

The Awesome Diversity of the Clique Graph Operator Dynamics

M.A. Pizaña

July 5th, 2019

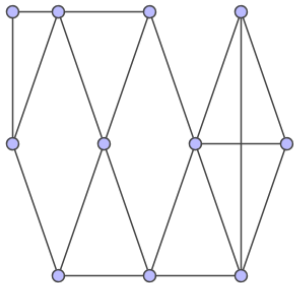
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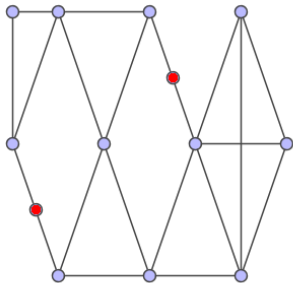
C. Cedillo, F. Escalante, M.E. Frías-Armenta, F. Larrión,
V. Neumann-Lara, E. Prisner, R. Villarroel-Flores

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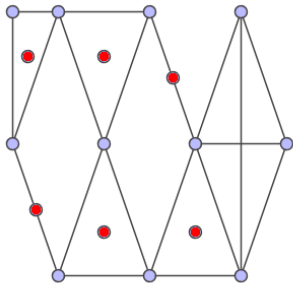
Clique Graphs



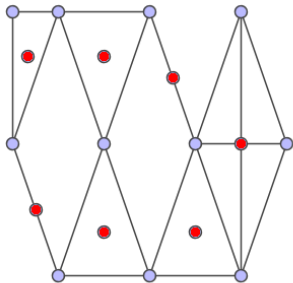
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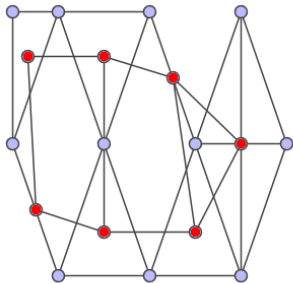
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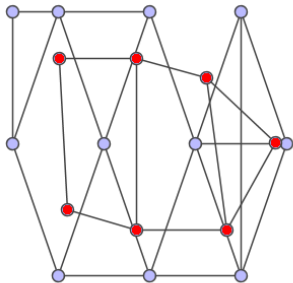
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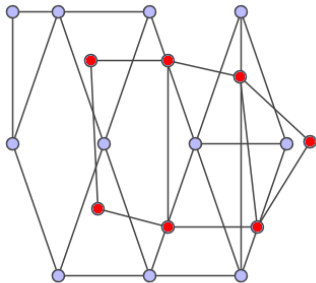
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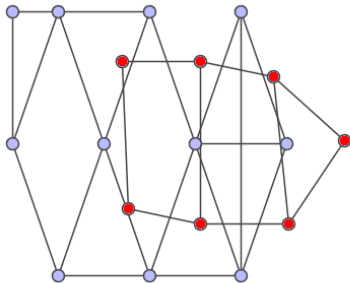
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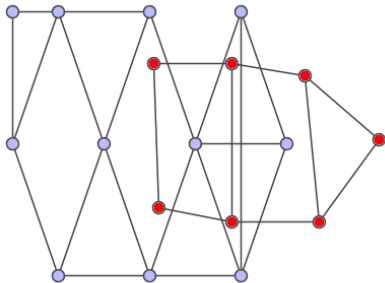
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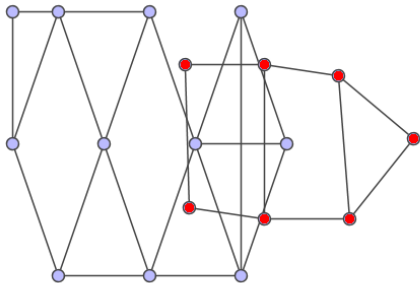
