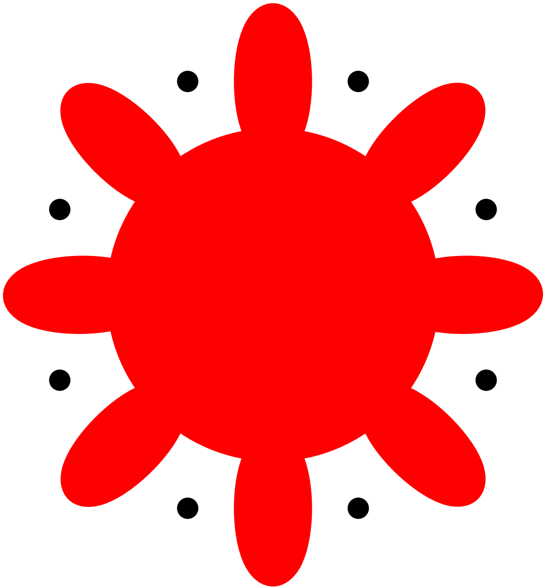
independent sets

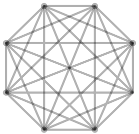




$\text{obs}(K_n) = 0$

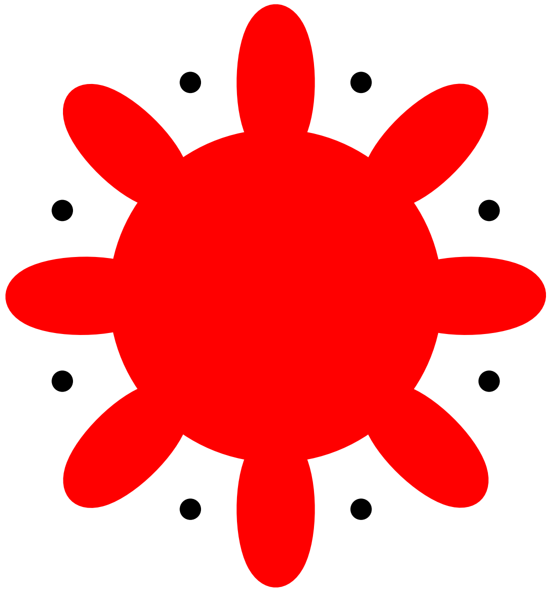
independent sets



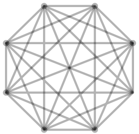


$\mathrm{obs}(K_n) = 0$

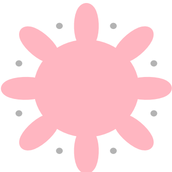
independent sets



$\mathrm{obs}(I_n) = 1$

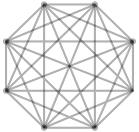


$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$

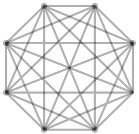
paths



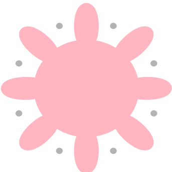
$\mathrm{obs}(K_n) = 0$

$\mathrm{obs}(I_n) = 1$

paths



$\mathrm{obs}(K_n) = 0$



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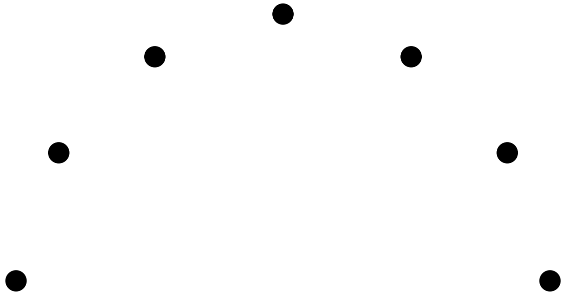
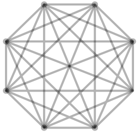
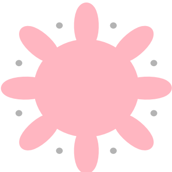


paths



$\mathrm{obs}(K_n) = 0$



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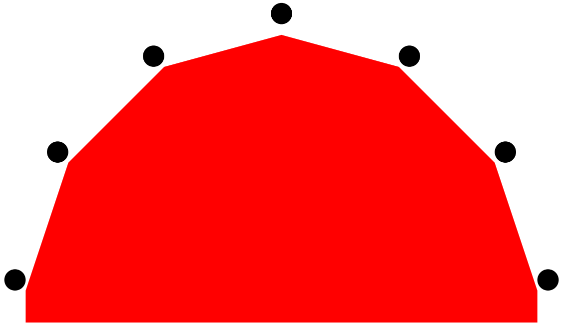
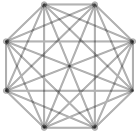
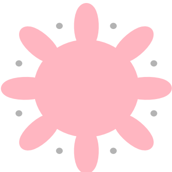


paths



$\text{obs}(K_n) = 0$



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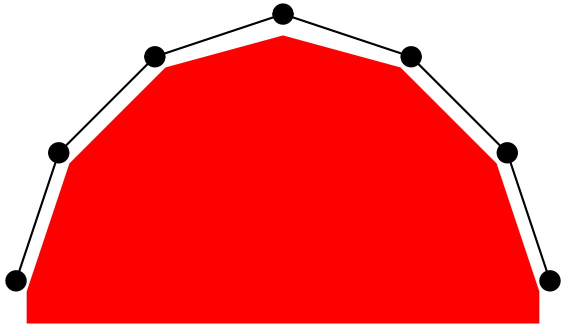

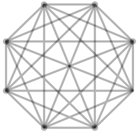

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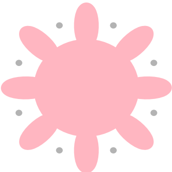
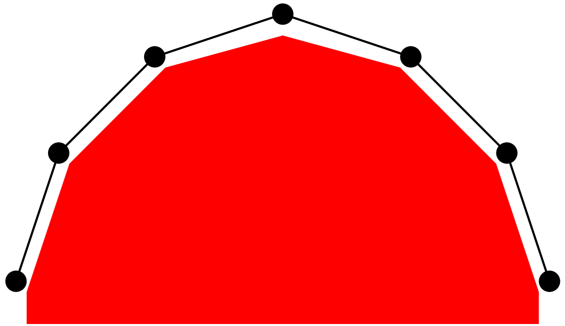
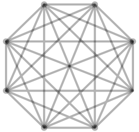


$\mathrm{obs}(I_n) = 1$

paths



$\mathrm{obs}(P_n) = 1$



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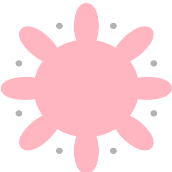

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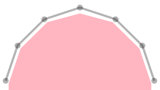
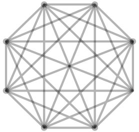


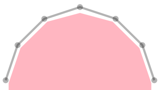
$\mathrm{obs}(P_n) = 1$

trees

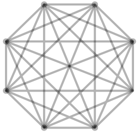


$\mathrm{obs}(K_n) = 0$

$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$



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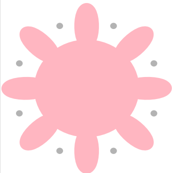

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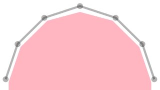

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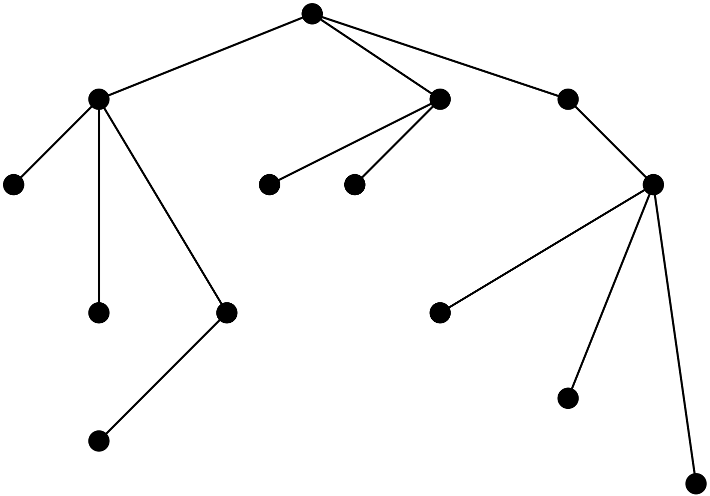
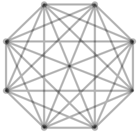
trees





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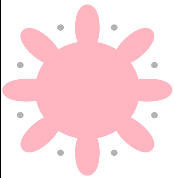

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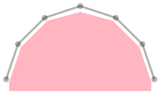

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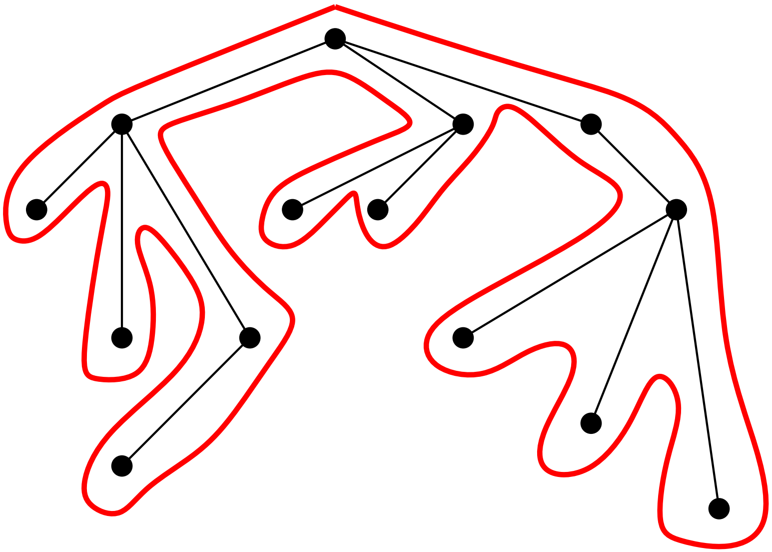
trees



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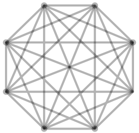

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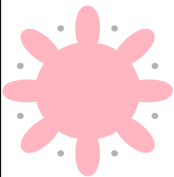

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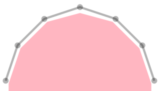
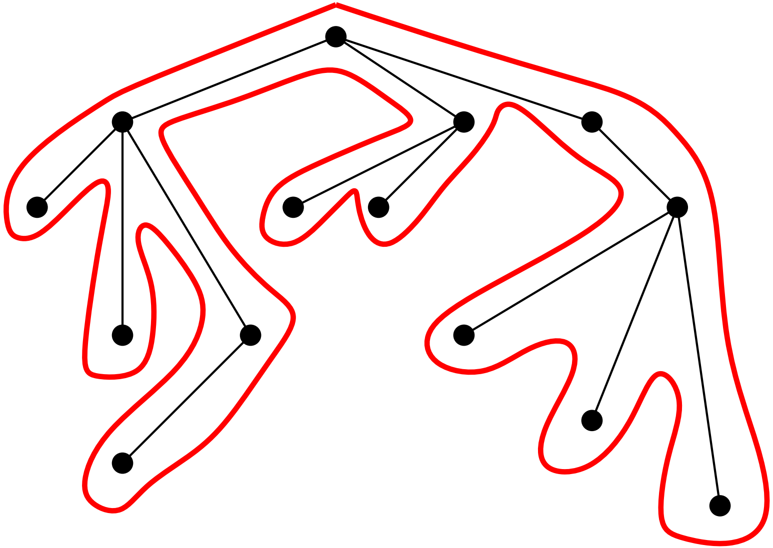


$\mathrm{obs}(P_n) = 1$



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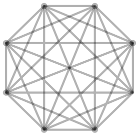

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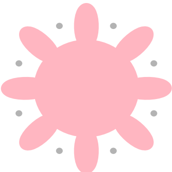

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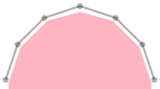

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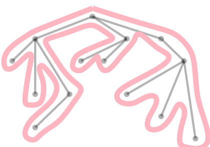
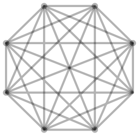
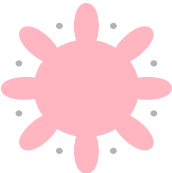


$\mathrm{obs}(T_n) = 1$

complete bipartite graphs



$\text{obs}(K_n) = 0$



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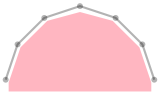

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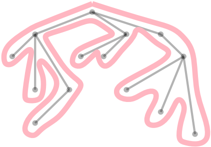
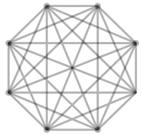


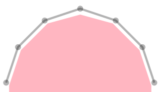
$\text{obs}(T_n) = 1$

complete bipartite graphs



$\text{obs}(K_n) = 0$

$\text{obs}(I_n) = 1$



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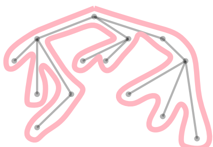

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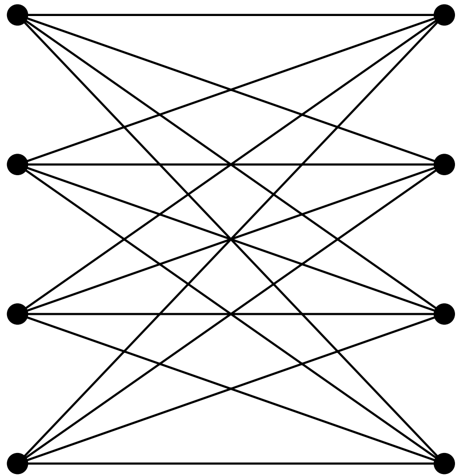
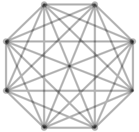
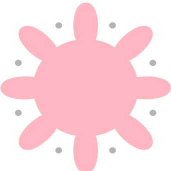


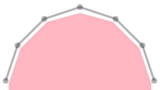
complete bipartite graphs



$\text{obs}(K_n) = 0$



$\text{obs}(I_n) = 1$



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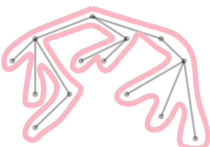

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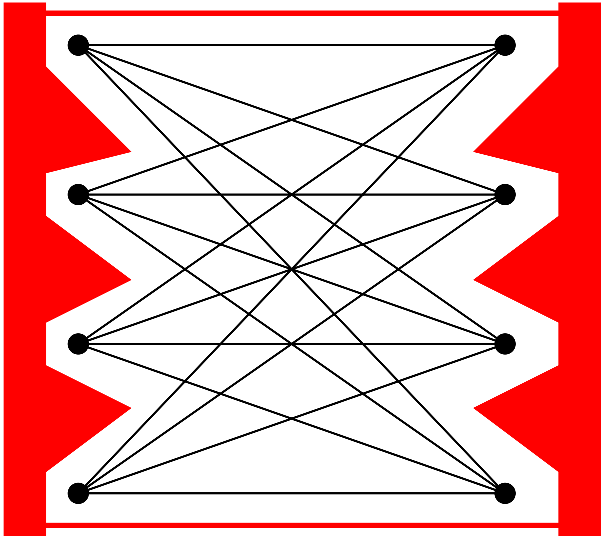
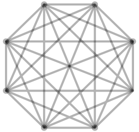
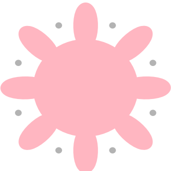


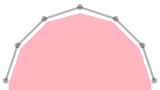
complete bipartite graphs



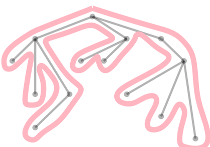
$\mathrm{obs}(K_n) = 0$



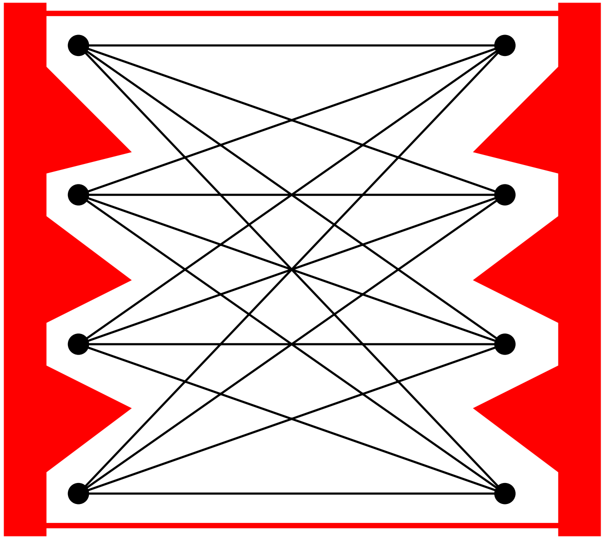
$\mathrm{obs}(I_n) = 1$



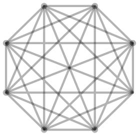
$\mathrm{obs}(P_n) = 1$



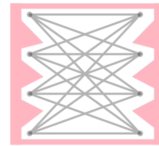
$\mathrm{obs}(T_n) = 1$



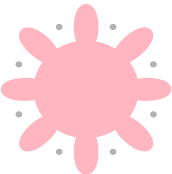
$\mathrm{obs}(K_{n,n}) = 1$



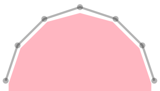
$\mathrm{obs}(K_n) = 0$



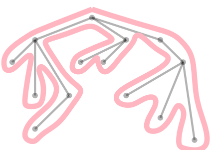
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(I_n) = 1$

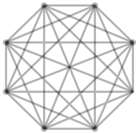


$\mathrm{obs}(P_n) = 1$



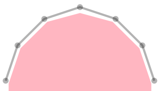
$\mathrm{obs}(T_n) = 1$

planar bipartite



$\mathrm{obs}(K_n) = 0$

$\mathrm{obs}(I_n) = 1$



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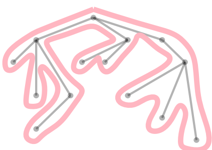
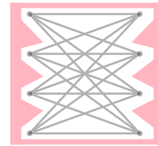
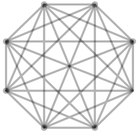


$\mathrm{obs}(T_n) = 1$



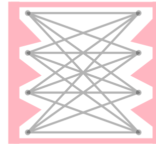
$\mathrm{obs}(K_{n,n}) = 1$



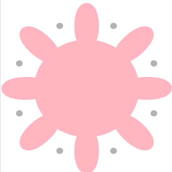
$\text{obs}(K_n) = 0$

planar bipartite

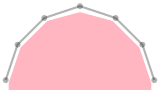
there exists a nice representation



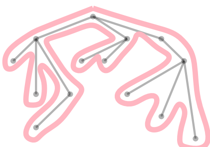
$\text{obs}(K_{n,n}) = 1$



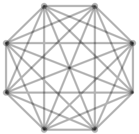
$\text{obs}(I_n) = 1$



$\text{obs}(P_n) = 1$



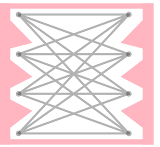
$\text{obs}(T_n) = 1$



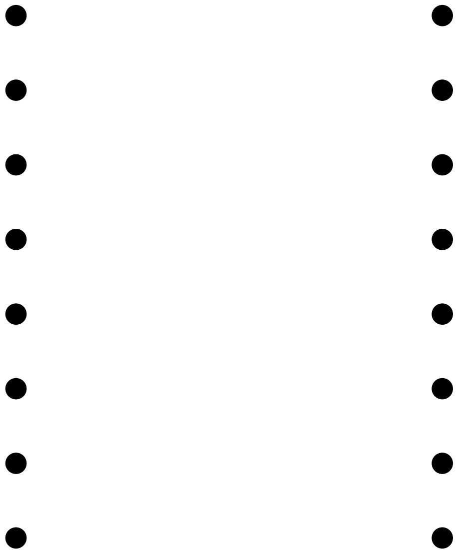
$\text{obs}(K_n) = 0$

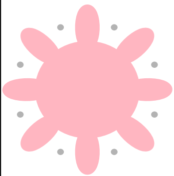
planar bipartite

there exists a nice representation

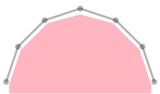


$\text{obs}(K_{n,n}) = 1$

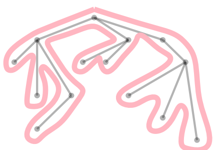




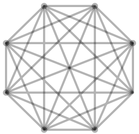
$\text{obs}(I_n) = 1$



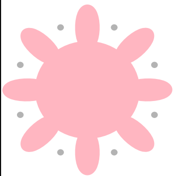
$\text{obs}(P_n) = 1$



$\text{obs}(T_n) = 1$



$\mathrm{obs}(K_n) = 0$



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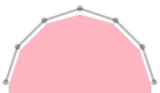

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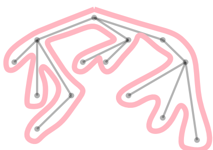
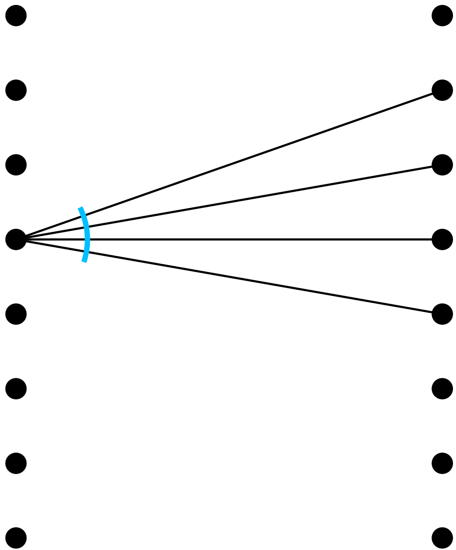
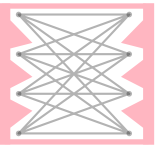


$\mathrm{obs}(T_n) = 1$

planar bipartite

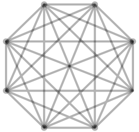
there exists a nice representation



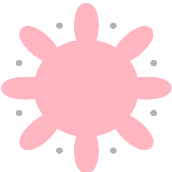


$\mathrm{obs}(K_{n,n}) = 1$

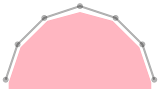
planar bipartite



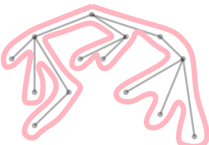
$\text{obs}(K_n) = 0$



$\text{obs}(I_n) = 1$

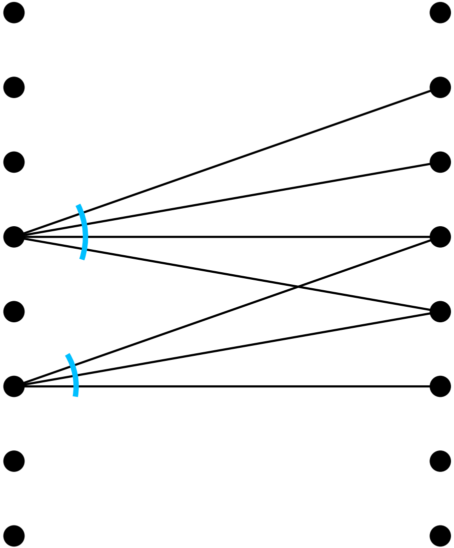


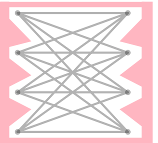
$\text{obs}(P_n) = 1$



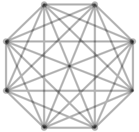
$\text{obs}(T_n) = 1$

there exists a nice representation

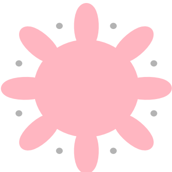




$\text{obs}(K_{n,n}) = 1$



$\text{obs}(K_n) = 0$



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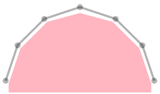
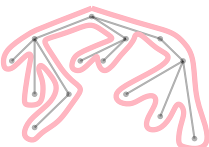


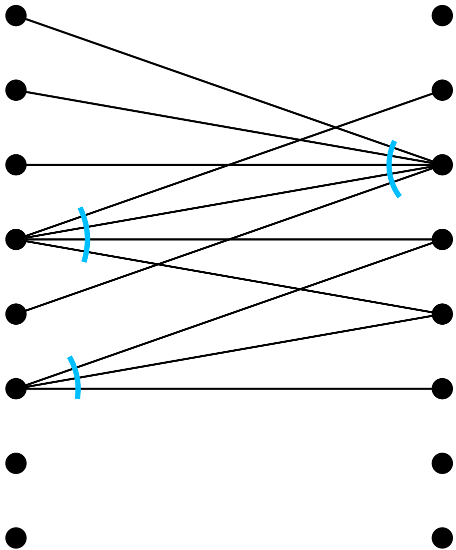
$\text{obs}(P_n) = 1$

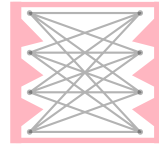


$\text{obs}(T_n) = 1$

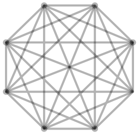
planar bipartite

there exists a nice representation

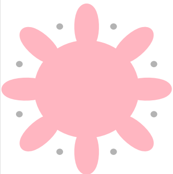




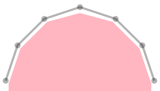
$\text{obs}(K_{n,n}) = 1$



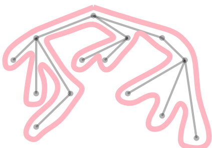
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$



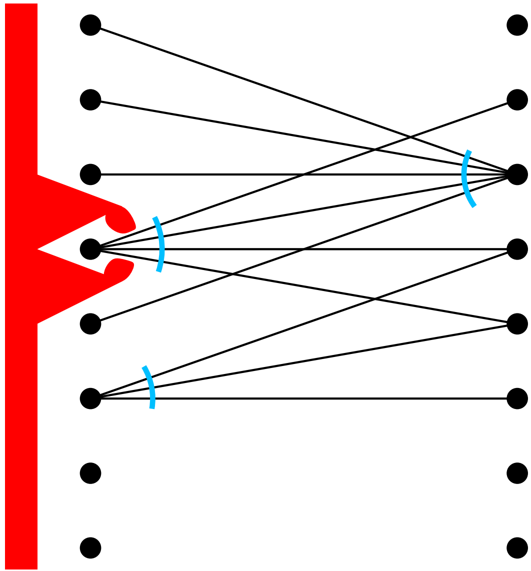
$\mathrm{obs}(P_n) = 1$

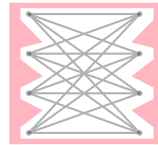


$\mathrm{obs}(T_n) = 1$

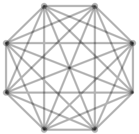
planar bipartite

there exists a nice representation





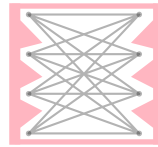
$\mathrm{obs}(K_{n,n}) = 1$



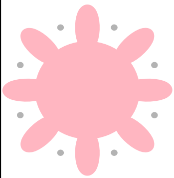
obs$(K_n) = 0$

planar bipartite

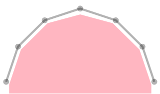
there exists a nice representation



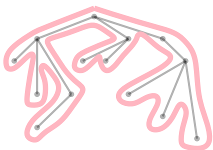
obs$(K_{n,n}) = 1$



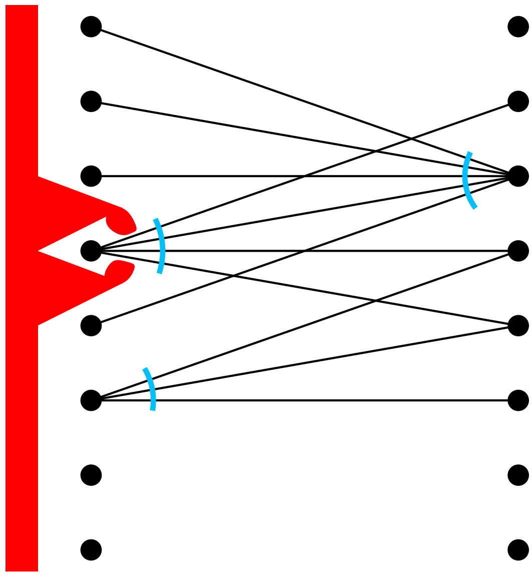
obs$(I_n) = 1$



obs$(P_n) = 1$

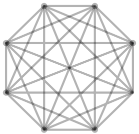


obs$(T_n) = 1$

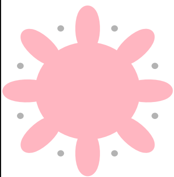


obs(pl.bip.) $= 1$

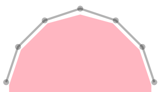
[Gimbel, Ossona de Mendez, Valtr, 2017]



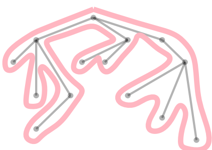
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$



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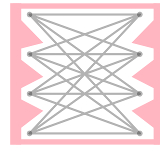
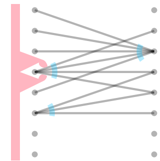
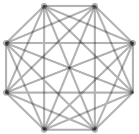


$\mathrm{obs}(K_{n,n}) = 1$

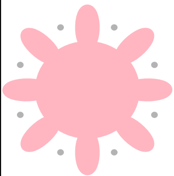


$\mathrm{obs}(\text{pl.bip.}) = 1$

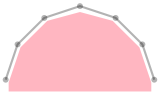
complete bipartite graphs without a matching



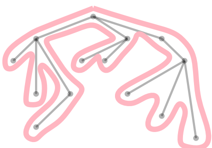
$\mathrm{obs}(K_n) = 0$



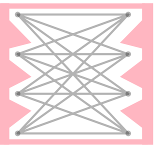
$\mathrm{obs}(I_n) = 1$



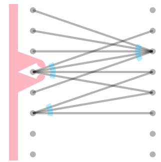
$\mathrm{obs}(P_n) = 1$



$\mathrm{obs}(T_n) = 1$

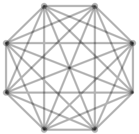


$\mathrm{obs}(K_{n,n}) = 1$



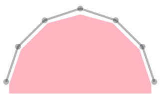
$\mathrm{obs}(\text{pl.bip.}) = 1$

complete bipartite graphs without a matching

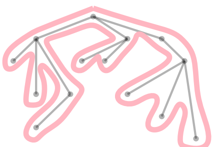


$\mathrm{obs}(K_n) = 0$

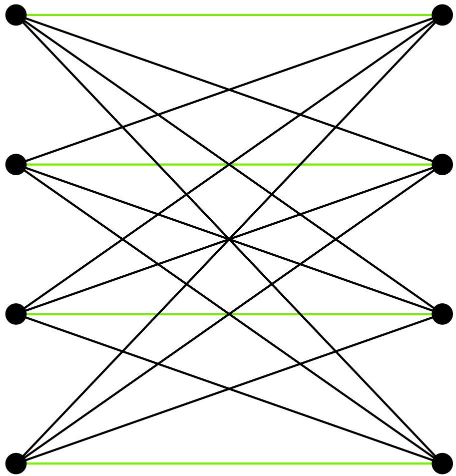
$\mathrm{obs}(I_n) = 1$

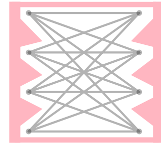


$\mathrm{obs}(P_n) = 1$

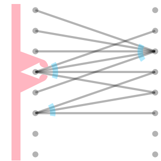


$\mathrm{obs}(T_n) = 1$



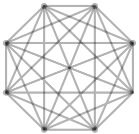


$\mathrm{obs}(K_{n,n}) = 1$

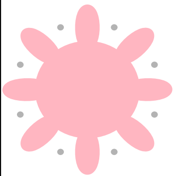


$\mathrm{obs}(\mathrm{pl.bip.}) = 1$

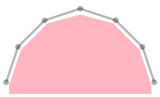
complete bipartite graphs without a matching



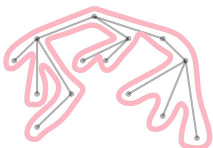
$\text{obs}(K_n) = 0$



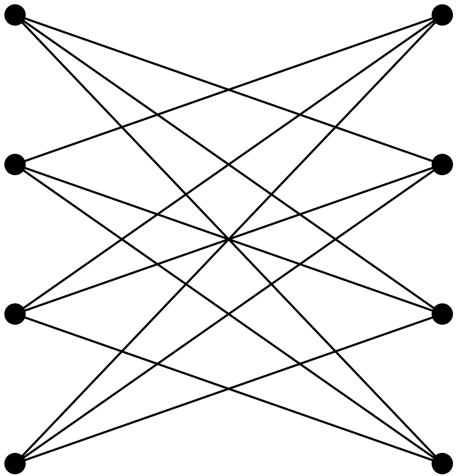
$\text{obs}(I_n) = 1$

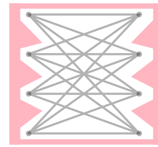


$\text{obs}(P_n) = 1$

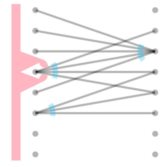


$\text{obs}(T_n) = 1$



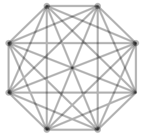


$\text{obs}(K_{n,n}) = 1$



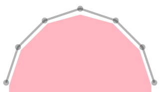
$\text{obs}(\text{pl.bip.}) = 1$

complete bipartite graphs without a matching

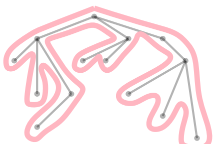


obs$(K_n) = 0$

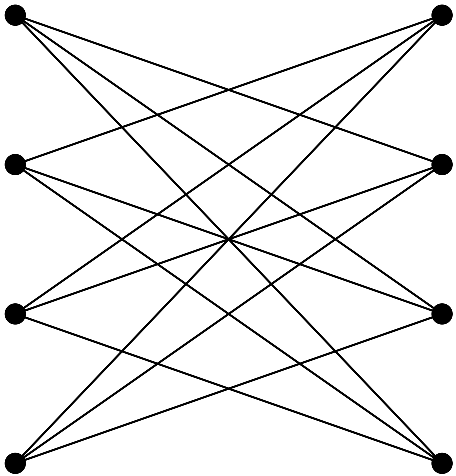
obs$(I_n) = 1$

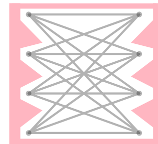


obs$(P_n) = 1$

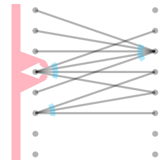


obs$(T_n) = 1$





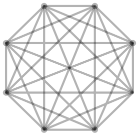
obs$(K_{n,n}) = 1$



obs(pl.bip.) $= 1$

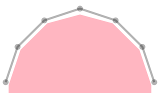
is the obstacle number large?

complete bipartite graphs without a matching

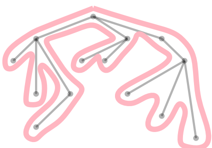


$\mathrm{obs}(K_n) = 0$

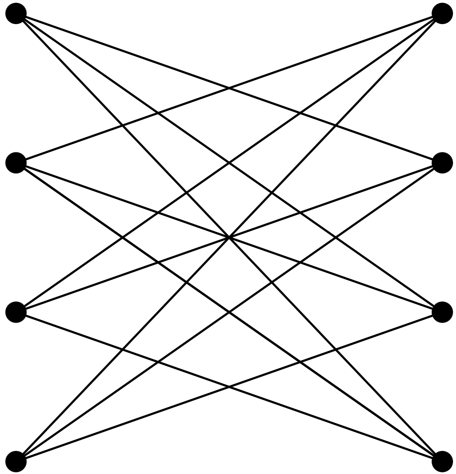
$\mathrm{obs}(I_n) = 1$

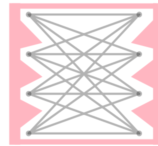


$\mathrm{obs}(P_n) = 1$

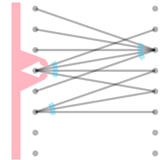


$\mathrm{obs}(T_n) = 1$



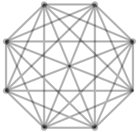


$\mathrm{obs}(K_{n,n}) = 1$

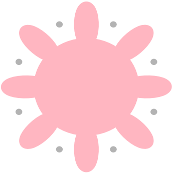


$\mathrm{obs}(\text{pl.bip.}) = 1$

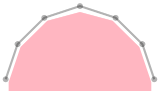
is the obstacle number large? not really...



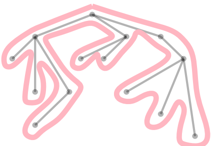
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$

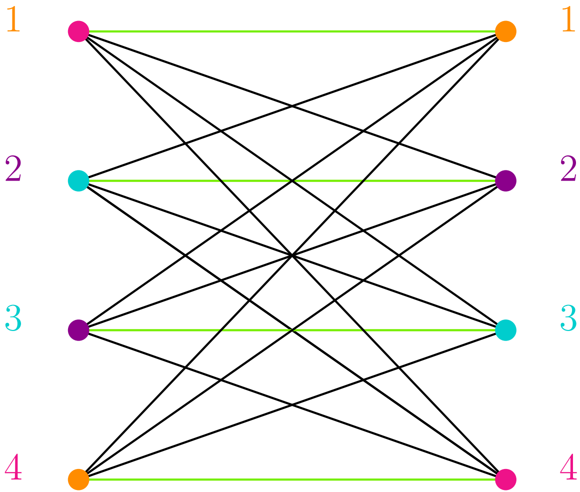


$\mathrm{obs}(P_n) = 1$

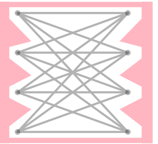


$\mathrm{obs}(T_n) = 1$

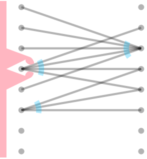
complete bipartite graphs without a matching



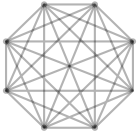
is the obstacle number large? not really...



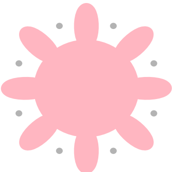
$\mathrm{obs}(K_{n,n}) = 1$



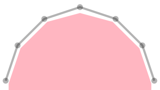
$\mathrm{obs}(\text{pl.bip.}) = 1$



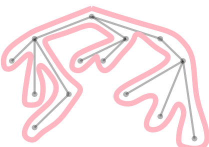
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$

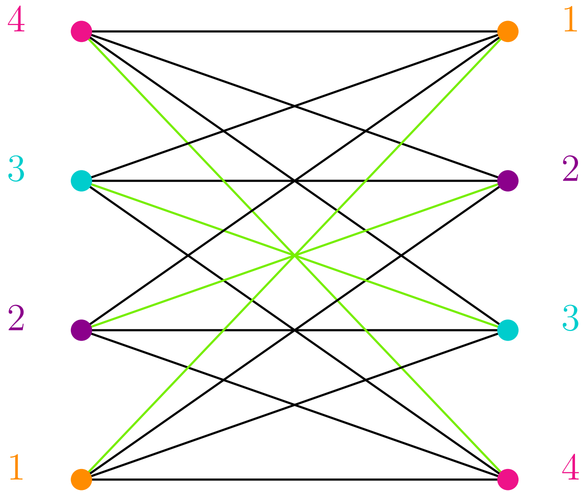


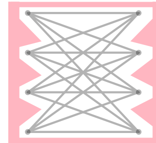
$\mathrm{obs}(P_n) = 1$



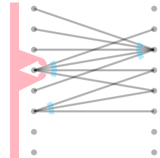
$\mathrm{obs}(T_n) = 1$

complete bipartite graphs without a matching





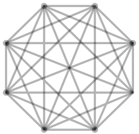
$\mathrm{obs}(K_{n,n}) = 1$



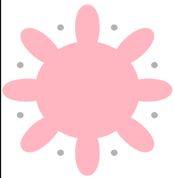
$\mathrm{obs}(\text{pl.bip.}) = 1$

is the obstacle number large? not really...

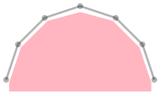
complete bipartite graphs without a matching



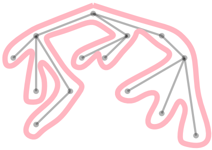
obs(K_n) = 0



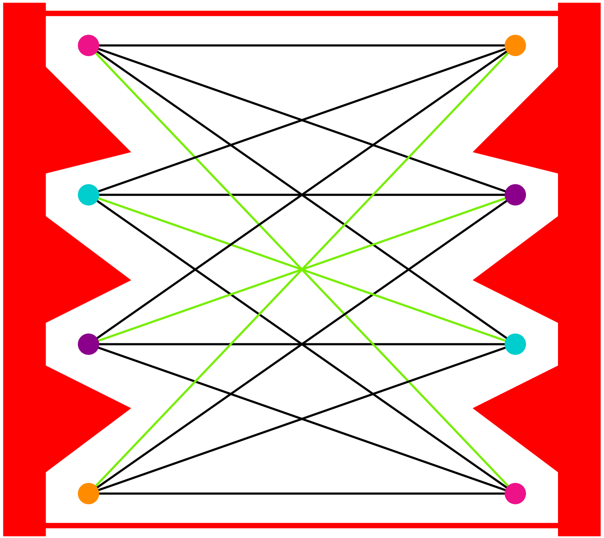
obs(I_n) = 1

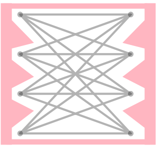


obs(P_n) = 1

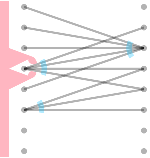


obs(T_n) = 1





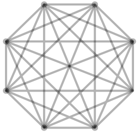
obs($K_{n,n}$) = 1



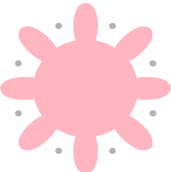
obs(pl.bip.) = 1

is the obstacle number large? not really...

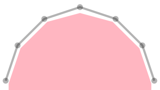
complete bipartite graphs without a matching



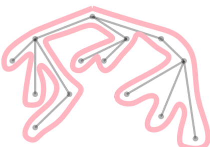
$\text{obs}(K_n) = 0$



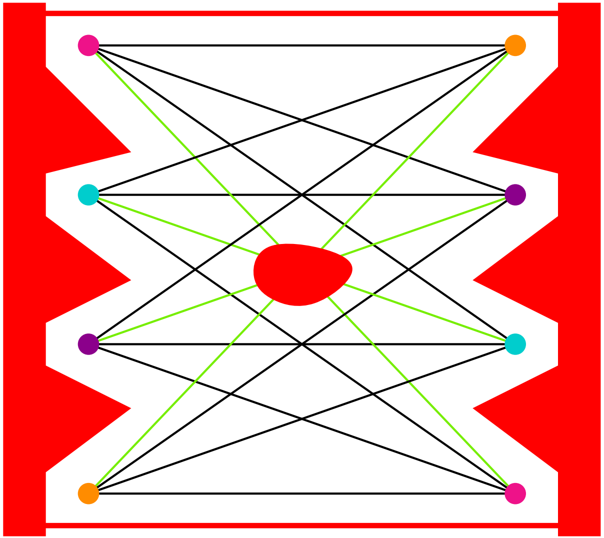
$\text{obs}(I_n) = 1$

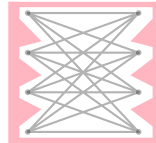


$\text{obs}(P_n) = 1$

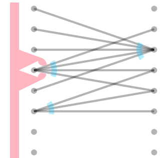


$\text{obs}(T_n) = 1$



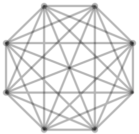


$\text{obs}(K_{n,n}) = 1$



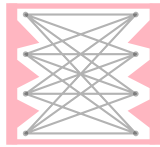
$\text{obs}(\text{pl.bip.}) = 1$

is the obstacle number large? not really...

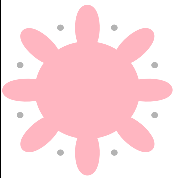


$\mathrm{obs}(K_n) = 0$

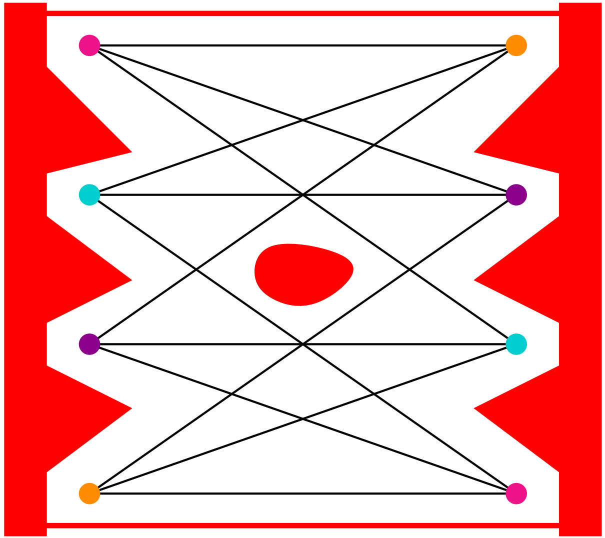
complete bipartite graphs without a matching

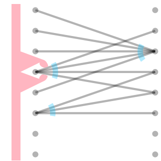


$\mathrm{obs}(K_{n,n}) = 1$

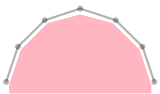


$\mathrm{obs}(I_n) = 1$

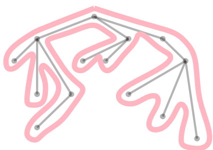




$\mathrm{obs}(\text{pl.bip.}) = 1$



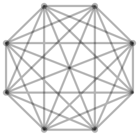
$\mathrm{obs}(P_n) = 1$



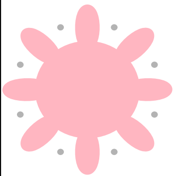
$\mathrm{obs}(T_n) = 1$

is the obstacle number large? not really...