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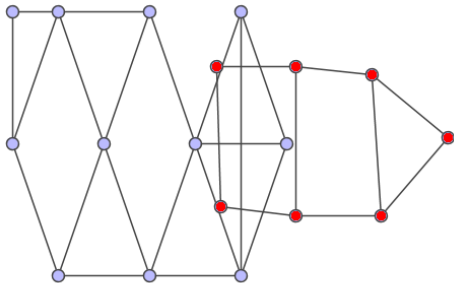
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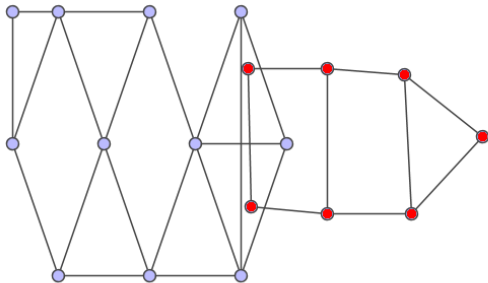
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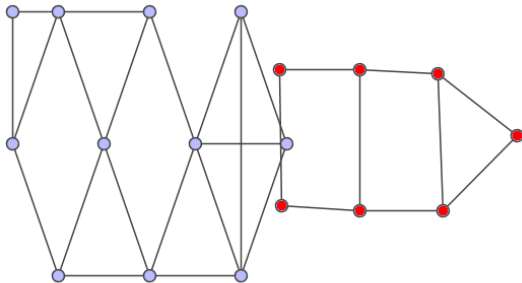
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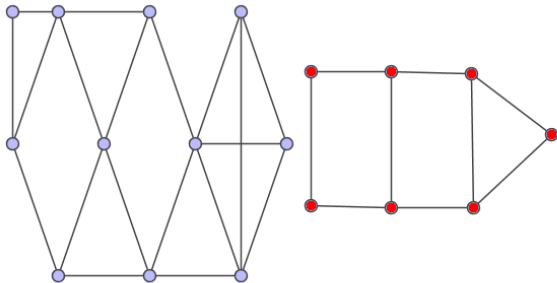
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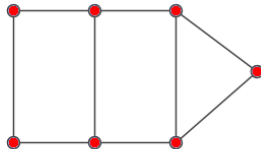
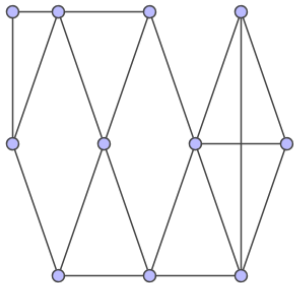
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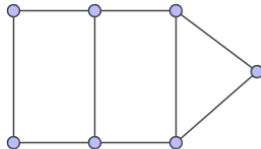
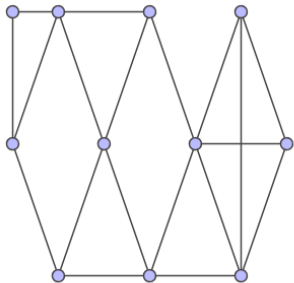
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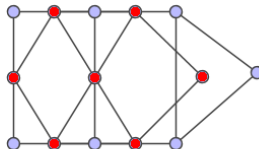
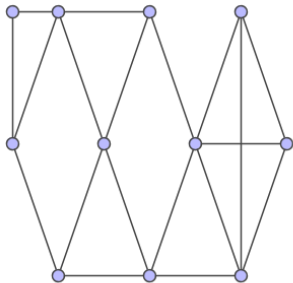
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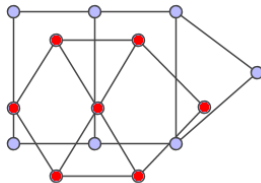
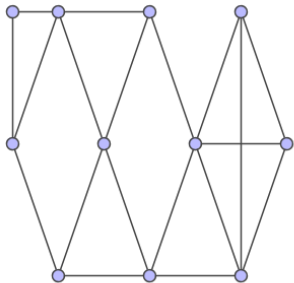
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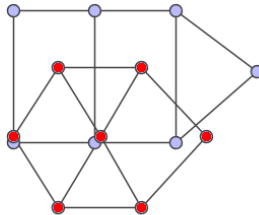
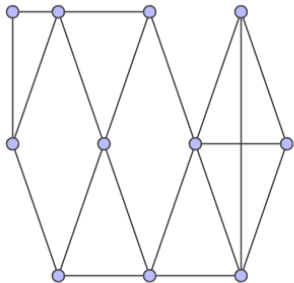
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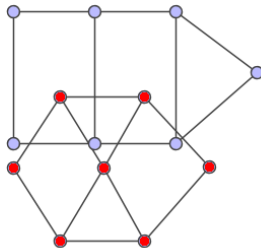
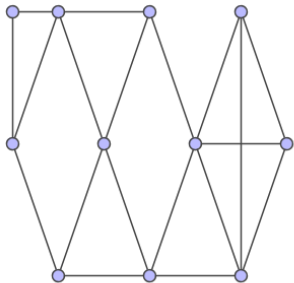
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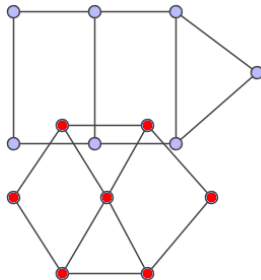
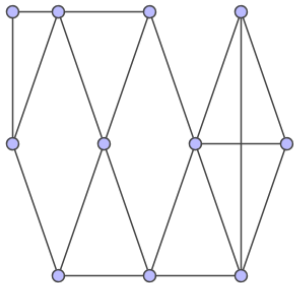
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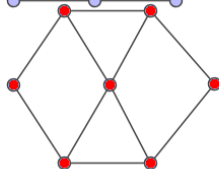
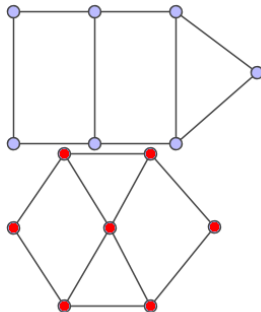
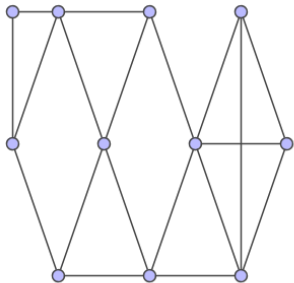
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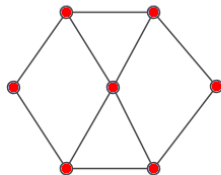
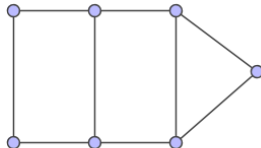
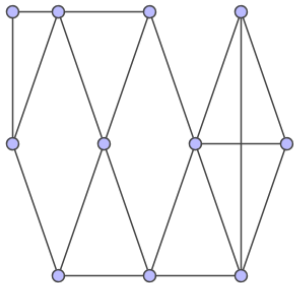
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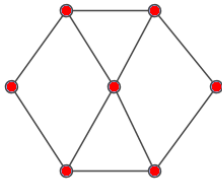
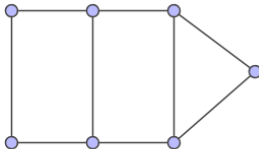
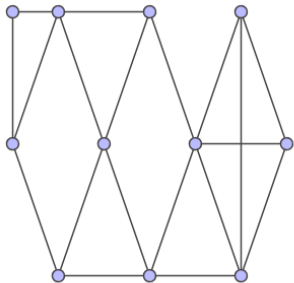
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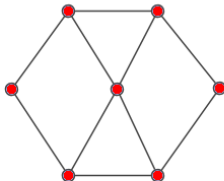
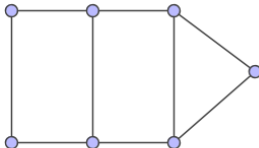
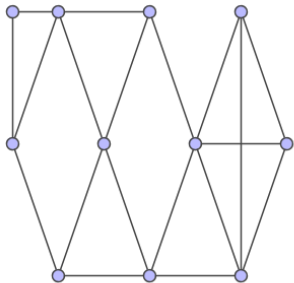