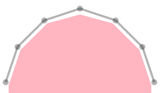
complete bipartite graphs without a matching



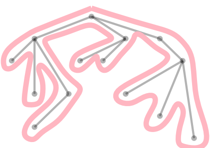
$\mathrm{obs}(K_n) = 0$



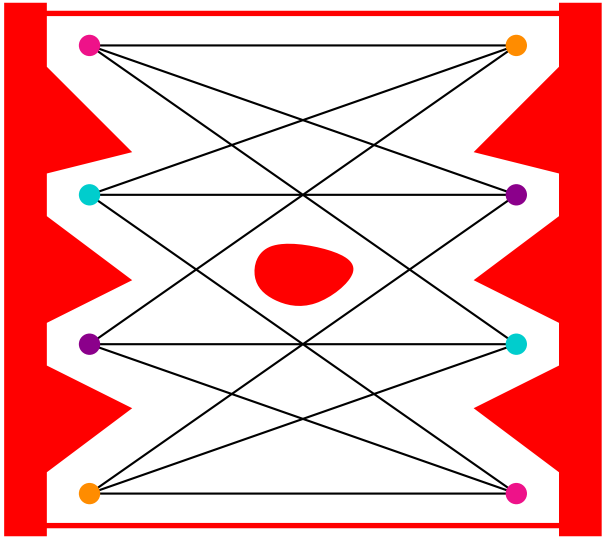
$\mathrm{obs}(I_n) = 1$



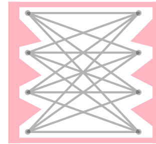
$\mathrm{obs}(P_n) = 1$



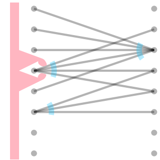
$\mathrm{obs}(T_n) = 1$



$\mathrm{obs}(K^*_{n,n}) \leqslant 2$



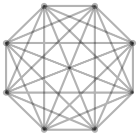
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$

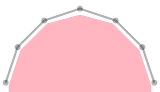
is the obstacle number large? not really...

complete bipartite graphs without a matching

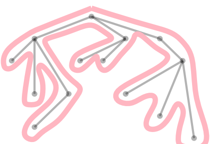


$\mathrm{obs}(K_n) = 0$

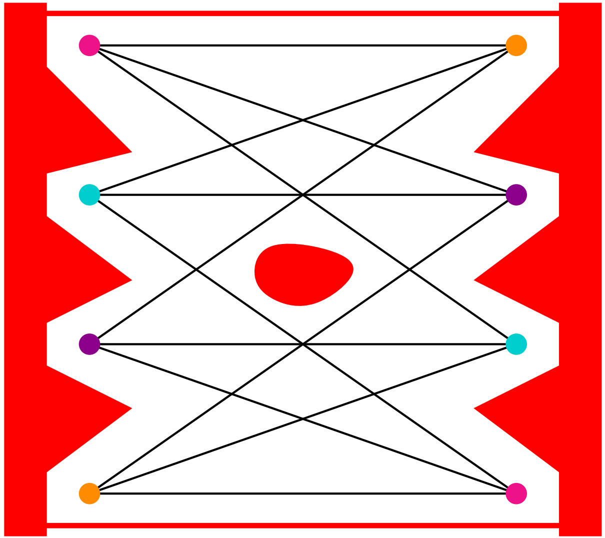
$\mathrm{obs}(I_n) = 1$

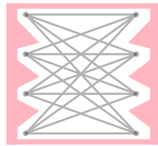


$\mathrm{obs}(P_n) = 1$

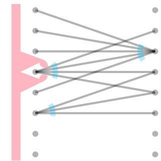


$\mathrm{obs}(T_n) = 1$





$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$

$\mathrm{obs}(K^*_{n,n}) \leqslant 2$

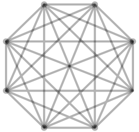
[Alpert, Koch, Laison, 2009]

$\mathrm{obs}(K^*_{5,7}) = 2$

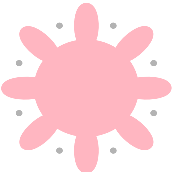
[Pach, Sariöz, 2011]

$\mathrm{obs}(K^*_{5,5}) = 2$

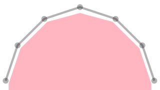
is the obstacle number large? not really...



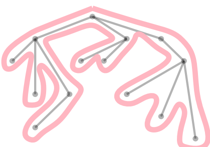
$\mathrm{obs}(K_n) = 0$



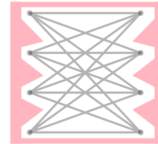
$\mathrm{obs}(I_n) = 1$



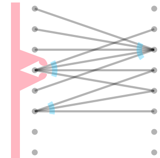
$\mathrm{obs}(P_n) = 1$



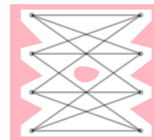
$\mathrm{obs}(T_n) = 1$



$\mathrm{obs}(K_{n,n}) = 1$

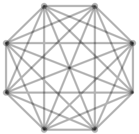


$\mathrm{obs}(\mathrm{pl.bip.}) = 1$



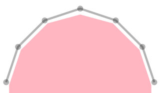
$\mathrm{obs}(K^*_{n,n}) = 2$

outerplanar graphs

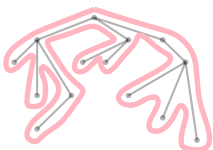


obs$(K_n) = 0$

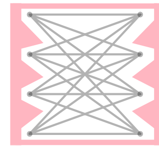
obs$(I_n) = 1$



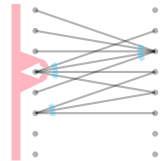
obs$(P_n) = 1$



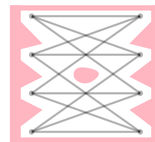
obs$(T_n) = 1$



obs$(K_{n,n}) = 1$

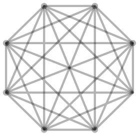


obs(pl.bip.) $= 1$

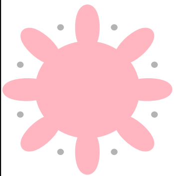


obs$(K^*_{n,n}) = 2$

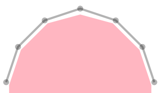
outerplanar graphs



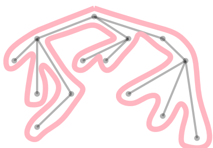
$\mathrm{obs}(K_n) = 0$



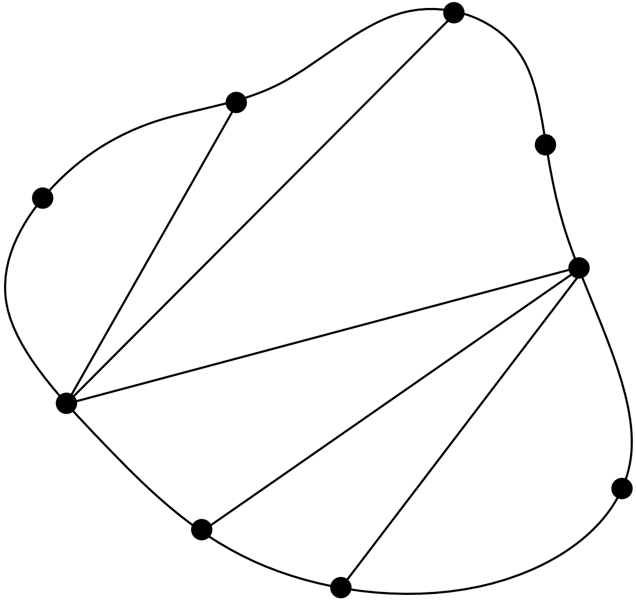
$\mathrm{obs}(I_n) = 1$

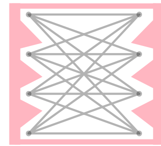


$\mathrm{obs}(P_n) = 1$

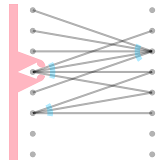


$\mathrm{obs}(T_n) = 1$

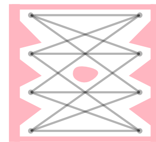




$\mathrm{obs}(K_{n,n}) = 1$

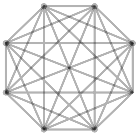


$\mathrm{obs}(\mathrm{pl.bip.}) = 1$



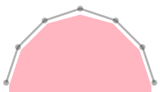
$\mathrm{obs}(K^*_{n,n}) = 2$

outerplanar graphs

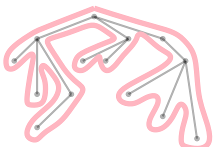


$\mathrm{obs}(K_n) = 0$

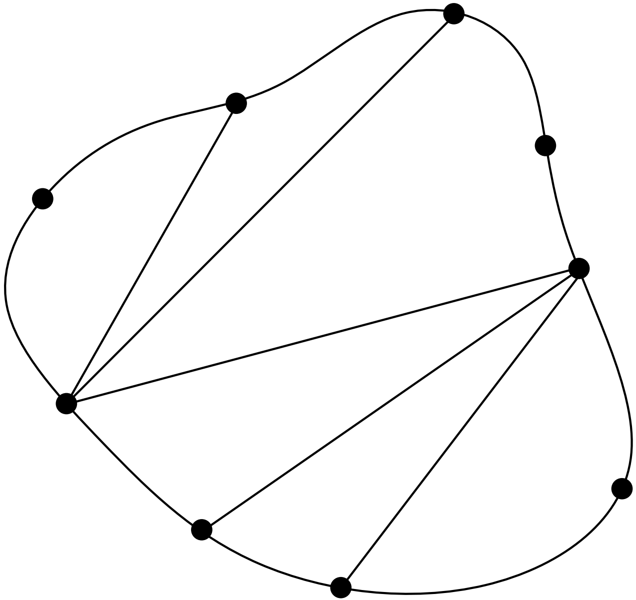
$\mathrm{obs}(I_n) = 1$

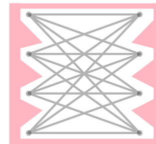


$\mathrm{obs}(P_n) = 1$

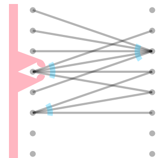


$\mathrm{obs}(T_n) = 1$

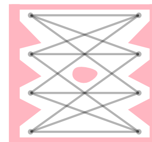




$\mathrm{obs}(K_{n,n}) = 1$



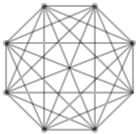
$\mathrm{obs}(\mathrm{pl.bip.}) = 1$



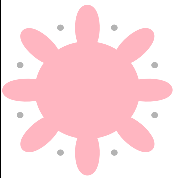
$\mathrm{obs}(K^*_{n,n}) = 2$

[Alpert, Koch, Laison, 2009]

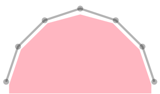
$\mathrm{obs}(G) = 1$



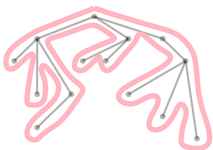
$\mathrm{obs}(K_n) = 0$



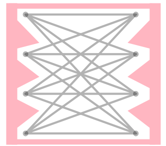
$\mathrm{obs}(I_n) = 1$



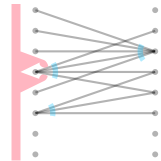
$\mathrm{obs}(P_n) = 1$



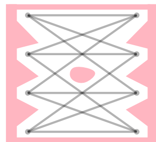
$\mathrm{obs}(T_n) = 1$



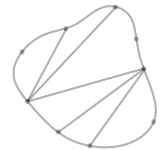
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



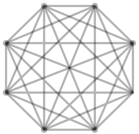
$\mathrm{obs}(K^*_{n,n}) = 2$



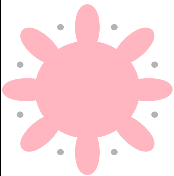
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

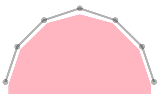
planar graphs



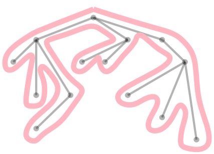
$\mathrm{obs}(K_n) = 0$



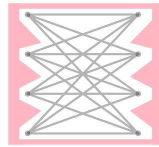
$\mathrm{obs}(I_n) = 1$



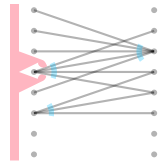
$\mathrm{obs}(P_n) = 1$



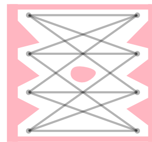
$\mathrm{obs}(T_n) = 1$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



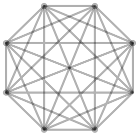
$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\text{outpl.}) = 1$

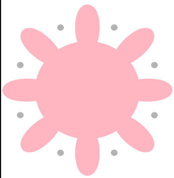
[Alpert, Koch, Laison, 2009]

planar graphs

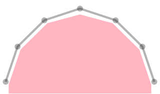
$\mathrm{obs}(\text{planar}) = 1???$



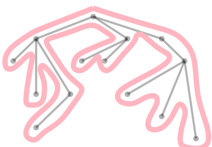
$\mathrm{obs}(K_n) = 0$



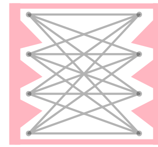
$\mathrm{obs}(I_n) = 1$



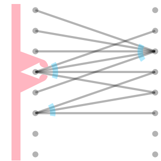
$\mathrm{obs}(P_n) = 1$



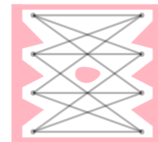
$\mathrm{obs}(T_n) = 1$



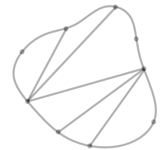
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$



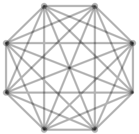
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

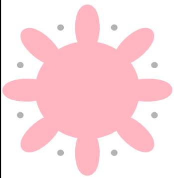
planar graphs

$\mathrm{obs}(\text{planar}) = 1???$

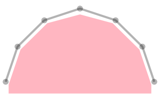
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



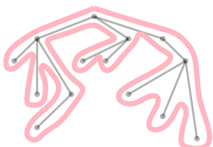
$\mathrm{obs}(K_n) = 0$



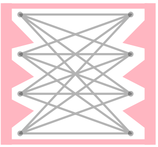
$\mathrm{obs}(I_n) = 1$



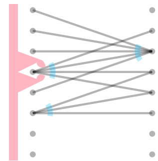
$\mathrm{obs}(P_n) = 1$



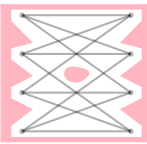
$\mathrm{obs}(T_n) = 1$



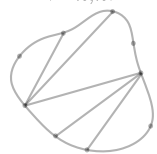
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$



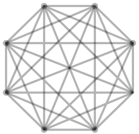
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

planar graphs

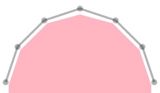
$\mathrm{obs}(\text{planar}) = 1???$

[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]

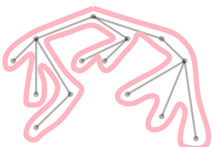


$\mathrm{obs}(K_n) = 0$

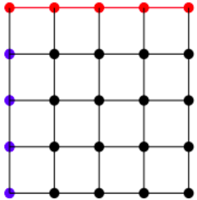
$\mathrm{obs}(I_n) = 1$

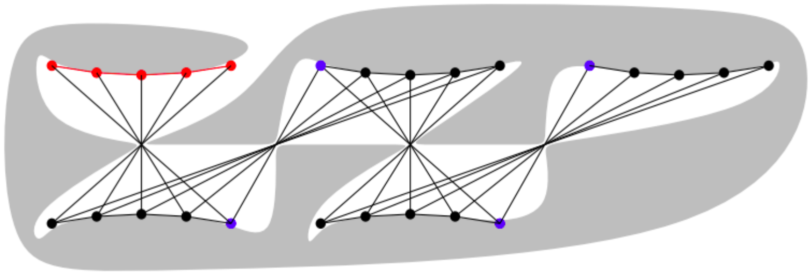


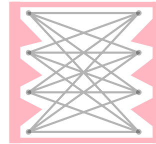
$\mathrm{obs}(P_n) = 1$



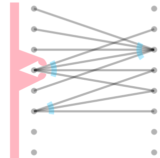
$\mathrm{obs}(T_n) = 1$



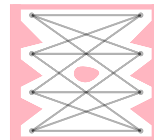




$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$

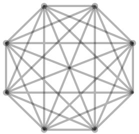
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

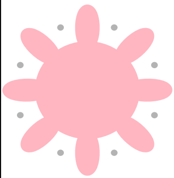
planar graphs

$\text{obs}(\text{planar}) = 1???$

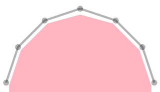
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



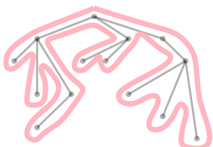
$\text{obs}(K_n) = 0$



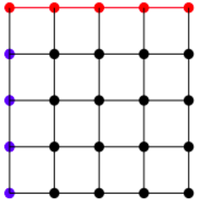
$\text{obs}(I_n) = 1$

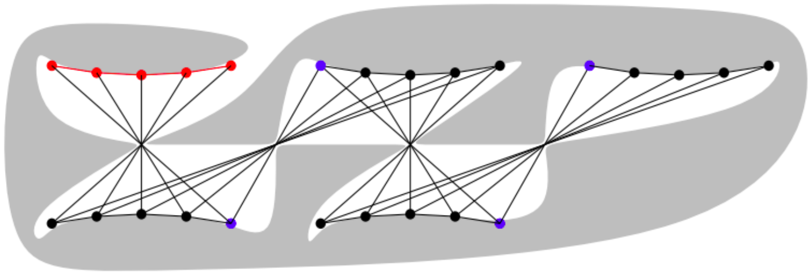


$\text{obs}(P_n) = 1$



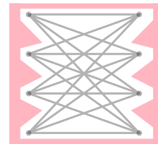
$\text{obs}(T_n) = 1$



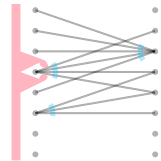


$\text{obs}(\boxplus_n) = 1$

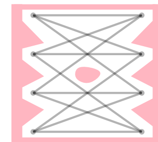
[Dujmovic, Morin, 2021]



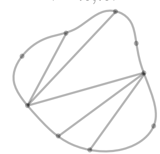
$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$



$\text{obs}(K^*_{n,n}) = 2$



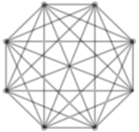
$\text{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

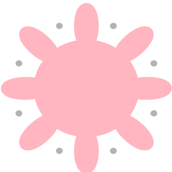
planar graphs

$\mathrm{obs}(\text{planar}) = 1???$

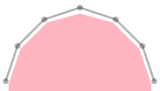
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



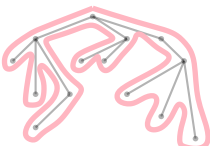
$\mathrm{obs}(K_n) = 0$



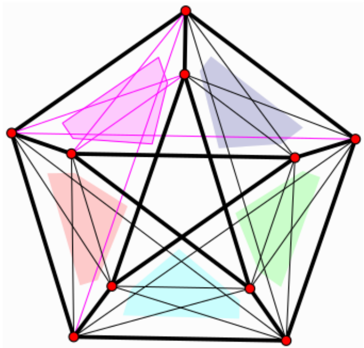
$\mathrm{obs}(I_n) = 1$

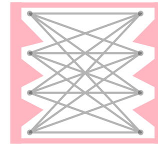


$\mathrm{obs}(P_n) = 1$

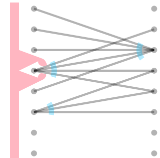


$\mathrm{obs}(T_n) = 1$

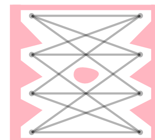




$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$

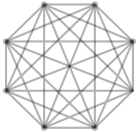
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

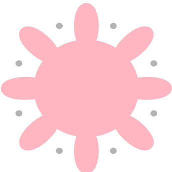
planar graphs

obs(planar) = 1???

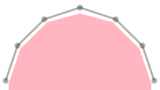
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



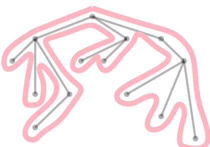
$\mathrm{obs}(K_n) = 0$



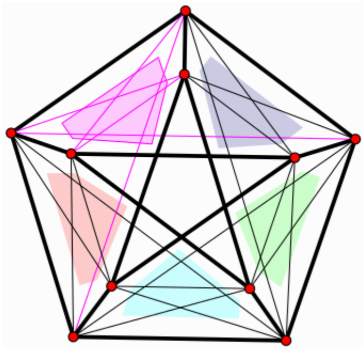
$\mathrm{obs}(I_n) = 1$

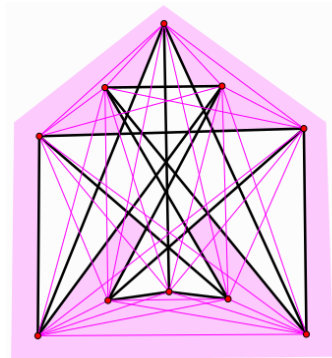


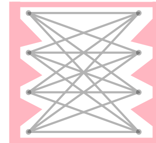
$\mathrm{obs}(P_n) = 1$



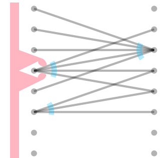
$\mathrm{obs}(T_n) = 1$



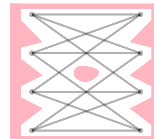




$\mathrm{obs}(K_{n,n}) = 1$



obs(pl.bip.) = 1



$\mathrm{obs}(K^*_{n,n}) = 2$

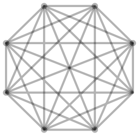
obs(outpl.) = 1

[Alpert, Koch, Laison, 2009]

planar graphs

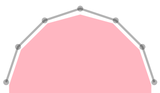
obs(planar) = 1???