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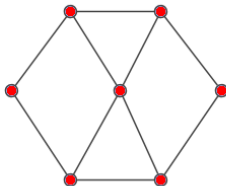
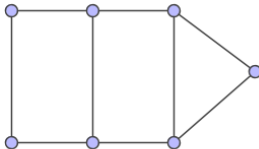
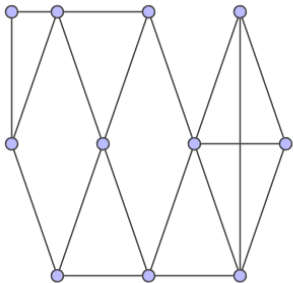
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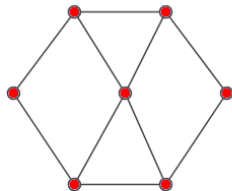
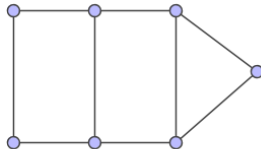
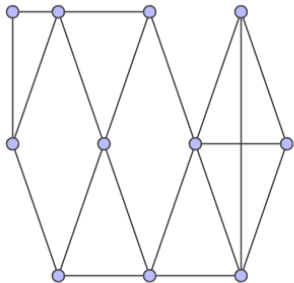
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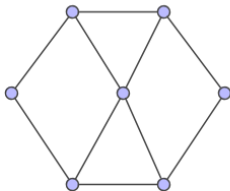
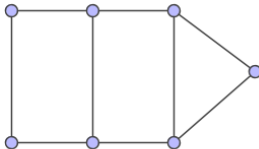
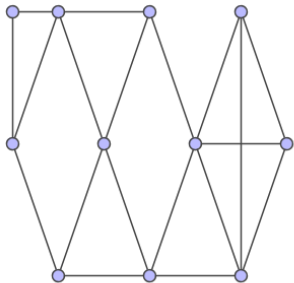
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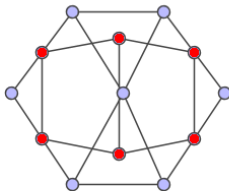
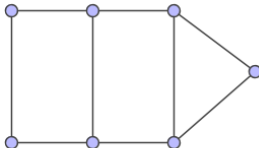
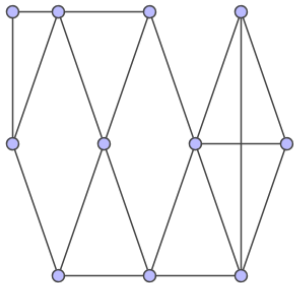
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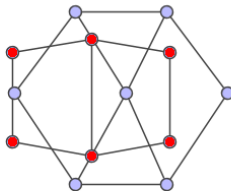
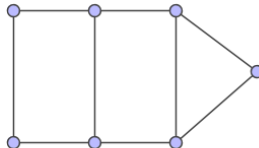
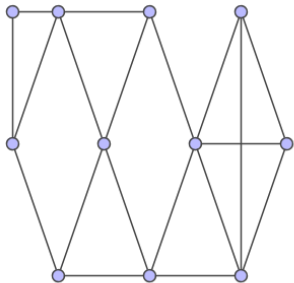
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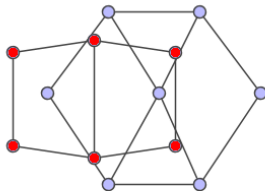
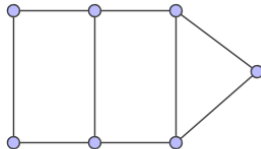
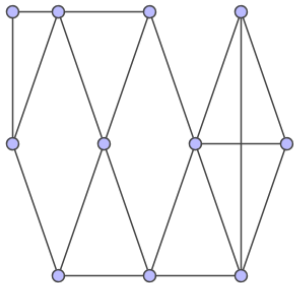