[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]

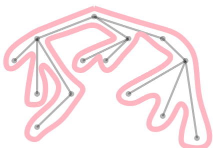


$\mathrm{obs}(K_n) = 0$

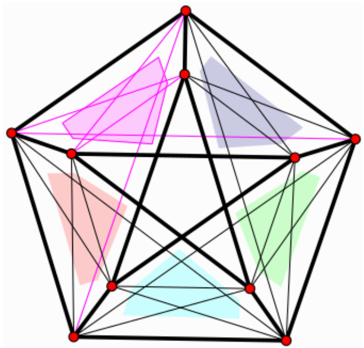
$\mathrm{obs}(I_n) = 1$

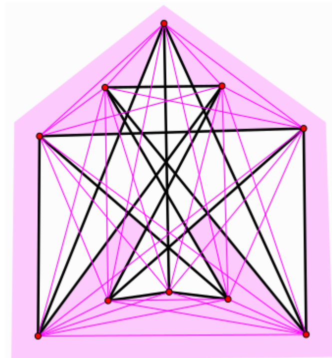


$\mathrm{obs}(P_n) = 1$

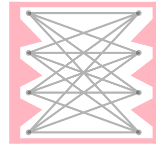


$\mathrm{obs}(T_n) = 1$

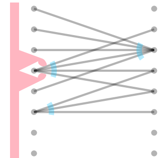




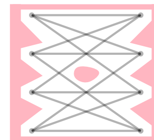
$\mathrm{obs}(\text{Petersen}) = 1$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$

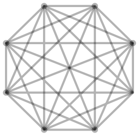
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

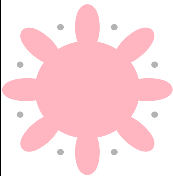
planar graphs

$\text{obs}(\text{planar}) = 1???$

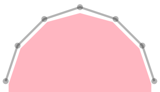
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



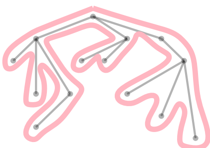
$\text{obs}(K_n) = 0$



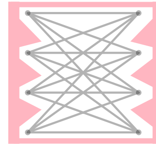
$\text{obs}(I_n) = 1$



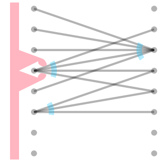
$\text{obs}(P_n) = 1$



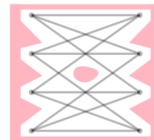
$\text{obs}(T_n) = 1$



$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$



$\text{obs}(K^*_{n,n}) = 2$

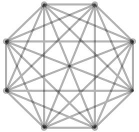
$\text{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

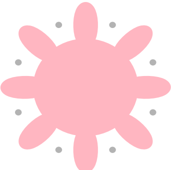
planar graphs

$\text{obs}(\text{planar}) = 1???$

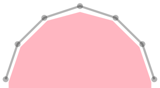
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



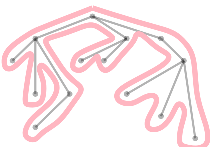
$\text{obs}(K_n) = 0$



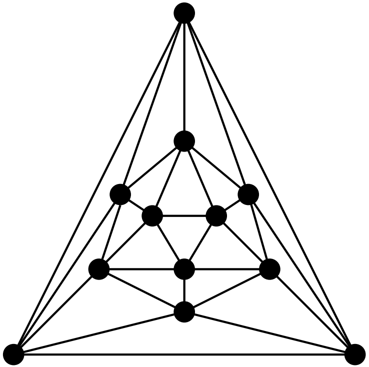
$\text{obs}(I_n) = 1$

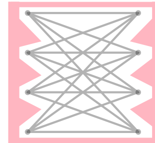


$\text{obs}(P_n) = 1$

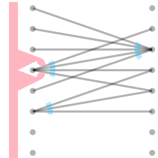


$\text{obs}(T_n) = 1$

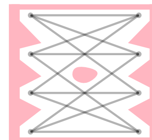




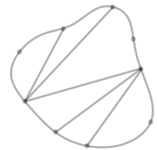
$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$



$\text{obs}(K^*_{n,n}) = 2$



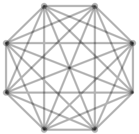
$\text{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

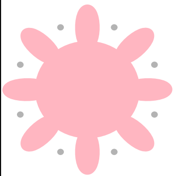
planar graphs

$\text{obs}(\text{planar}) = 1???$

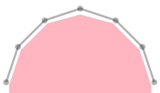
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



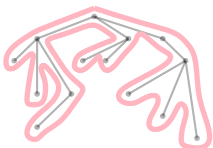
$\text{obs}(K_n) = 0$



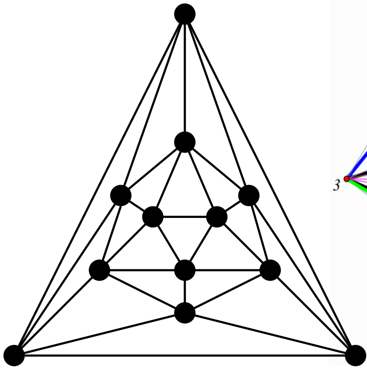
$\text{obs}(I_n) = 1$

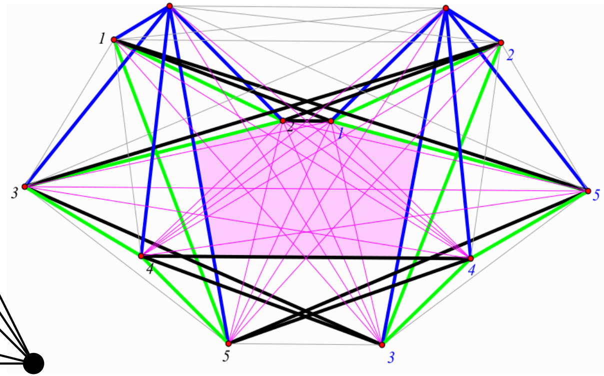


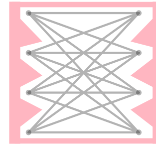
$\text{obs}(P_n) = 1$



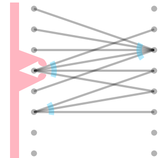
$\text{obs}(T_n) = 1$



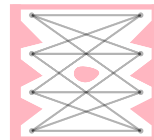




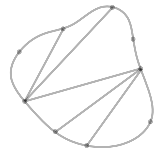
$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$



$\text{obs}(K^*_{n,n}) = 2$



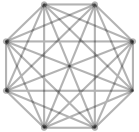
$\text{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

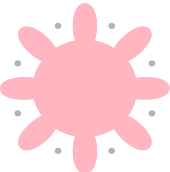
planar graphs

$\text{obs}(\text{planar}) = 1???$

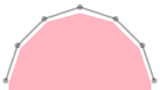
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



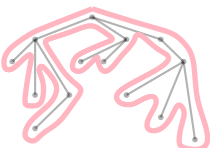
$\text{obs}(K_n) = 0$



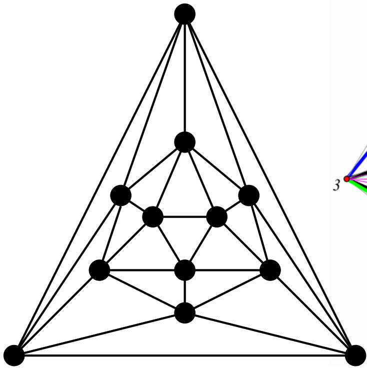
$\text{obs}(I_n) = 1$

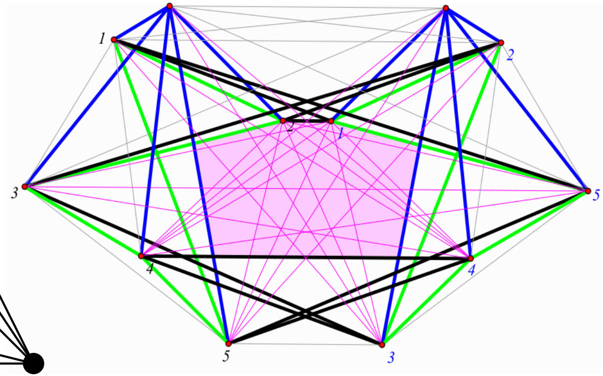


$\text{obs}(P_n) = 1$

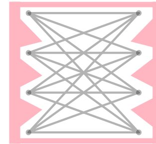


$\text{obs}(T_n) = 1$

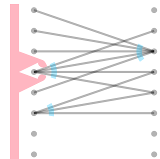




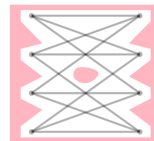
$\text{obs}(\text{icosahedron}) = 2$



$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$



$\text{obs}(K^*_{n,n}) = 2$

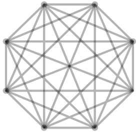
$\text{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

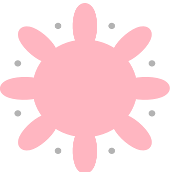
planar graphs

$\textcolor{red}{\mathrm{obs}}(\text{planar}) = 1???$

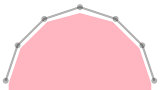
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



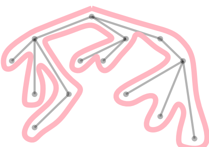
$\mathrm{obs}(K_n) = 0$



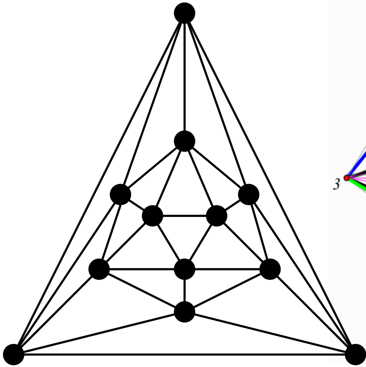
$\mathrm{obs}(I_n) = 1$

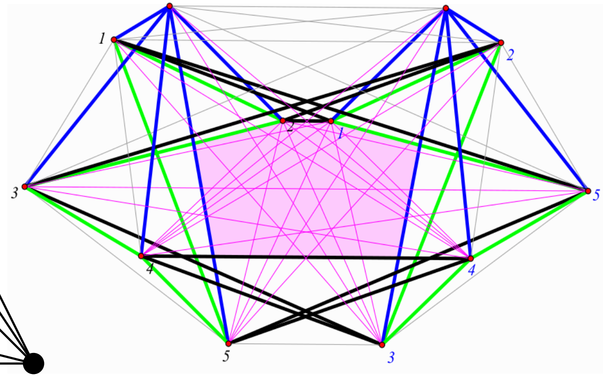


$\mathrm{obs}(P_n) = 1$



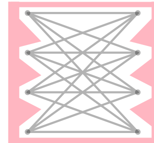
$\mathrm{obs}(T_n) = 1$



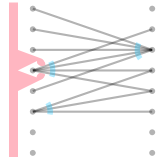


$\textcolor{red}{\mathrm{obs}}(\text{icosahedron}) = 2$

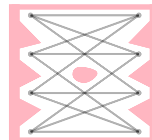
maybe take two such graphs?



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$

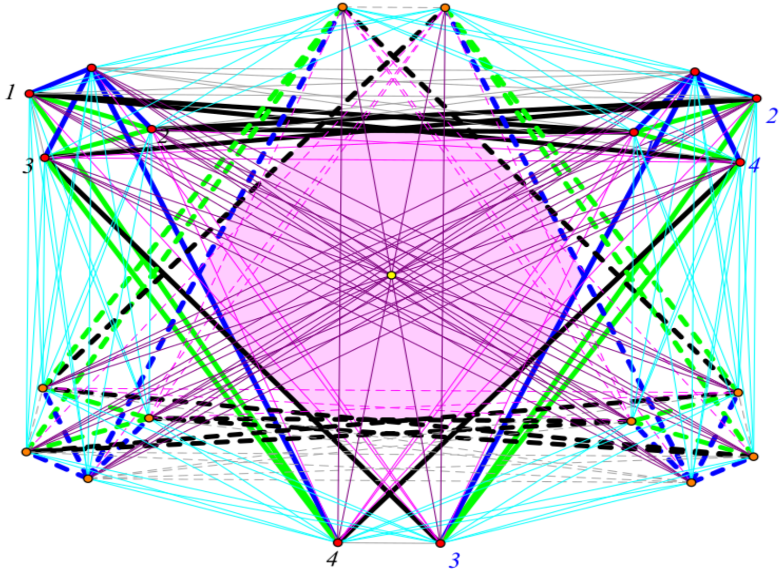
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

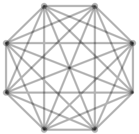
planar graphs

$\text{obs}(\text{planar}) = 1???$

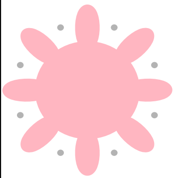
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



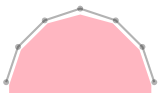
maybe take two such graphs? No...



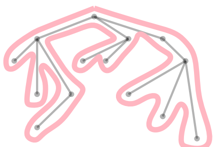
$\text{obs}(K_n) = 0$



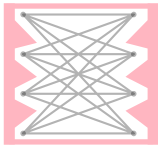
$\text{obs}(I_n) = 1$



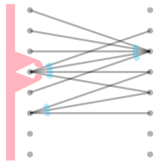
$\text{obs}(P_n) = 1$



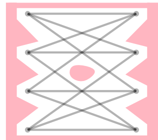
$\text{obs}(T_n) = 1$



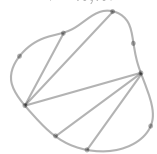
$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$



$\text{obs}(K^*_{n,n}) = 2$



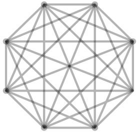
$\text{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

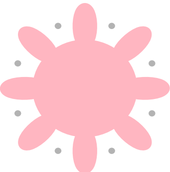
planar graphs

$\text{obs}(\text{planar}) = 1???$

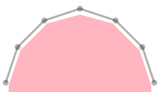
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



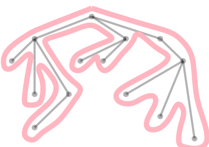
$\text{obs}(K_n) = 0$



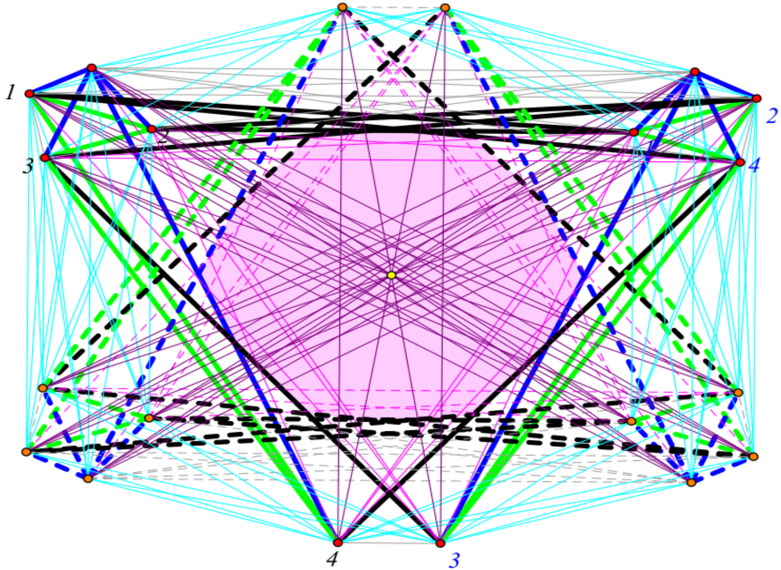
$\text{obs}(I_n) = 1$



$\text{obs}(P_n) = 1$

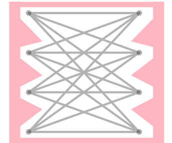


$\text{obs}(T_n) = 1$

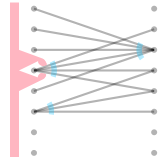


maybe take two such graphs? No...

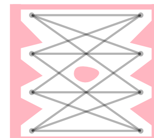
$\text{obs}(\text{icosahedron+icosahedron}) = 2$



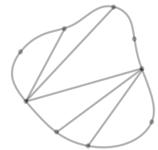
$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$



$\text{obs}(K^*_{n,n}) = 2$



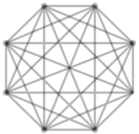
$\text{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

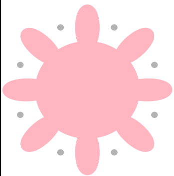
planar graphs

$\text{obs}(\text{planar}) = 1???$

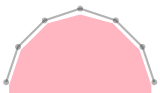
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



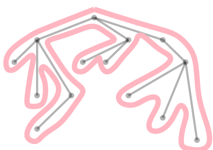
$\text{obs}(K_n) = 0$



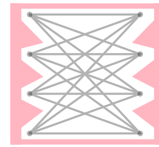
$\text{obs}(I_n) = 1$



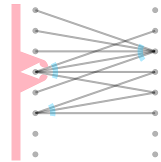
$\text{obs}(P_n) = 1$



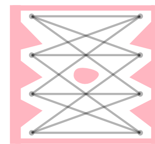
$\text{obs}(T_n) = 1$



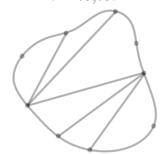
$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$



$\text{obs}(K^*_{n,n}) = 2$



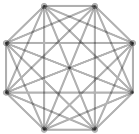
$\text{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

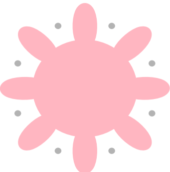
planar graphs

$\mathrm{obs}(\mathrm{planar}) = 1???$

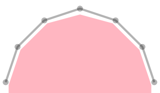
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



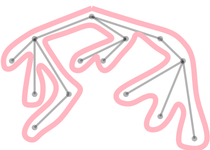
$\mathrm{obs}(K_n) = 0$



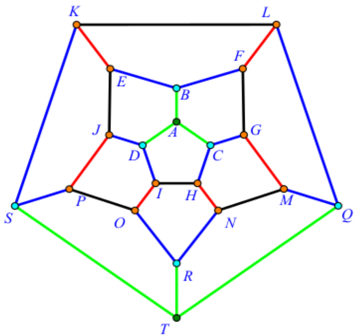
$\mathrm{obs}(I_n) = 1$

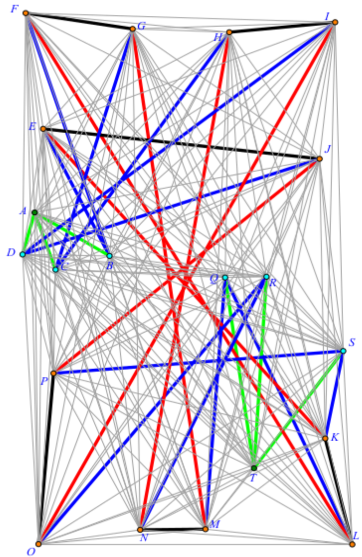


$\mathrm{obs}(P_n) = 1$

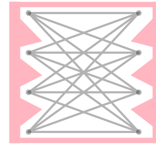


$\mathrm{obs}(T_n) = 1$

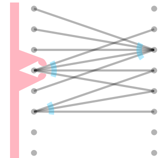




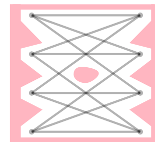
$\mathrm{obs}(\mathrm{dodecahedron}) = 1$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\mathrm{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$

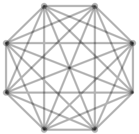
$\mathrm{obs}(\mathrm{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

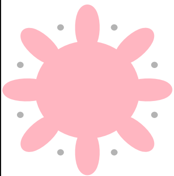
planar graphs

obs(planar) = 1??? NO!

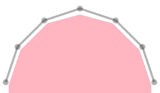
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



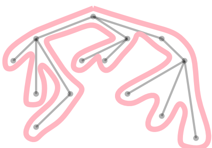
obs$(K_n) = 0$



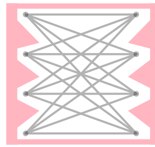
obs$(I_n) = 1$



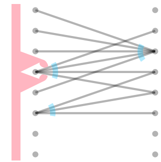
obs$(P_n) = 1$



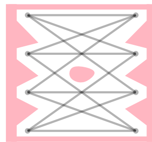
obs$(T_n) = 1$



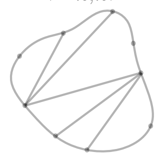
obs$(K_{n,n}) = 1$



obs(pl.bip.) $= 1$



obs$(K^*_{n,n}) = 2$



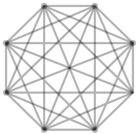
obs(outpl.) $= 1$

[Alpert, Koch, Laison, 2009]

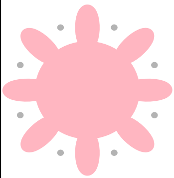
planar graphs

$\text{obs}(\text{planar}) = 1???$ NO!

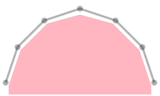
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



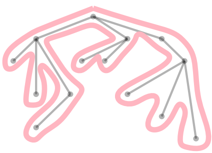
$\text{obs}(K_n) = 0$



$\text{obs}(I_n) = 1$



$\text{obs}(P_n) = 1$

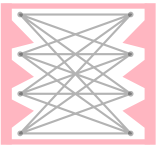


$\text{obs}(T_n) = 1$

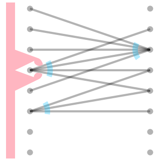
Open question:

Is the obstacle number of planar graphs bounded?

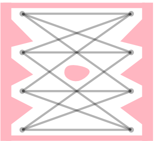
$$2 \leqslant \text{obs}(\text{planar}) \leqslant \infty$$



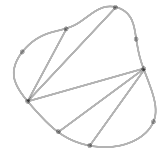
$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$



$\text{obs}(K^*_{n,n}) = 2$



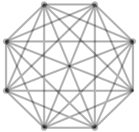
$\text{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

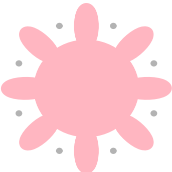
planar graphs

$\text{obs}(\text{planar}) = 1???$ NO!

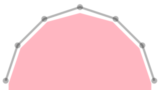
[Berman, Chappell, Faudree, Gimbel, Hartman, Williams, 2017]



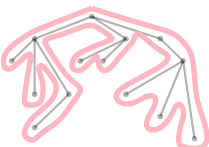
$\text{obs}(K_n) = 0$



$\text{obs}(I_n) = 1$



$\text{obs}(P_n) = 1$



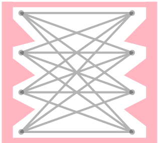
$\text{obs}(T_n) = 1$

Open question:

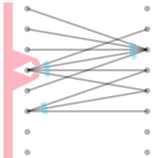
Is the obstacle number of planar graphs bounded?

$$2 \leqslant \text{obs}(\text{planar}) \leqslant \infty$$

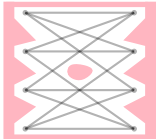
So are there graphs with large obstacle number at all?



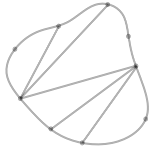
$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$

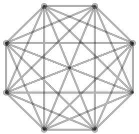


$\text{obs}(K^*_{n,n}) = 2$



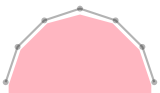
$\text{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

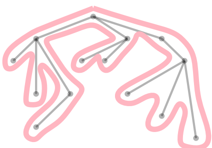


$\text{obs}(K_n) = 0$

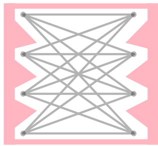
$\text{obs}(I_n) = 1$



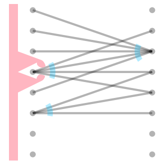
$\text{obs}(P_n) = 1$



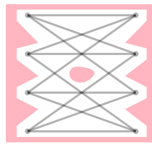
$\text{obs}(T_n) = 1$



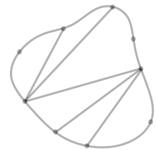
$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$



$\text{obs}(K^*_{n,n}) = 2$

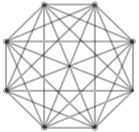


$\text{obs}(\text{outpl.}) = 1$

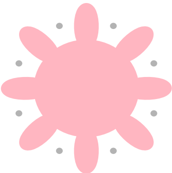
[Alpert, Koch, Laison, 2009]

[Pach, Sarıöz, 2011]

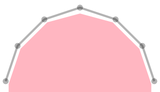
$$|\text{graphs with } \mathrm{obs}(G) \leqslant h| \leqslant 2^{o(n^2)}$$



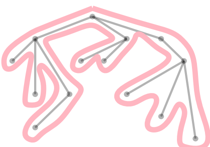
$\mathrm{obs}(K_n) = 0$



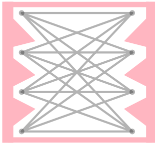
$\mathrm{obs}(I_n) = 1$



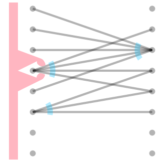
$\mathrm{obs}(P_n) = 1$



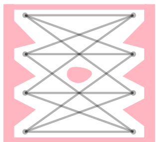
$\mathrm{obs}(T_n) = 1$



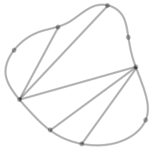
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$



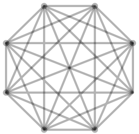
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

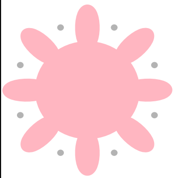
[Pach, Sarıöz, 2011]

$$|\text{graphs with } \mathrm{obs}(G) \leqslant h| \leqslant 2^{o(n^2)}$$

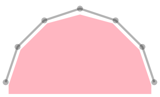
$$|\text{bipartite graphs with } \mathrm{obs}(G) \leqslant h| \leqslant 2^{o(n^2)}$$



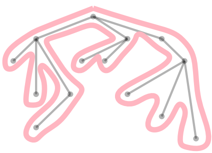
$\mathrm{obs}(K_n) = 0$



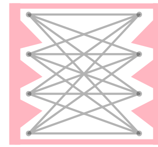
$\mathrm{obs}(I_n) = 1$



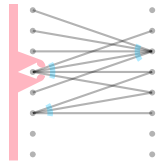
$\mathrm{obs}(P_n) = 1$



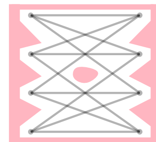
$\mathrm{obs}(T_n) = 1$



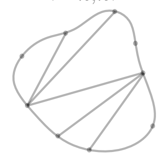
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$



$\mathrm{obs}(\text{outpl.}) = 1$

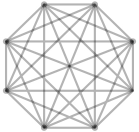
[Alpert, Koch, Laison, 2009]

[Pach, Sarıöz, 2011]

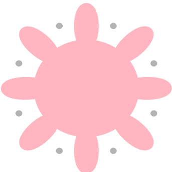
$$|\text{graphs with } \mathrm{obs}(G) \leqslant h| \leqslant 2^{o(n^2)}$$

$$|\text{bipartite graphs with } \mathrm{obs}(G) \leqslant h| \leqslant 2^{o(n^2)}$$

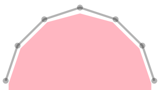
$\Rightarrow$ there is a bipartite graph with arbitrarly large obs



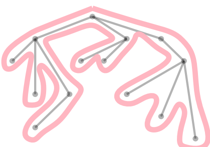
$\mathrm{obs}(K_n) = 0$



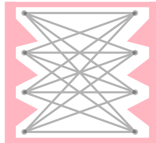
$\mathrm{obs}(I_n) = 1$



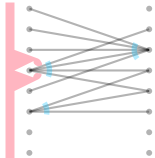
$\mathrm{obs}(P_n) = 1$



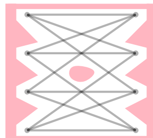
$\mathrm{obs}(T_n) = 1$



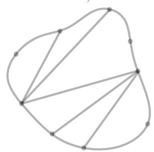
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$



$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

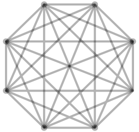
[Pach, Sarıöz, 2011]

$$|\text{graphs with } \mathrm{obs}(G) \leqslant h| \leqslant 2^{o(n^2)}$$

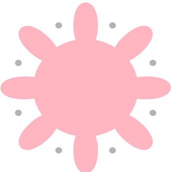
$$|\text{bipartite graphs with } \mathrm{obs}(G) \leqslant h| \leqslant 2^{o(n^2)}$$

$\Rightarrow$ there is a bipartite graph with arbitrarily large obs

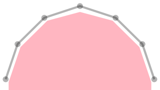
$$\mathrm{obs}(n) := \max\{\mathrm{obs}(G) : |V(G)| = n\}$$



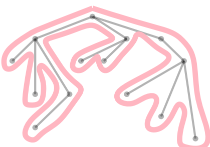
$\mathrm{obs}(K_n) = 0$



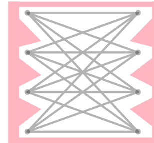
$\mathrm{obs}(I_n) = 1$



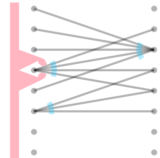
$\mathrm{obs}(P_n) = 1$



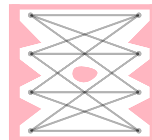
$\mathrm{obs}(T_n) = 1$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

[Pach, Sarıöz, 2011]

$|\text{graphs with } \mathrm{obs}(G) \leqslant h| \leqslant 2^{o(n^2)}$

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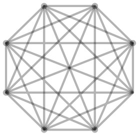
$\Rightarrow$ there is a bipartite graph with arbitrarily large obs

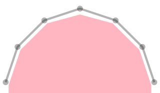
$$\mathrm{obs}(n) := \max\{\mathrm{obs}(G) : |V(G)| = n\}$$

$$\mathrm{obs}(n) \leqslant O(n^2)$$

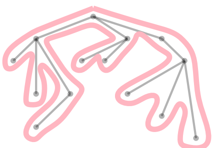


$\mathrm{obs}(K_n) = 0$

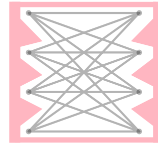
$\mathrm{obs}(I_n) = 1$



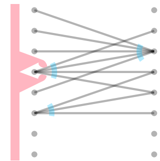
$\mathrm{obs}(P_n) = 1$



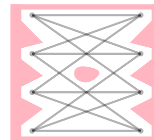
$\mathrm{obs}(T_n) = 1$



$\mathrm{obs}(K_{n,n}) = 1$



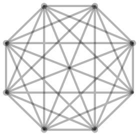
$\mathrm{obs}(\text{pl.bip.}) = 1$



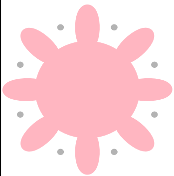
$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\text{outpl.}) = 1$

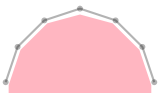
[Alpert, Koch, Laison, 2009]



$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$



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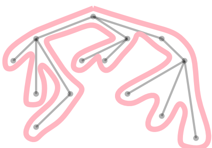

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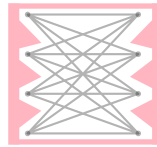
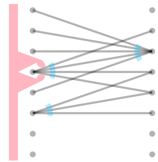
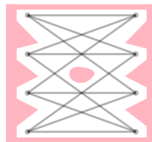


$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$

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[Alpert, Koch, Laison, 2009]

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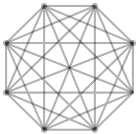

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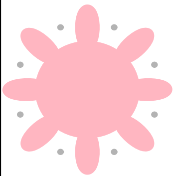

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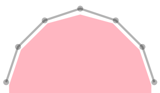

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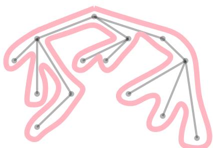

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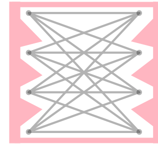

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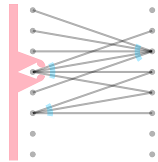

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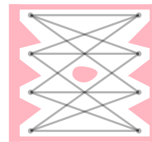

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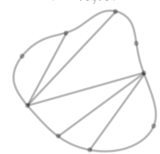

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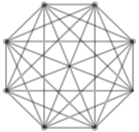

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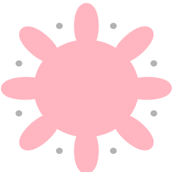

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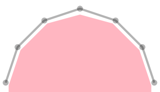
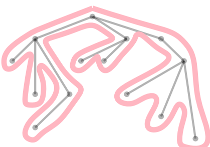


$\mathrm{obs}(P_n) = 1$



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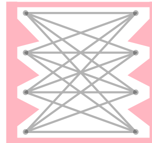

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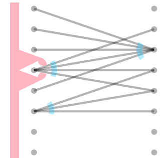

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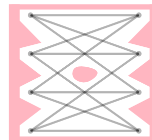

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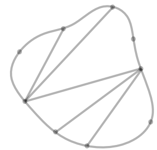

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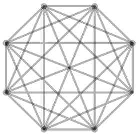

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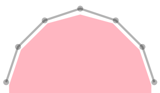

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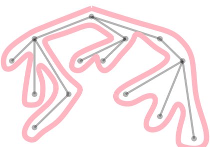

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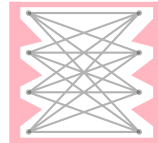

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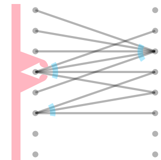

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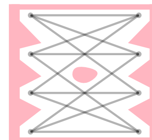

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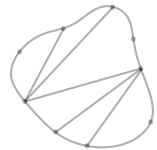

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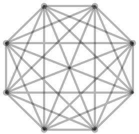

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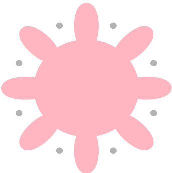

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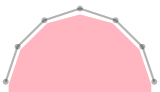

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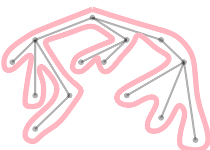

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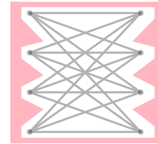

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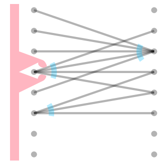

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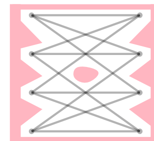

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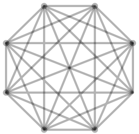

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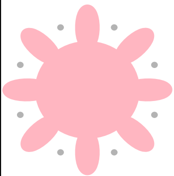

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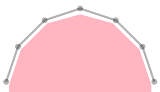

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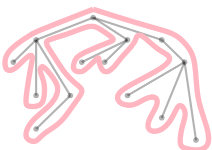

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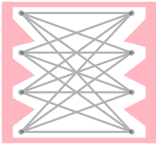

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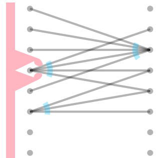

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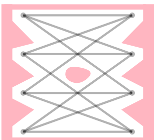

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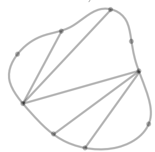

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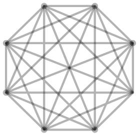

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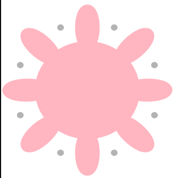

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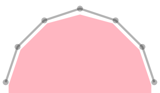

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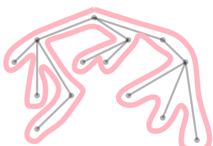

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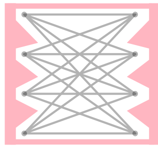
Open question:

Does $\mathrm{obs}(n) = \Theta(n)$ hold?



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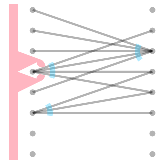
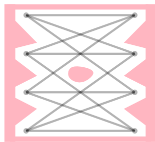


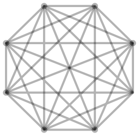
$\mathrm{obs}(\text{pl.bip.}) = 1$



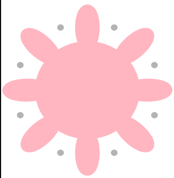
$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\text{outpl.}) = 1$

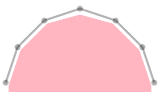
[Alpert, Koch, Laison, 2009]



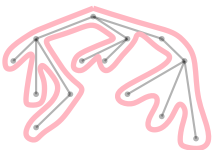
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$



$\mathrm{obs}(T_n) = 1$

[Pach, Sarıöz, 2011]

$$|\text{graphs with } \mathrm{obs}(G) \leqslant h| \leqslant 2^{o(n^2)}$$

$$|\text{bipartite graphs with } \mathrm{obs}(G) \leqslant h| \leqslant 2^{o(n^2)}$$

$\Rightarrow$ there is a bipartite graph with arbitrarily large obs

$$\mathrm{obs}(n) := \max\{\mathrm{obs}(G) : |V(G)| = n\}$$

$$\Omega(\sqrt{\log n}) \leqslant \mathrm{obs}(n)$$

[Alpert, Koch, Laison, 2009]

$$\Omega(n/(\log n)^2) \leqslant \mathrm{obs}(n)$$

[Mukkamala, Pach, Sarıöz, 2010]

$$\Omega(n/\log n) \leqslant \mathrm{obs}(n)$$

[Mukkamala, Pach, Palvölgyi, 2012]

$$\Omega(n/(\log\log n)^2) \leqslant \mathrm{obs}(n)$$

[Dujmovic, Morin, 2015]

$$\Omega(n/\log\log n) \leqslant \mathrm{obs}(n)$$

[Balko, Chaplick, Ganian, Gupta, Hoffmann, Valtr, Wolff, 2022]

$$\mathrm{obs}(n) \leqslant O(n^2)$$

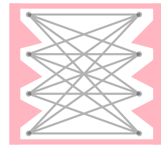
$$\mathrm{obs}(n) \leqslant O(n \log n)$$

$$\mathrm{obs}(n) \leqslant O(n) \text{ for } \chi = \text{const}$$

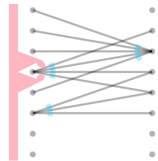
[Balko, Cibulka, Valtr, 2016]

Open question:

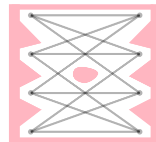
Does $\mathrm{obs}(n) = \Theta(n)$ hold?



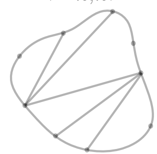
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$

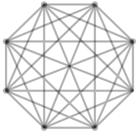


$\mathrm{obs}(K^*_{n,n}) = 2$

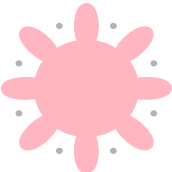


$\mathrm{obs}(\text{outpl.}) = 1$

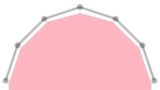
[Alpert, Koch, Laison, 2009]



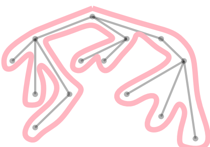
$\mathrm{obs}(K_n) = 0$



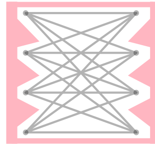
$\mathrm{obs}(I_n) = 1$



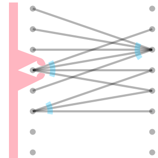
$\mathrm{obs}(P_n) = 1$



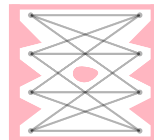
$\mathrm{obs}(T_n) = 1$



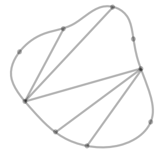
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$



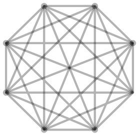
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

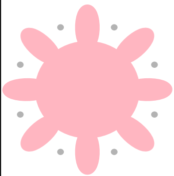
Construction of a graph with large on

[Alpert, Koch, Laison, 2009]

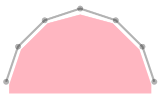
$G_{k,m}$



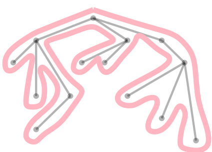
$\text{obs}(K_n) = 0$



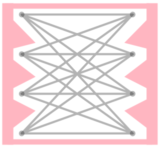
$\text{obs}(I_n) = 1$



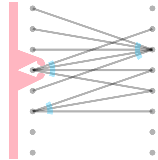
$\text{obs}(P_n) = 1$



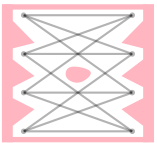
$\text{obs}(T_n) = 1$



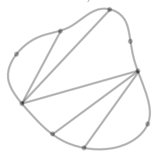
$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$



$\text{obs}(K^*_{n,n}) = 2$



$\text{obs}(\text{outpl.}) = 1$

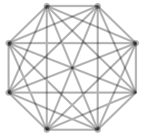
[Alpert, Koch, Laison, 2009]

Construction of a graph with large on

[Alpert, Koch, Laison, 2009]

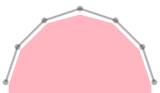
$G_{k,m}$

$\mathrm{obs}(G_{k,m}) \geqslant m$

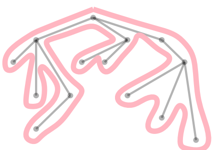


$\mathrm{obs}(K_n) = 0$

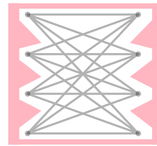
$\mathrm{obs}(I_n) = 1$



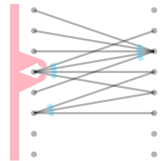
$\mathrm{obs}(P_n) = 1$



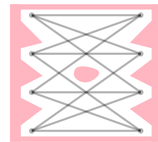
$\mathrm{obs}(T_n) = 1$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

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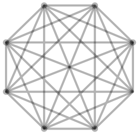
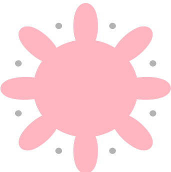
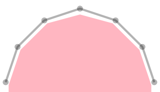


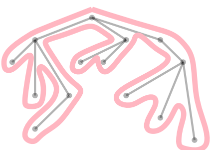
$\mathrm{obs}(K_n) = 0$



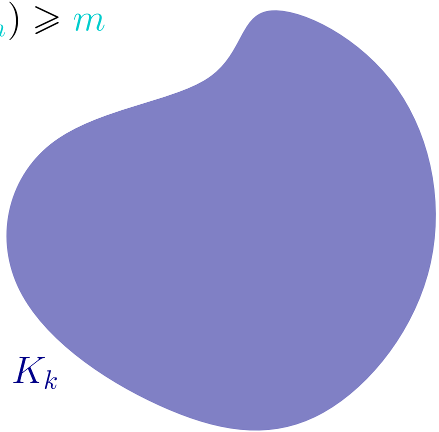
$\mathrm{obs}(I_n) = 1$

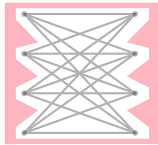


$\mathrm{obs}(P_n) = 1$

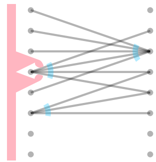


$\mathrm{obs}(T_n) = 1$

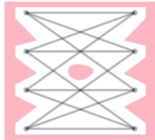




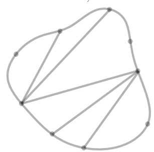
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\mathrm{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$



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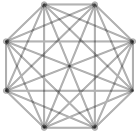
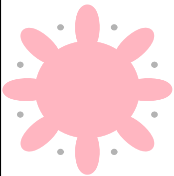
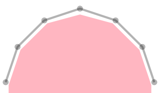
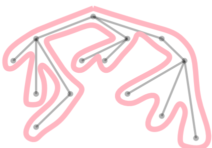
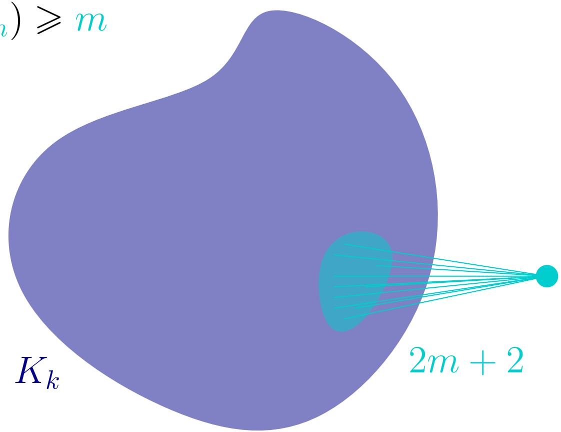
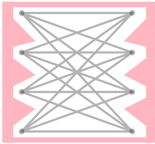

$\mathrm{obs}(K_n) = 0$

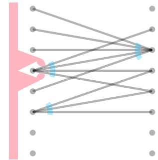

$\mathrm{obs}(I_n) = 1$

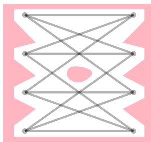

$\mathrm{obs}(P_n) = 1$

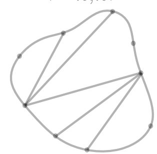

$\mathrm{obs}(T_n) = 1$




$\mathrm{obs}(K_{n,n}) = 1$


$\mathrm{obs}(\mathrm{pl.bip.}) = 1$


$\mathrm{obs}(K^*_{n,n}) = 2$


$\mathrm{obs}(\mathrm{outpl.}) = 1$

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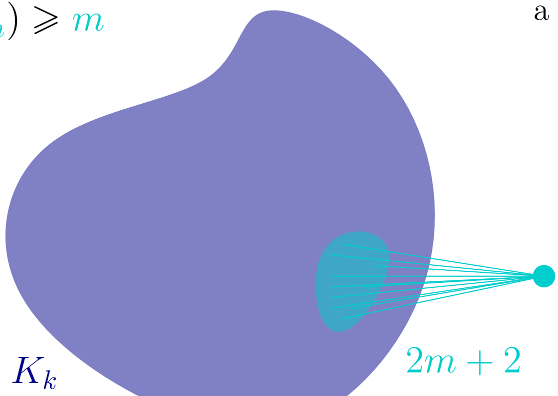
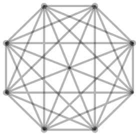
$G_{k,m}$

$\mathrm{obs}(G_{k,m}) \geqslant m$

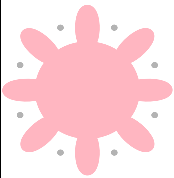
[Erdős, Szekeres, 1935]

k such that $4m+4$ in a convex position

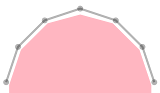




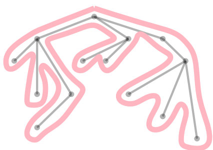
$\mathrm{obs}(K_n) = 0$



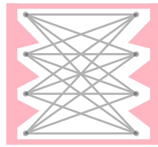
$\mathrm{obs}(I_n) = 1$



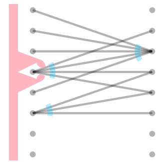
$\mathrm{obs}(P_n) = 1$



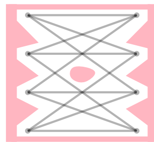
$\mathrm{obs}(T_n) = 1$



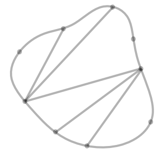
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\mathrm{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$



$\mathrm{obs}(\mathrm{outpl.}) = 1$

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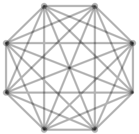
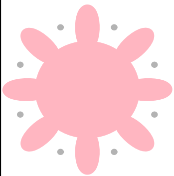
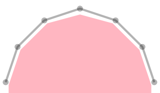


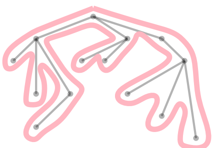
$\mathrm{obs}(K_n) = 0$



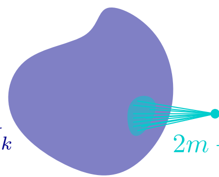
$\mathrm{obs}(I_n) = 1$

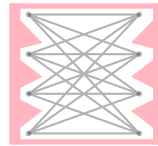


$\mathrm{obs}(P_n) = 1$

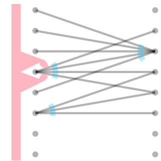


$\mathrm{obs}(T_n) = 1$

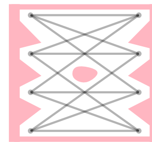




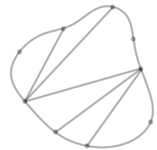
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\mathrm{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$



$\mathrm{obs}(\mathrm{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

Construction of a graph with large on

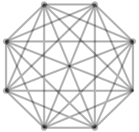
[Alpert, Koch, Laison, 2009]

$G_{k,m}$

$\mathrm{obs}(G_{k,m}) \geqslant m$

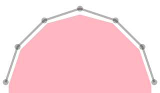
[Erdős, Szekeres, 1935]

k such that $4m+4$ in a convex position

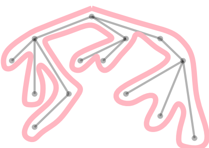


$\mathrm{obs}(K_n) = 0$

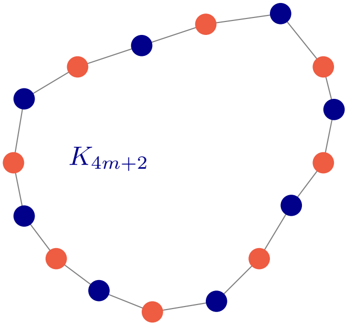
$\mathrm{obs}(I_n) = 1$

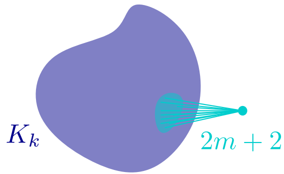


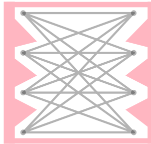
$\mathrm{obs}(P_n) = 1$



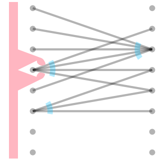
$\mathrm{obs}(T_n) = 1$



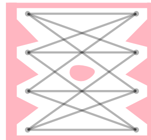




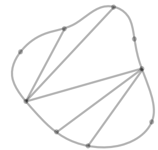
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$



$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

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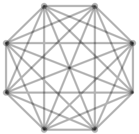
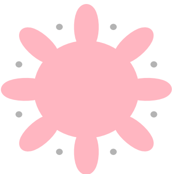
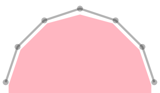
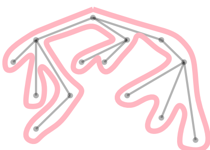
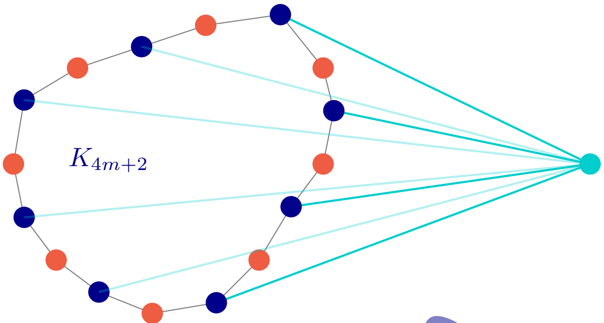
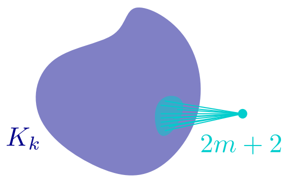

$\text{obs}(K_n) = 0$

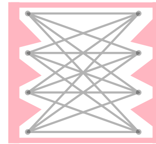

$\text{obs}(I_n) = 1$

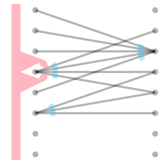

$\text{obs}(P_n) = 1$

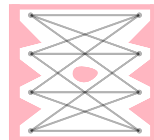

$\text{obs}(T_n) = 1$






$\text{obs}(K_{n,n}) = 1$


$\text{obs}(\text{pl.bip.}) = 1$


$\text{obs}(K^*_{n,n}) = 2$


$\text{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

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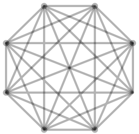
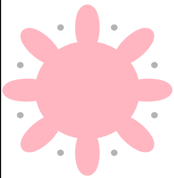
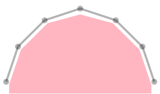


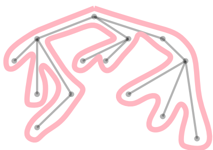
$\text{obs}(K_n) = 0$



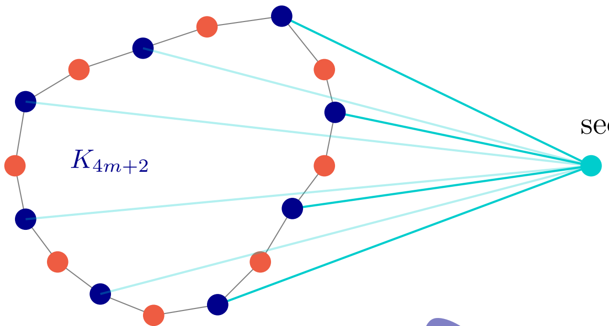
$\text{obs}(I_n) = 1$

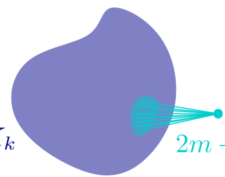


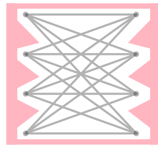
$\text{obs}(P_n) = 1$



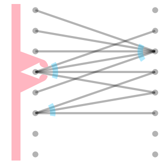
$\text{obs}(T_n) = 1$



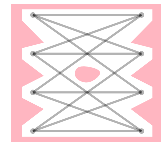




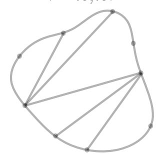
$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$



$\text{obs}(K^*_{n,n}) = 2$



$\text{obs}(\text{outpl.}) = 1$

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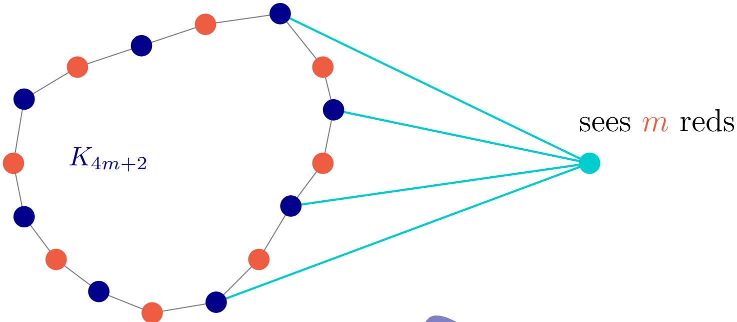

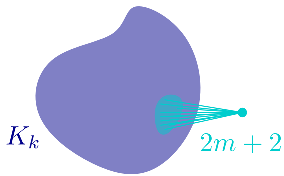

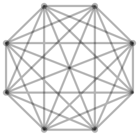

$\mathrm{obs}(K_n) = 0$

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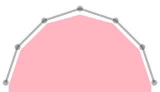
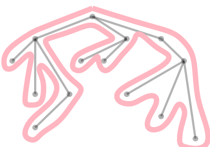
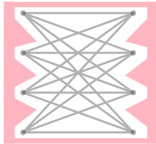


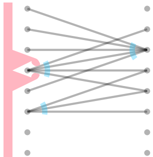
$\mathrm{obs}(P_n) = 1$



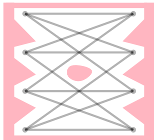
$\mathrm{obs}(T_n) = 1$



$\mathrm{obs}(K_{n,n}) = 1$



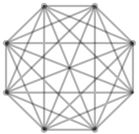
$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]



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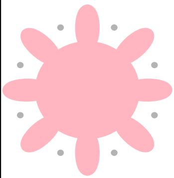
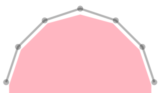


$\mathrm{obs}(I_n) = 1$



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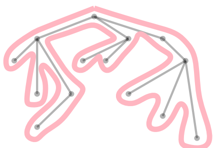

$\mathrm{obs}(T_n) = 1$

Construction of a graph with large on

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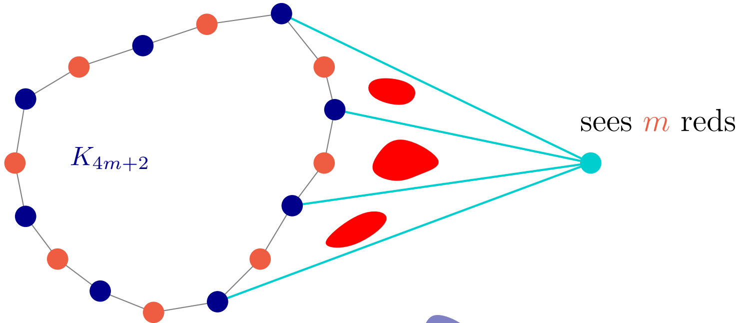

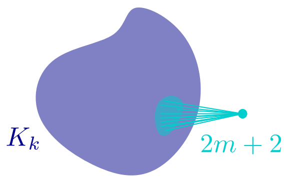

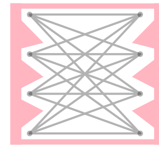

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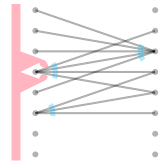
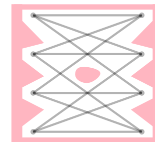


$\mathrm{obs}(\mathrm{pl.bip.}) = 1$



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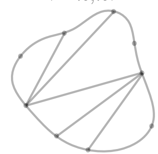

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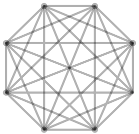

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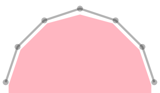

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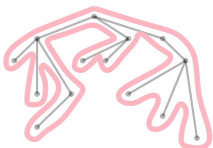
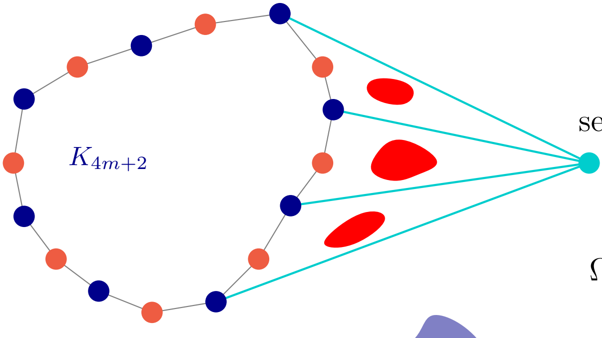
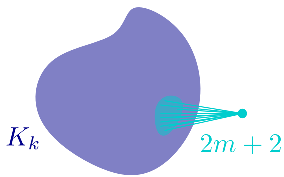


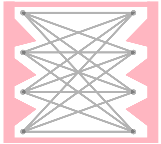
$\mathrm{obs}(T_n) = 1$



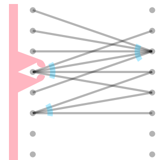
sees m reds

$\Omega(\sqrt{\log n}) \leqslant \mathrm{obs}(n)$





$\mathrm{obs}(K_{n,n}) = 1$



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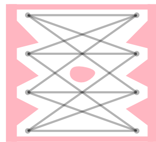

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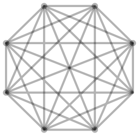
[Alpert, Koch, Laison, 2009]



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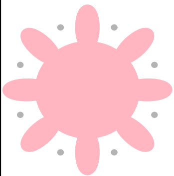
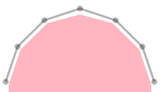
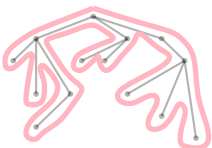


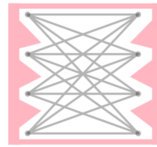
$\mathrm{obs}(I_n) = 1$



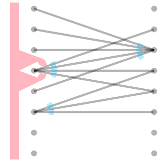
$\mathrm{obs}(P_n) = 1$



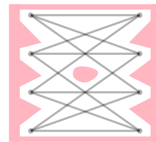
$\mathrm{obs}(T_n) = 1$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$

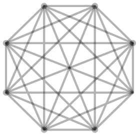


$\mathrm{obs}(K^*_{n,n}) = 2$

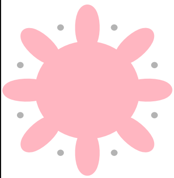
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

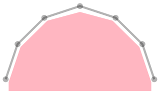
Covex obstacle number – obs_c



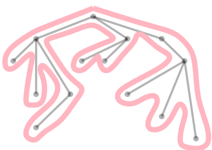
$\mathrm{obs}(K_n) = 0$



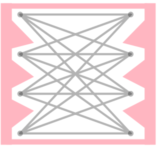
$\mathrm{obs}(I_n) = 1$



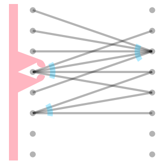
$\mathrm{obs}(P_n) = 1$



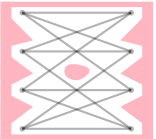
$\mathrm{obs}(T_n) = 1$



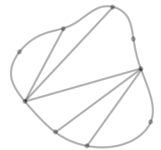
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



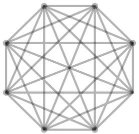
$\mathrm{obs}(K^*_{n,n}) = 2$



$\mathrm{obs}(\text{outpl.}) = 1$

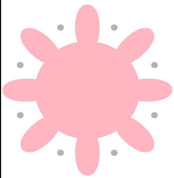
[Alpert, Koch, Laison, 2009]

Covex obstacle number – obs_c

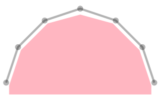


$\mathrm{obs}(K_n) = 0$

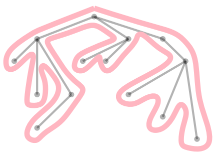
$\mathrm{obs}_c(K_n) = 0$



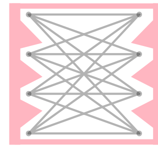
$\mathrm{obs}(I_n) = 1$



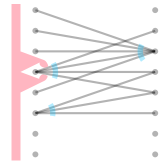
$\mathrm{obs}(P_n) = 1$



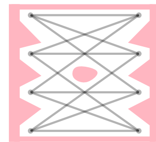
$\mathrm{obs}(T_n) = 1$



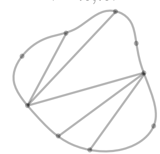
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



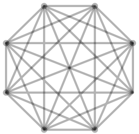
$\mathrm{obs}(K^*_{n,n}) = 2$



$\mathrm{obs}(\text{outpl.}) = 1$

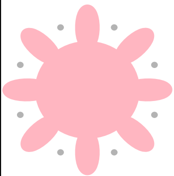
[Alpert, Koch, Laison, 2009]

Covex obstacle number – obs_c



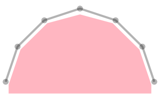
$\text{obs}(K_n) = 0$

$\text{obs}_c(K_n) = 0$

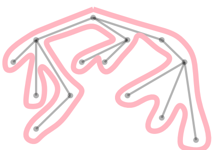


$\text{obs}(I_n) = 1$

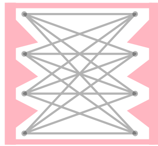
$\text{obs}_c(I_n) = 1$



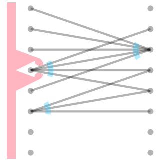
$\text{obs}(P_n) = 1$



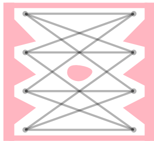
$\text{obs}(T_n) = 1$



$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$

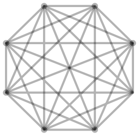


$\text{obs}(K^*_{n,n}) = 2$

$\text{obs}(\text{outpl.}) = 1$

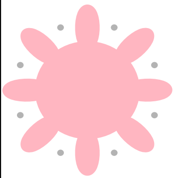
[Alpert, Koch, Laison, 2009]

Covex obstacle number – obs_c



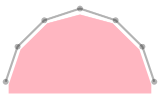
$\mathrm{obs}(K_n) = 0$

$\mathrm{obs}_c(K_n) = 0$



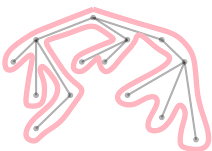
$\mathrm{obs}(I_n) = 1$

$\mathrm{obs}_c(I_n) = 1$

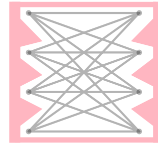


$\mathrm{obs}(P_n) = 1$

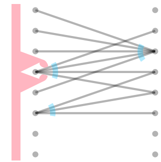
$\mathrm{obs}_c(P_n) = 1$



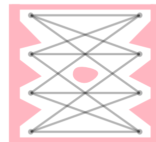
$\mathrm{obs}(T_n) = 1$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$

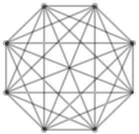


$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\text{outpl.}) = 1$

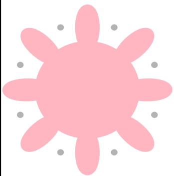
[Alpert, Koch, Laison, 2009]

Covex obstacle number – obs_c



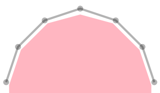
$\mathrm{obs}_c(K_n) = 0$

$\mathrm{obs}(K_n) = 0$



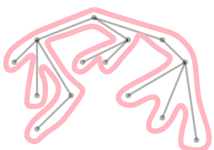
$\mathrm{obs}_c(I_n) = 1$

$\mathrm{obs}(I_n) = 1$



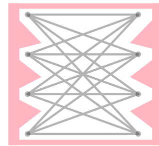
$\mathrm{obs}_c(P_n) = 1$

$\mathrm{obs}(P_n) = 1$

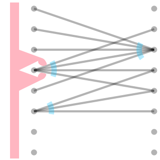


$\mathrm{obs}(T_n) = 1$

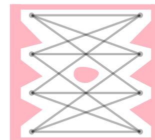
$\mathrm{obs}_c(K_{n,n}) \leqslant 2$



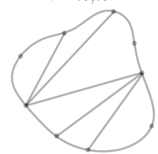
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



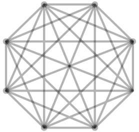
$\mathrm{obs}(K^*_{n,n}) = 2$



$\mathrm{obs}(\text{outpl.}) = 1$

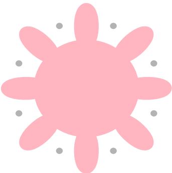
[Alpert, Koch, Laison, 2009]

Covex obstacle number – obs_c



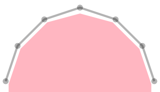
$\mathrm{obs}(K_n) = 0$

$\mathrm{obs}_c(K_n) = 0$



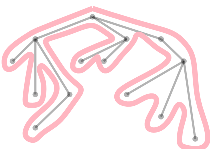
$\mathrm{obs}(I_n) = 1$

$\mathrm{obs}_c(I_n) = 1$



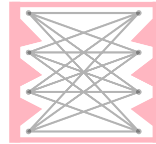
$\mathrm{obs}(P_n) = 1$

$\mathrm{obs}_c(P_n) = 1$



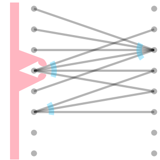
$\mathrm{obs}(T_n) = 1$

$\mathrm{obs}_c(K_{n,n}) \leqslant 2$

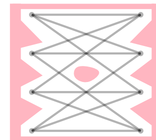


$\mathrm{obs}(K_{n,n}) = 1$

$\mathrm{obs}_c(\text{pl.bip.}) \leqslant 2$



$\mathrm{obs}(\text{pl.bip.}) = 1$

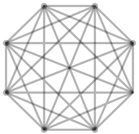


$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\text{outpl.}) = 1$

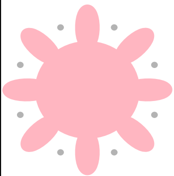
[Alpert, Koch, Laison, 2009]

Covex obstacle number – obs_c



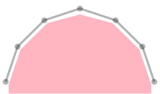
$\mathrm{obs}_c(K_n) = 0$

$\mathrm{obs}(K_n) = 0$



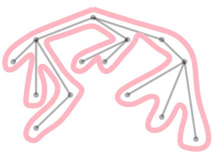
$\mathrm{obs}_c(I_n) = 1$

$\mathrm{obs}(I_n) = 1$



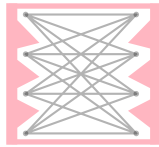
$\mathrm{obs}_c(P_n) = 1$

$\mathrm{obs}(P_n) = 1$



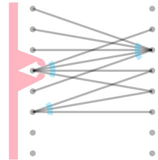
$\mathrm{obs}(T_n) = 1$

$\mathrm{obs}_c(K_{n,n}) \leqslant 2$



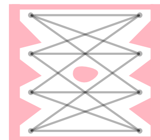
$\mathrm{obs}(K_{n,n}) = 1$

$\mathrm{obs}_c(\text{pl.bip.}) \leqslant 2$



$\mathrm{obs}(\text{pl.bip.}) = 1$

$\mathrm{obs}_c(K^*_{n,n}) \leqslant 3$

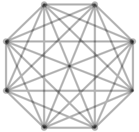


$\mathrm{obs}(K^*_{n,n}) = 2$

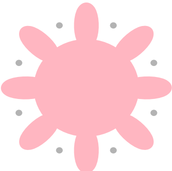
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

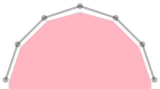
Covex obstacle number – obs_c



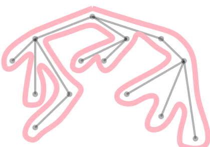
$\mathrm{obs}(K_n) = 0$



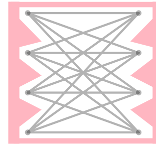
$\mathrm{obs}(I_n) = 1$



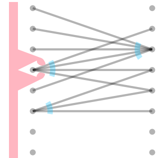
$\mathrm{obs}(P_n) = 1$



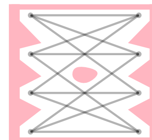
$\mathrm{obs}(T_n) = 1$



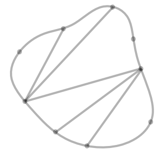
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



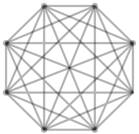
$\mathrm{obs}(K^*_{n,n}) = 2$



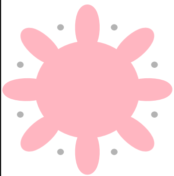
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

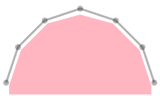
Covex obstacle number – obs_c



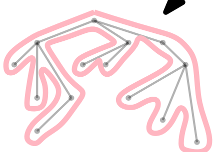
$\mathrm{obs}(K_n) = 0$



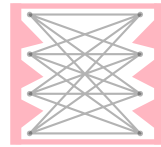
$\mathrm{obs}(I_n) = 1$



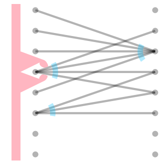
$\mathrm{obs}(P_n) = 1$



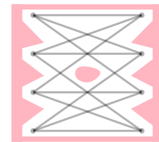
$\mathrm{obs}(T_n) = 1$



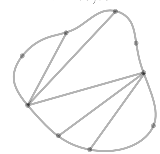
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



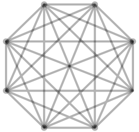
$\mathrm{obs}(K^*_{n,n}) = 2$



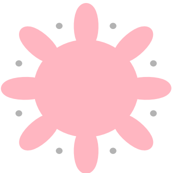
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

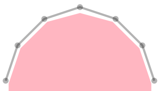
Covex obstacle number – obs_c



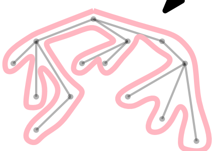
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$

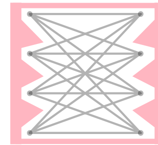


$\mathrm{obs}(P_n) = 1$

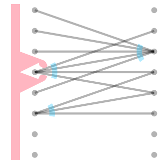


$\mathrm{obs}(T_n) = 1$

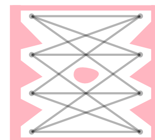
[Fulek, Saeedi, Sarıöz, 2011]



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$

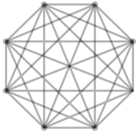


$\mathrm{obs}(K^*_{n,n}) = 2$

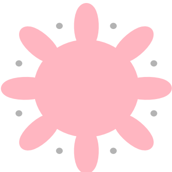
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

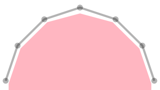
Covex obstacle number – obs_c



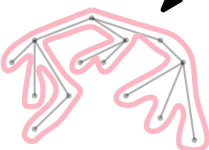
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$



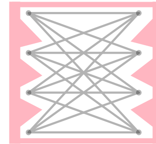
$\mathrm{obs}(P_n) = 1$



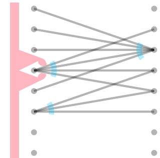
$\mathrm{obs}(T_n) = 1$

[Fulek, Saeedi, Sarıöz, 2011]

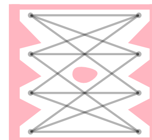
$4 \leqslant \mathrm{obs}_c(T_n)$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\mathrm{pl.bip.}) = 1$

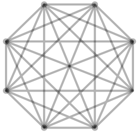


$\mathrm{obs}(K^*_{n,n}) = 2$

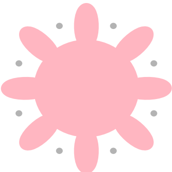
$\mathrm{obs}(\mathrm{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

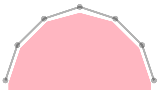
Covex obstacle number – obs_c



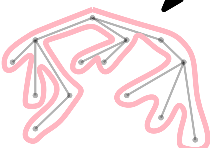
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$

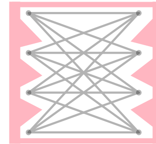


$\mathrm{obs}(T_n) = 1$

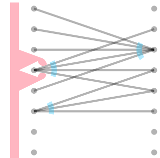
[Fulek, Saeedi, Sarıöz, 2011]

$4 \leqslant \mathrm{obs}_c(T_n)$

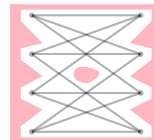
$\mathrm{obs}_c(\text{outpl.}) \leqslant 5$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$

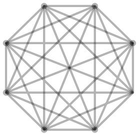


$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\text{outpl.}) = 1$

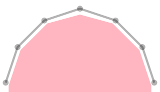
[Alpert, Koch, Laison, 2009]

Covex obstacle number – obs_c

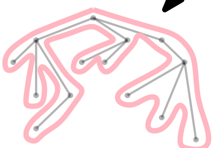


$\mathrm{obs}(K_n) = 0$

$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$

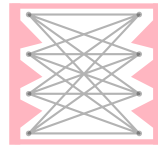


$\mathrm{obs}(T_n) = 1$

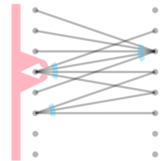
[Fulek, Saeedi, Sarıöz, 2011]

$4 \leqslant \mathrm{obs}_c(T_n)$

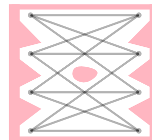
$\mathrm{obs}_c(\text{outpl.}) \leqslant 5$



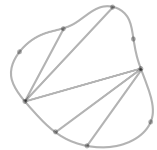
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



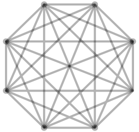
$\mathrm{obs}(K^*_{n,n}) = 2$



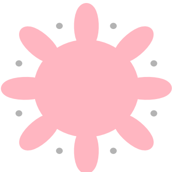
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

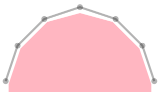
Covex obstacle number – obs_c



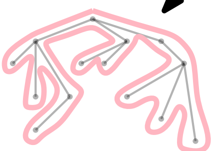
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$

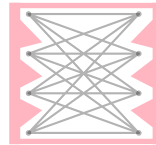


$\mathrm{obs}(T_n) = 1$

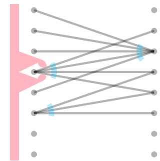
[Fulek, Saeedi, Sarıöz, 2011]

$4 \leqslant \mathrm{obs}_c(T_n)$

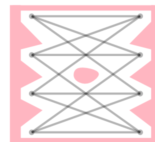
$\mathrm{obs}_c(\text{outpl.}) \leqslant 5$



$\mathrm{obs}(K_{n,n}) = 1$



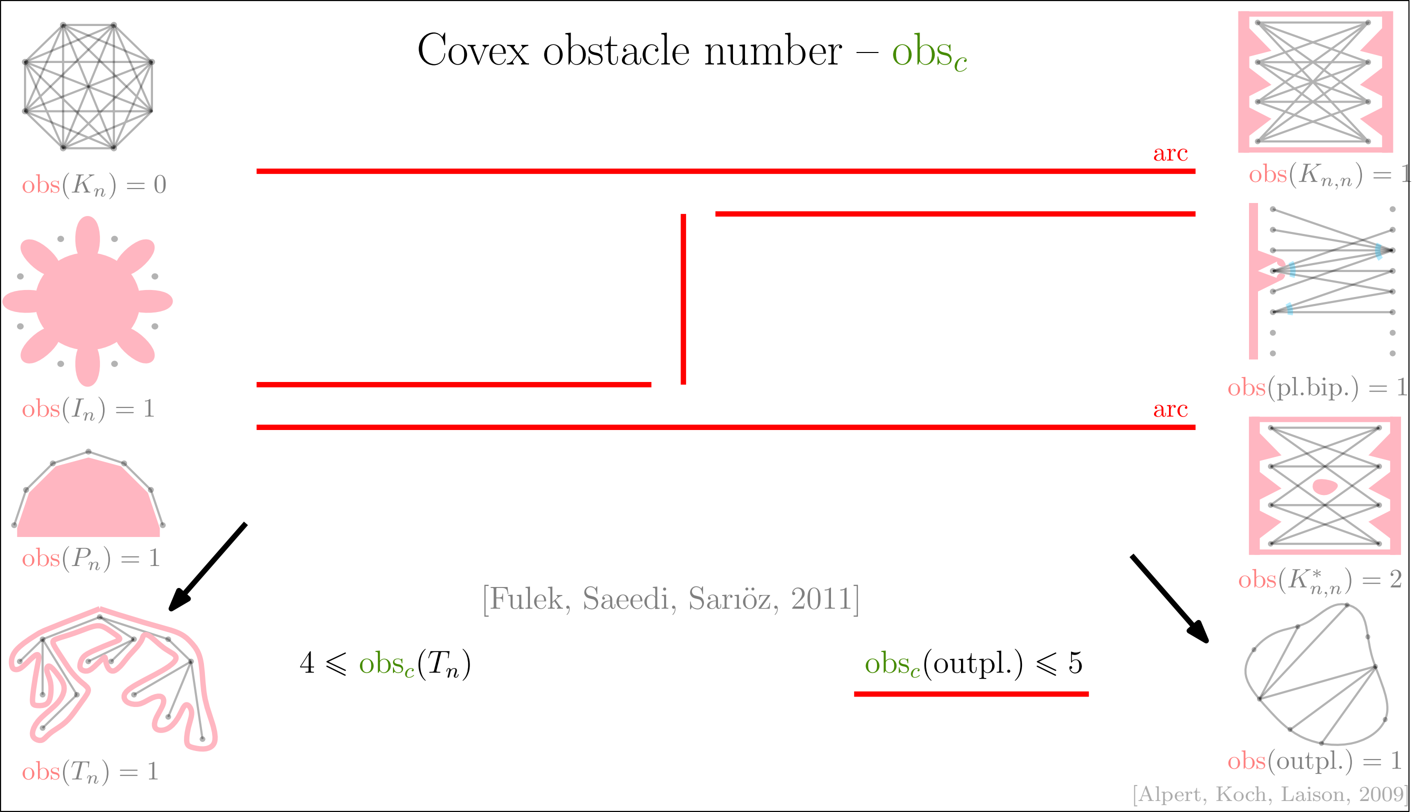
$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$

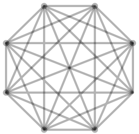
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]



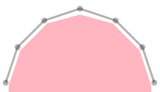
Covex obstacle number – obs$_c$
obs$(K_n) = 0$
obs$(I_n) = 1$
obs$(P_n) = 1$
obs$(T_n) = 1$
arc
arc
obs$(K_{n,n}) = 1$
obs(pl.bip.) = 1
obs$(K^*_{n,n}) = 2$
obs(outpl.) = 1
[Fulek, Saeedi, Sarıöz, 2011]
$4 \leqslant$ obs$_c(T_n)$
obs$_c$(outpl.) $\leqslant 5$
[Alpert, Koch, Laison, 2009]

Covex obstacle number – obs_c

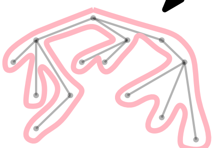


$\mathrm{obs}(K_n) = 0$

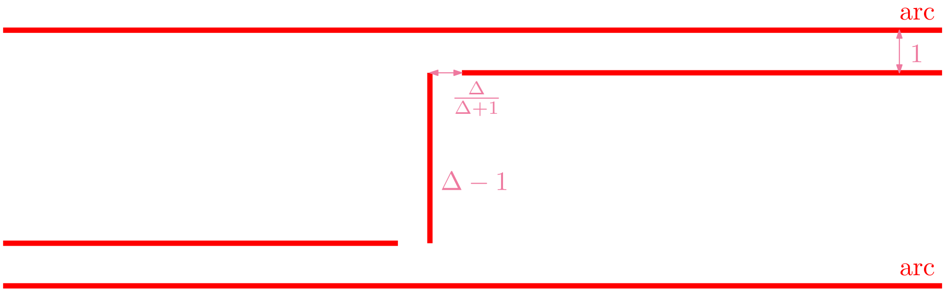
$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$



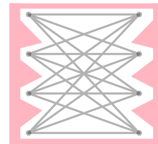
$\mathrm{obs}(T_n) = 1$



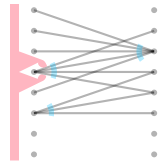
[Fulek, Saeedi, Sarıöz, 2011]

$4 \leqslant \mathrm{obs}_c(T_n)$

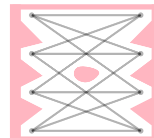
$\mathrm{obs}_c(\text{outpl.}) \leqslant 5$



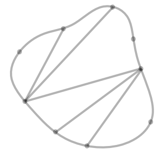
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



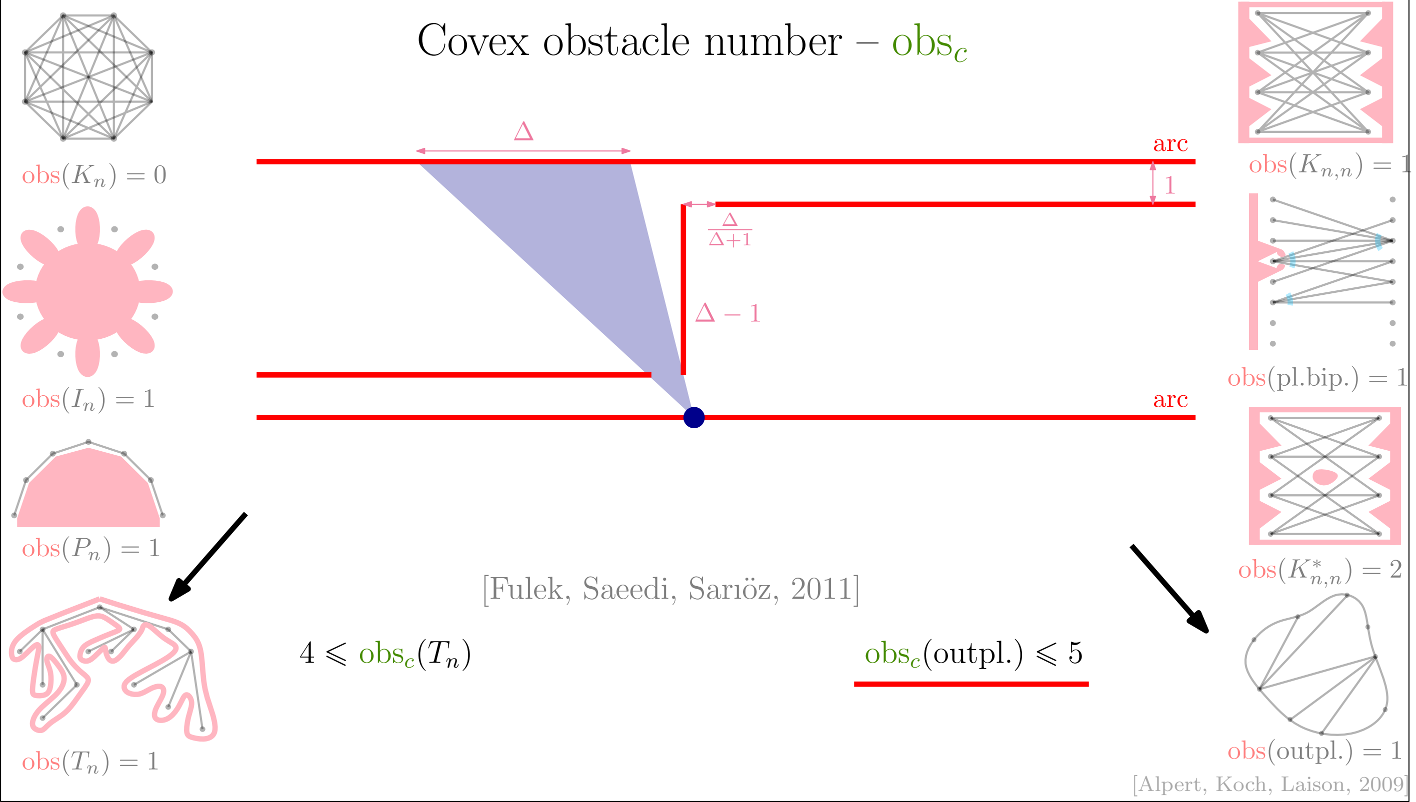
$\mathrm{obs}(K^*_{n,n}) = 2$



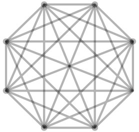
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

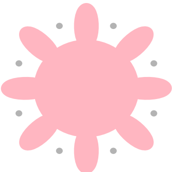
Covex obstacle number – obs_c



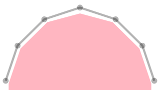
Covex obstacle number – obs_c



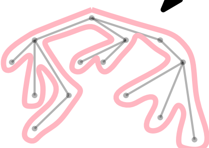
$\mathrm{obs}(K_n) = 0$



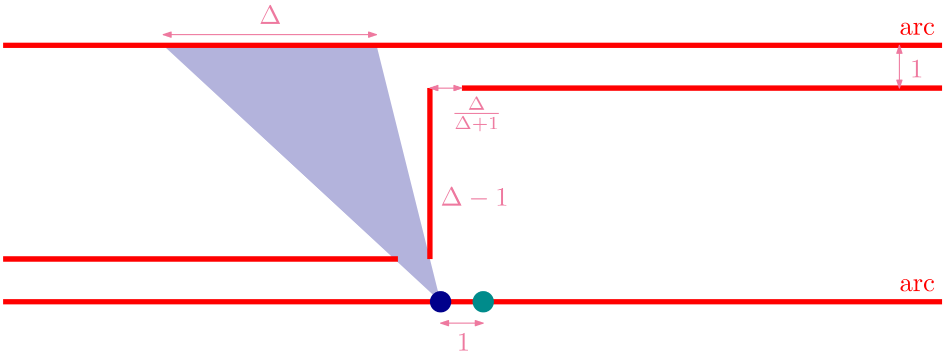
$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$



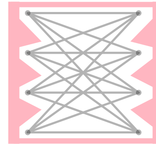
$\mathrm{obs}(T_n) = 1$



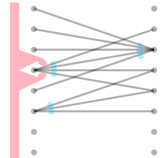
[Fulek, Saeedi, Sarıöz, 2011]

$4 \leqslant \mathrm{obs}_c(T_n)$

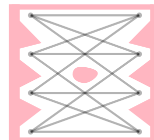
$\mathrm{obs}_c(\text{outpl.}) \leqslant 5$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$

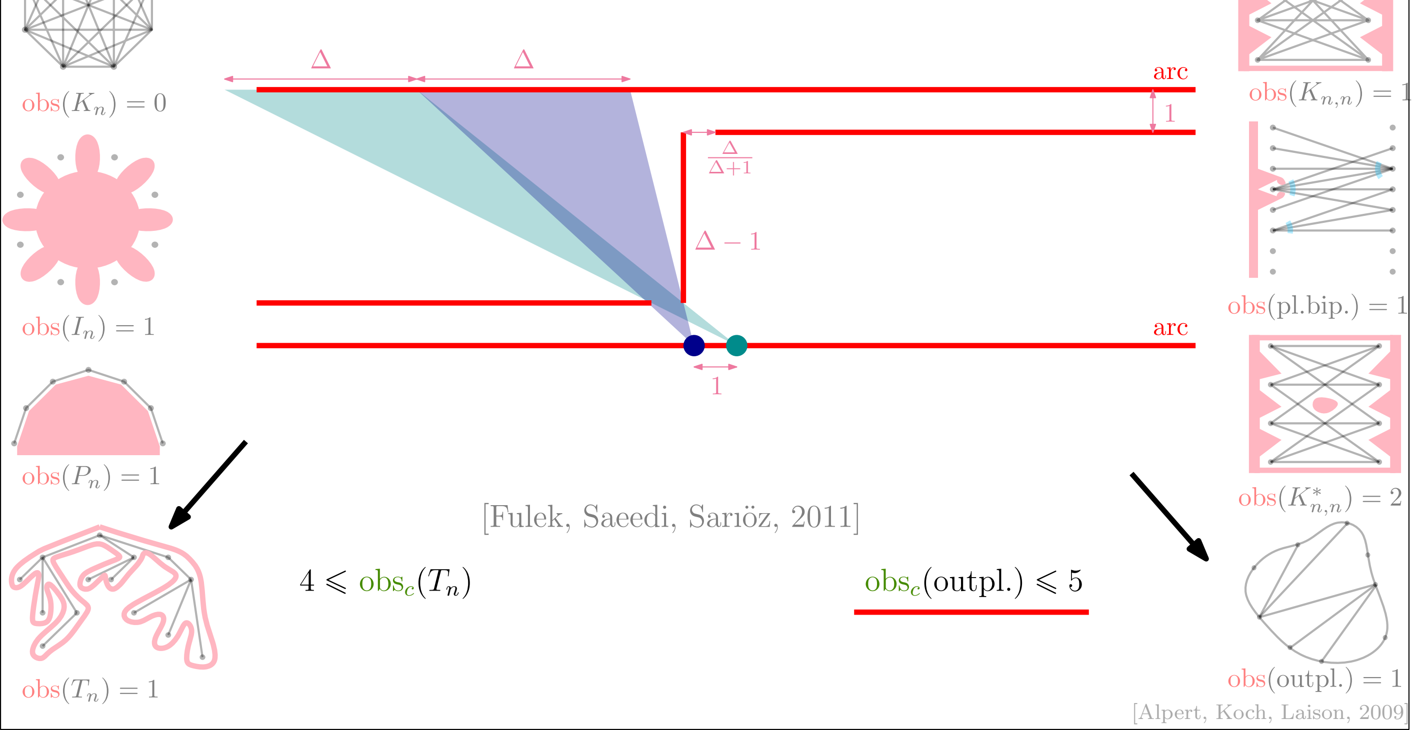


$\mathrm{obs}(K^*_{n,n}) = 2$

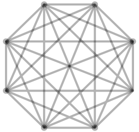
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

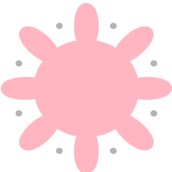
Covex obstacle number – obs_c



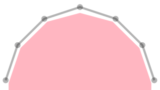
Covex obstacle number – obs_c



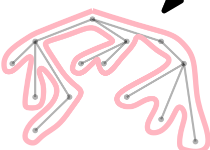
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$

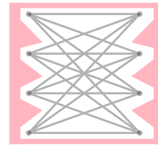


$\mathrm{obs}(T_n) = 1$

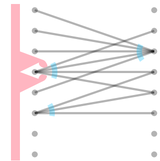
[Fulek, Saeedi, Sarıöz, 2011]

$4 \leqslant \mathrm{obs}_c(T_n)$

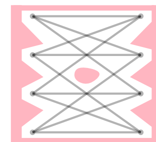
$\mathrm{obs}_c(\text{outpl.}) \leqslant 5$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$

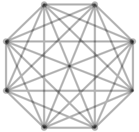


$\mathrm{obs}(K^*_{n,n}) = 2$

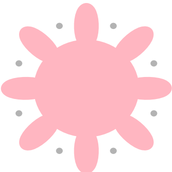
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

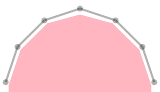
Covex obstacle number – obs_c



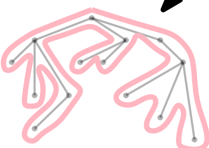
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$

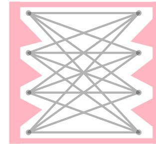


$\mathrm{obs}(T_n) = 1$

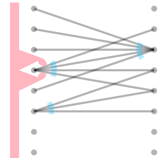
[Fulek, Saeedi, Sarıöz, 2011]

$4 \leqslant \mathrm{obs}_c(T_n)$

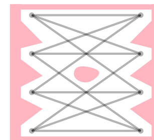
$\mathrm{obs}_c(\text{outpl.}) \leqslant 5$



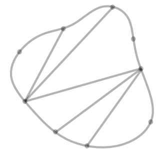
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



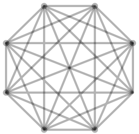
$\mathrm{obs}(K^*_{n,n}) = 2$



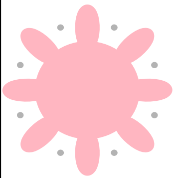
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

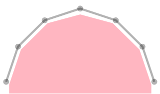
Covex obstacle number – obs_c



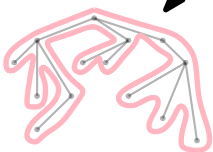
$\mathrm{obs}(K_n) = 0$



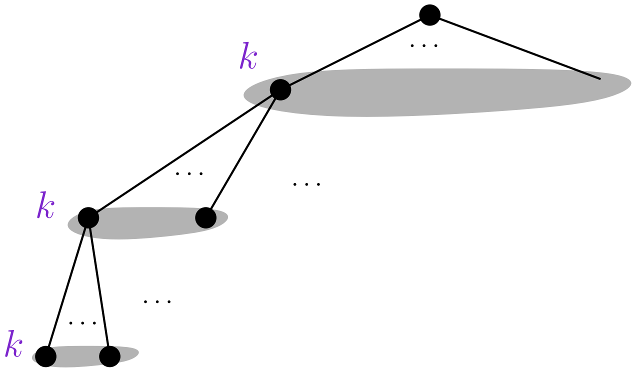
$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$



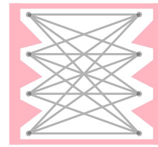
$\mathrm{obs}(T_n) = 1$



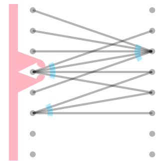
[Fulek, Saeedi, Sarıöz, 2011]

$4 \leqslant \mathrm{obs}_c(T_n)$

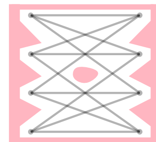
$\mathrm{obs}_c(\text{outpl.}) \leqslant 5$



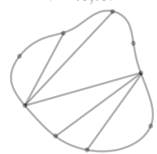
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



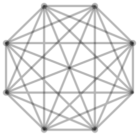
$\mathrm{obs}(K^*_{n,n}) = 2$



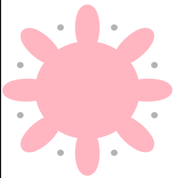
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

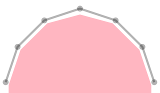
Covex obstacle number – obs_c



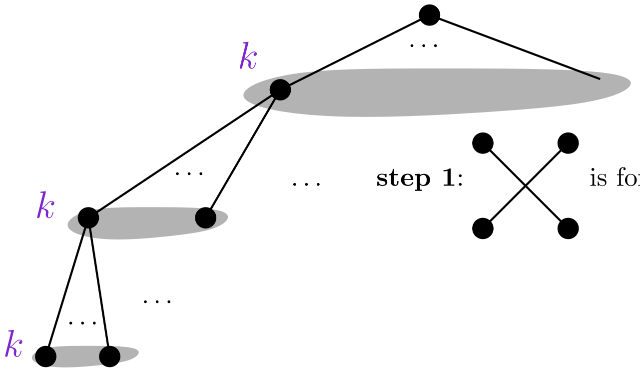
$\mathrm{obs}(K_n) = 0$



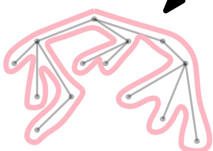
$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$



step 1: is forbidden

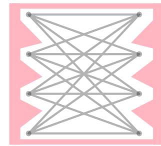


$\mathrm{obs}(T_n) = 1$

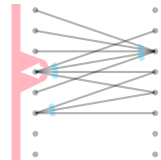
[Fulek, Saeedi, Sarıöz, 2011]

$4 \leqslant \mathrm{obs}_c(T_n)$

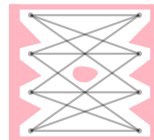
$\mathrm{obs}_c(\text{outpl.}) \leqslant 5$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$

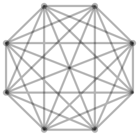


$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\text{outpl.}) = 1$

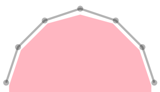
[Alpert, Koch, Laison, 2009]

Covex obstacle number – obs_c

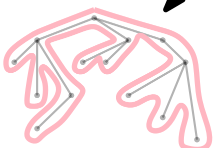


$\mathrm{obs}(K_n) = 0$

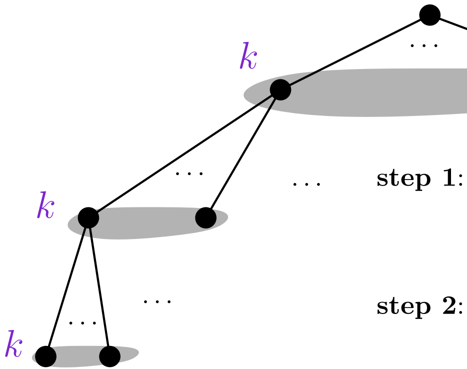
$\mathrm{obs}(I_n) = 1$

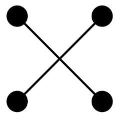


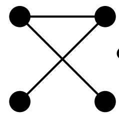
$\mathrm{obs}(P_n) = 1$



$\mathrm{obs}(T_n) = 1$



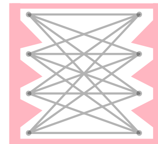
step 1:  is forbidden

step 2: Ramsay to get 3x  disjoint

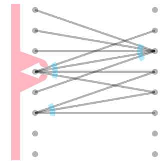
[Fulek, Saeedi, Sarıöz, 2011]

$4 \leqslant \mathrm{obs}_c(T_n)$

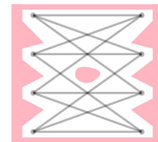
$\mathrm{obs}_c(\text{outpl.}) \leqslant 5$



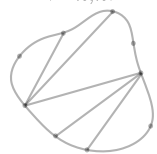
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



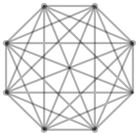
$\mathrm{obs}(K^*_{n,n}) = 2$



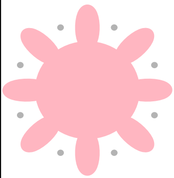
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

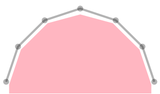
Covex obstacle number – obs_c



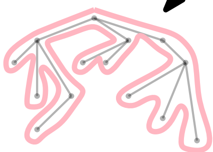
$\mathrm{obs}(K_n) = 0$



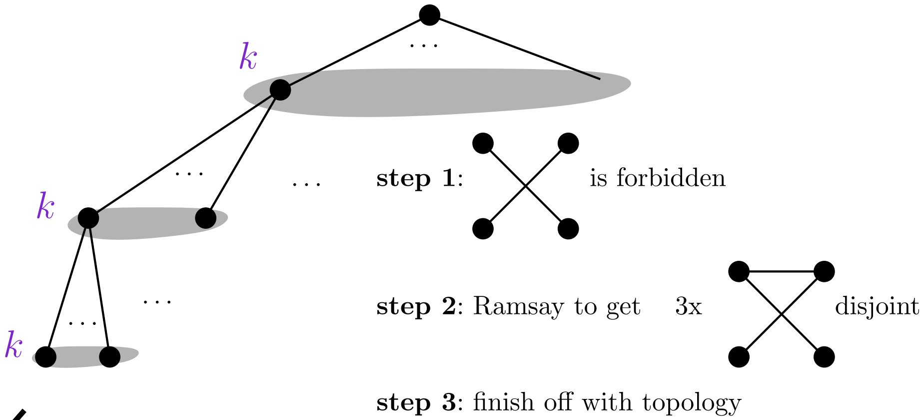
$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$



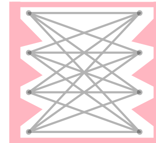
$\mathrm{obs}(T_n) = 1$



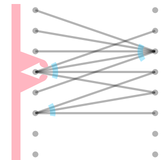
[Fulek, Saeedi, Sarıöz, 2011]

$4 \leqslant \mathrm{obs}_c(T_n)$

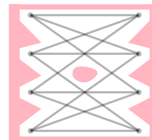
$\mathrm{obs}_c(\text{outpl.}) \leqslant 5$



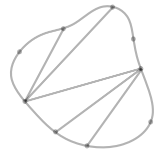
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



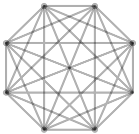
$\mathrm{obs}(K^*_{n,n}) = 2$



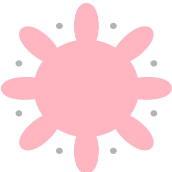
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

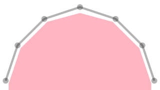
Covex obstacle number – obs_c



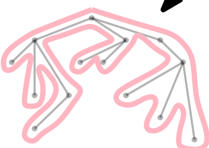
$\mathrm{obs}(K_n) = 0$



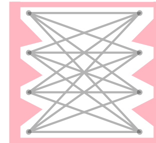
$\mathrm{obs}(I_n) = 1$



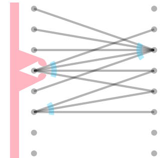
$\mathrm{obs}(P_n) = 1$



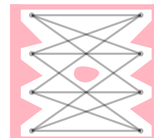
$\mathrm{obs}(T_n) = 1$



$\mathrm{obs}(K_{n,n}) = 1$



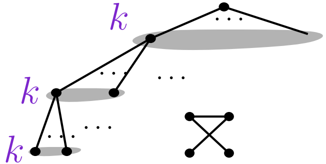
$\mathrm{obs}(\text{pl.bip.}) = 1$

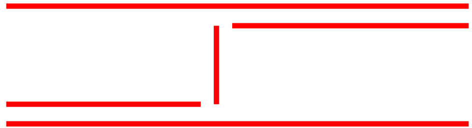


$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]



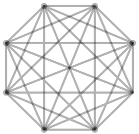


[Fulek, Saeedi, Sarıöz, 2011]

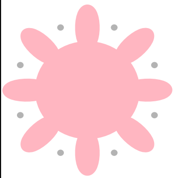
$4 \leqslant \mathrm{obs}_c(T_n)$

$\mathrm{obs}_c(\text{outpl.}) \leqslant 5$

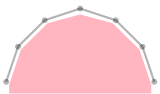
Covex obstacle number – obs_c



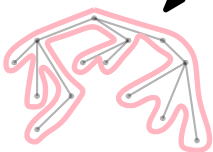
$\mathrm{obs}(K_n) = 0$



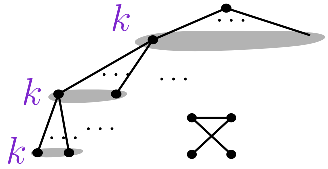
$\mathrm{obs}(I_n) = 1$

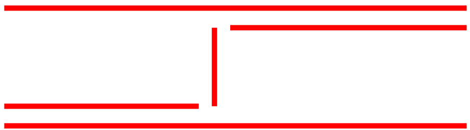


$\mathrm{obs}(P_n) = 1$



$\mathrm{obs}(T_n) = 1$





[Fulek, Saeedi, Sarıöz, 2011]

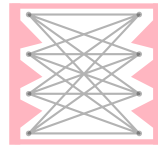
$4 \leqslant \mathrm{obs}_c(T_n)$

?

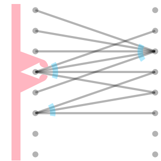
$5 \leqslant \mathrm{obs}_c(T_n)$ [Work In Progress: Briański, Hodor, Jungeblut, La]

Ramsay + small configurations + SAT solvers

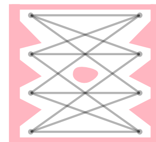
$\mathrm{obs}_c(\text{outpl.}) \leqslant 5$



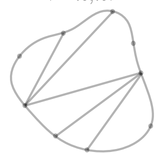
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$

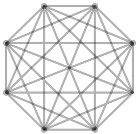


$\mathrm{obs}(\text{outpl.}) = 1$

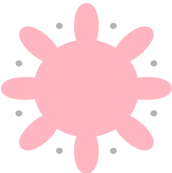
[Alpert, Koch, Laison, 2009]

Covex obstacle number – obs_c

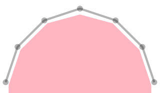
$$\mathrm{obs}_c(n) := \max\{\mathrm{obs}_c(G) : |V(G)| = n\}$$



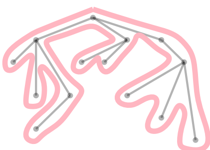
$\mathrm{obs}(K_n) = 0$



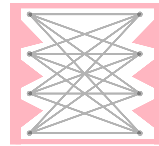
$\mathrm{obs}(I_n) = 1$



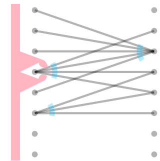
$\mathrm{obs}(P_n) = 1$



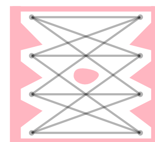
$\mathrm{obs}(T_n) = 1$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\mathrm{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\mathrm{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

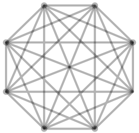
Covex obstacle number – obs_c

$$\mathrm{obs}_c(n) := \max\{\mathrm{obs}_c(G) : |V(G)| = n\}$$

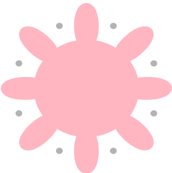
$\Omega(n/\log\log n) \leqslant \mathrm{obs}(n)$ $\quad\quad$ $\mathrm{obs}(n) \leqslant O(n \log n)$

[Balko, Chaplick, Ganian, Gupta, Hoffmann, Valtr, Wolff, 2022]

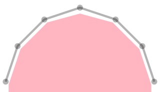
[Balko, Cibulka, Valtr, 2016]



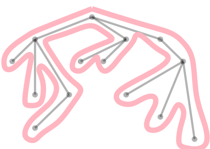
$\mathrm{obs}(K_n) = 0$



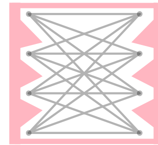
$\mathrm{obs}(I_n) = 1$



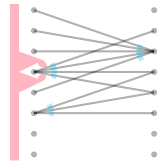
$\mathrm{obs}(P_n) = 1$



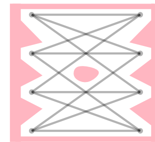
$\mathrm{obs}(T_n) = 1$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$

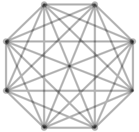


$\mathrm{obs}(K^*_{n,n}) = 2$

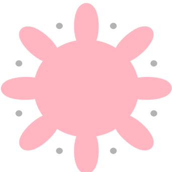
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

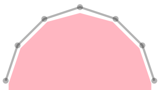
Covex obstacle number – obs_c



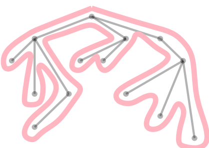
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$



$\mathrm{obs}(T_n) = 1$

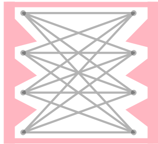
$$\mathrm{obs}_c(n) := \max\{\mathrm{obs}_c(G) : |V(G)| = n\}$$

$$\Omega(n/\log\log n) \leqslant \mathrm{obs}(n)$$

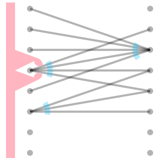
[Balko, Chaplick, Ganian, Gupta, Hoffmann, Valtr, Wolff, 2022]

$$\mathrm{obs}(n) \leqslant O(n \log n)$$
$$\mathrm{obs}_c(n) \leqslant O(n \log n)$$

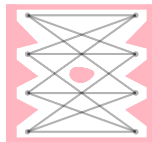
[Balko, Cibulka, Valtr, 2016]



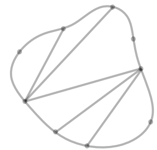
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$



$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

Covex obstacle number – obs_c

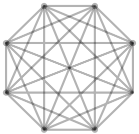
$$\mathrm{obs}_c(n) := \max\{\mathrm{obs}_c(G) : |V(G)| = n\}$$

$$\Omega(n/\log\log n) \leqslant \mathrm{obs}(n) \qquad \mathrm{obs}(n) \leqslant O(n\log n)$$

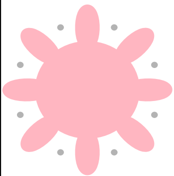
$$\Omega(n) \leqslant \mathrm{obs}_c(n) \qquad \mathrm{obs}_c(n) \leqslant O(n\log n)$$

[Balko, Chaplick, Ganian, Gupta, Hoffmann, Valtr, Wolff, 2022]

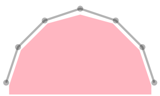
[Balko, Cibulka, Valtr, 2016]



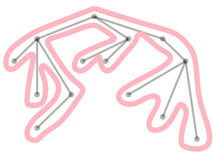
$\mathrm{obs}(K_n) = 0$



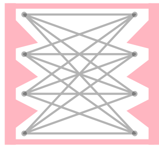
$\mathrm{obs}(I_n) = 1$



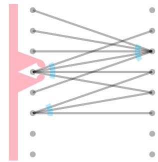
$\mathrm{obs}(P_n) = 1$



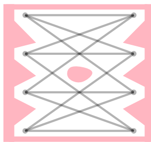
$\mathrm{obs}(T_n) = 1$



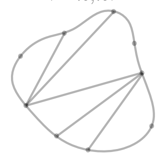
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$

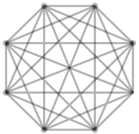


$\mathrm{obs}(K^*_{n,n}) = 2$

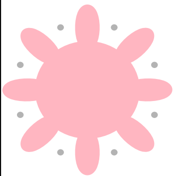


$\mathrm{obs}(\text{outpl.}) = 1$

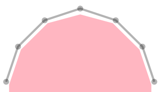
[Alpert, Koch, Laison, 2009]



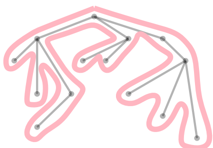
$\text{obs}(K_n) = 0$



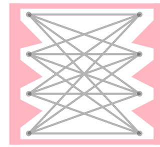
$\text{obs}(I_n) = 1$



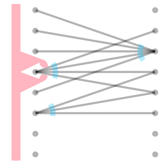
$\text{obs}(P_n) = 1$



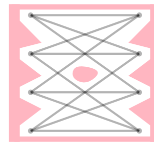
$\text{obs}(T_n) = 1$



$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$



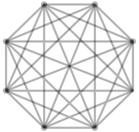
$\text{obs}(K^*_{n,n}) = 2$

$\text{obs}(\text{outpl.}) = 1$

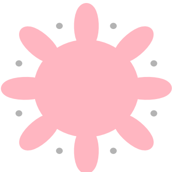
[Alpert, Koch, Laison, 2009]

Open problem

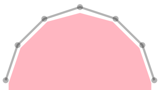
(Convex) obstacle number of planar graphs? $2 \leqslant \textbf{obs}(\text{planar}) \leqslant \infty$



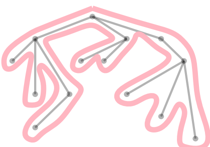
$\text{obs}(K_n) = 0$



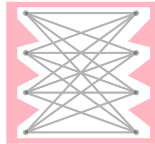
$\text{obs}(I_n) = 1$



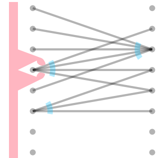
$\text{obs}(P_n) = 1$



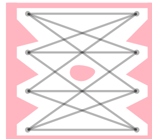
$\text{obs}(T_n) = 1$



$\text{obs}(K_{n,n}) = 1$



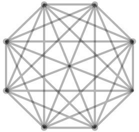
$\text{obs}(\text{pl.bip.}) = 1$



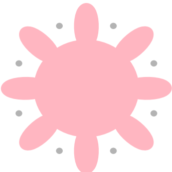
$\text{obs}(K^*_{n,n}) = 2$

$\text{obs}(\text{outpl.}) = 1$

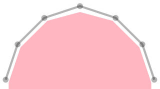
[Alpert, Koch, Laison, 2009]



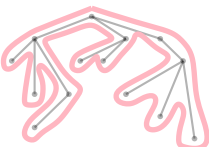
$\mathrm{obs}(K_n) = 0$



$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$



$\mathrm{obs}(T_n) = 1$

Open problem

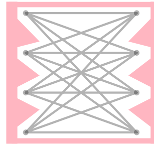
(Convex) obstacle number of planar graphs? $2 \leqslant \mathrm{obs}(\text{planar}) \leqslant \infty$

Open problem

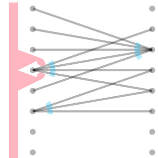
Order of magnitude of $\mathrm{obs}(n)$ and $\mathrm{obs}_c(n)$?

$$\Omega(n) \leqslant \mathrm{obs}_c(n) \leqslant O(n \log n)$$

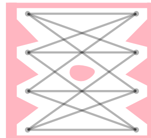
$$\Omega(n/\log\log n) \leqslant \mathrm{obs}(n) \leqslant O(n \log n)$$



$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

Open problem

(Convex) obstacle number of planar graphs?

$2 \leqslant \mathrm{obs}(\text{planar}) \leqslant \infty$

Open problem

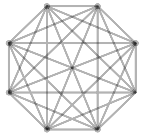
Order of magnitude of $\mathrm{obs}(n)$ and $\mathrm{obs}_c(n)$?

$\Omega(n) \leqslant \mathrm{obs}_c(n) \leqslant O(n \log n)$

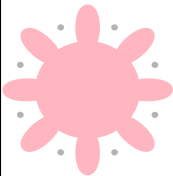
$\Omega(n/\log\log n) \leqslant \mathrm{obs}(n) \leqslant O(n \log n)$

Open problem

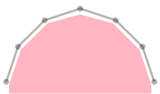
Is it NP-hard to decide if a graph has obstacle number 1?



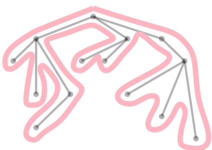
$\mathrm{obs}(K_n) = 0$



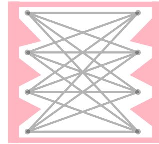
$\mathrm{obs}(I_n) = 1$



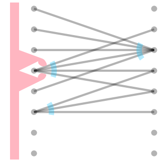
$\mathrm{obs}(P_n) = 1$



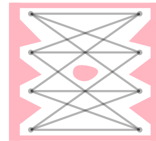
$\mathrm{obs}(T_n) = 1$



$\mathrm{obs}(K_{n,n}) = 1$



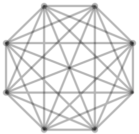
$\mathrm{obs}(\text{pl.bip.}) = 1$



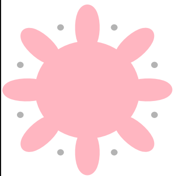
$\mathrm{obs}(K^*_{n,n}) = 2$

$\mathrm{obs}(\text{outpl.}) = 1$

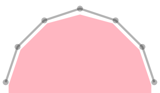
[Alpert, Koch, Laison, 2009]



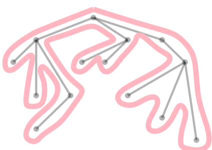
$\text{obs}(K_n) = 0$



$\text{obs}(I_n) = 1$



$\text{obs}(P_n) = 1$



$\text{obs}(T_n) = 1$

Open problem

(Convex) obstacle number of planar graphs? $2 \leqslant \text{obs}(\text{planar}) \leqslant \infty$

Open problem

Order of magnitude of $\text{obs}(n)$ and $\text{obs}_c(n)$?

$$\Omega(n) \leqslant \text{obs}_c(n) \leqslant O(n \log n)$$

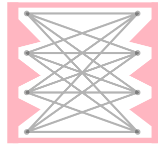
$$\Omega(n/\log\log n) \leqslant \text{obs}(n) \leqslant O(n \log n)$$

Open problem

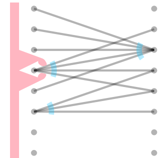
Is it NP-hard to decide if a graph has obstacle number 1?

Open problem

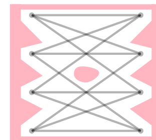
Smallest graph with $\text{obs} > 1$? $6 \leqslant \cdots \leqslant 10$ $\text{obs}(K^*_{5,5}) = 2$



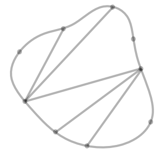
$\text{obs}(K_{n,n}) = 1$



$\text{obs}(\text{pl.bip.}) = 1$

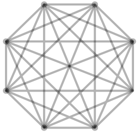


$\text{obs}(K^*_{n,n}) = 2$



$\text{obs}(\text{outpl.}) = 1$

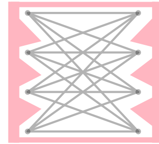
[Alpert, Koch, Laison, 2009]



$\mathrm{obs}(K_n) = 0$

Open problem

(Convex) obstacle number of planar graphs? $2 \leqslant \mathrm{obs}(\text{planar}) \leqslant \infty$



$\mathrm{obs}(K_{n,n}) = 1$

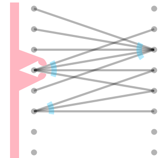
$\mathrm{obs}(I_n) = 1$

Open problem

Order of magnitude of $\mathrm{obs}(n)$ and $\mathrm{obs}_c(n)$?

$$\Omega(n) \leqslant \mathrm{obs}_c(n) \leqslant O(n \log n)$$

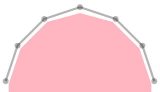
$$\Omega(n/\log\log n) \leqslant \mathrm{obs}(n) \leqslant O(n \log n)$$



$\mathrm{obs}(\text{pl.bip.}) = 1$

Open problem

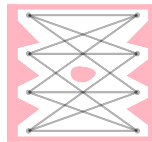
Is it NP-hard to decide if a graph has obstacle number 1?



$\mathrm{obs}(P_n) = 1$

Open problem

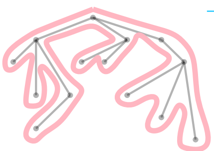
Smallest graph with $\mathrm{obs} > 1$? $6 \leqslant \cdots \leqslant 10$ $\mathrm{obs}(K^*_{5,5}) = 2$



$\mathrm{obs}(K^*_{n,n}) = 2$

Open problem

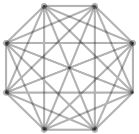
Convex obstacle number of trees? $4 \leqslant \mathrm{obs}_c(\text{trees}) \leqslant 5$



$\mathrm{obs}(T_n) = 1$

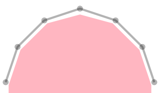
$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]

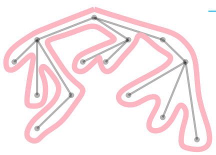


$\mathrm{obs}(K_n) = 0$

$\mathrm{obs}(I_n) = 1$



$\mathrm{obs}(P_n) = 1$



$\mathrm{obs}(T_n) = 1$

Open problem

(Convex) obstacle number of planar graphs? $2 \leqslant \mathrm{obs}(\text{planar}) \leqslant \infty$

Open problem

Order of magnitude of $\mathrm{obs}(n)$ and $\mathrm{obs}_c(n)$?

$$\Omega(n) \leqslant \mathrm{obs}_c(n) \leqslant O(n \log n)$$

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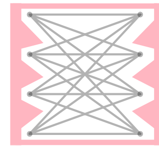
Open problem

Smallest graph with $\mathrm{obs} > 1$? $6 \leqslant \cdots \leqslant 10$ $\mathrm{obs}(K^*_{5,5}) = 2$

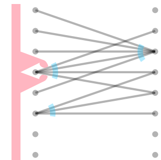
Open problem

Convex obstacle number of trees? $4 \leqslant \mathrm{obs}_c(\text{trees}) \leqslant 5$

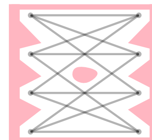
Thank you, questions?



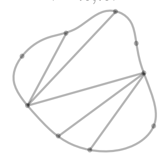
$\mathrm{obs}(K_{n,n}) = 1$



$\mathrm{obs}(\text{pl.bip.}) = 1$



$\mathrm{obs}(K^*_{n,n}) = 2$



$\mathrm{obs}(\text{outpl.}) = 1$

[Alpert, Koch, Laison, 2009]