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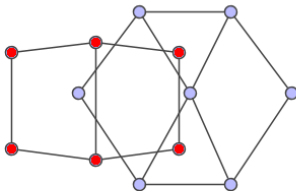
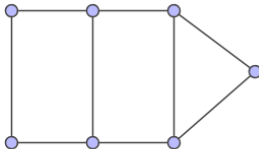
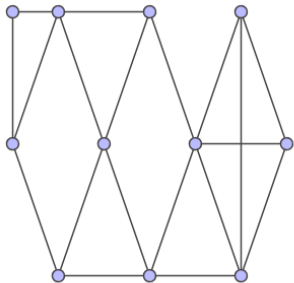
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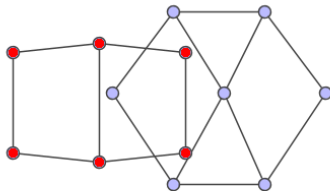
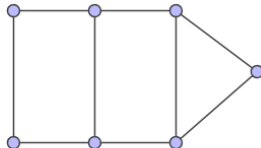
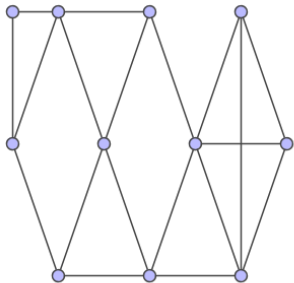
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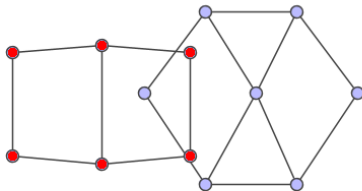
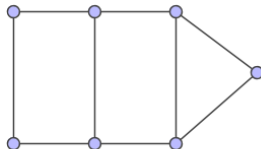
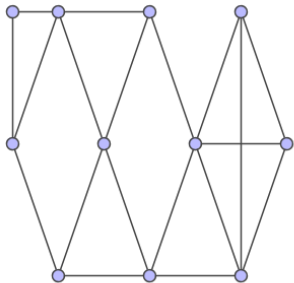
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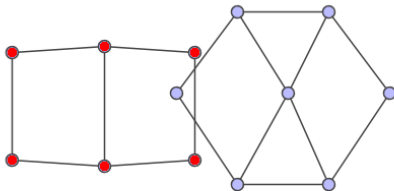
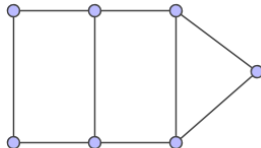
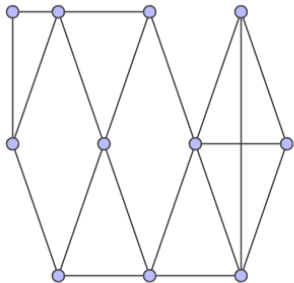
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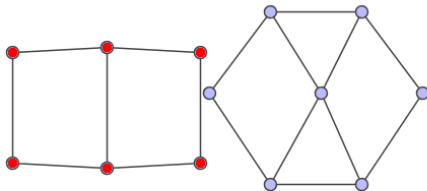
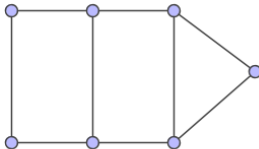
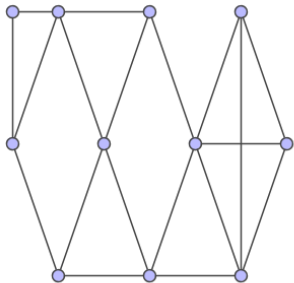
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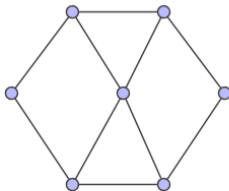
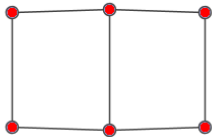
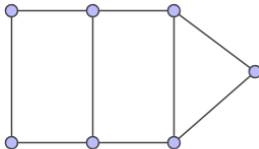
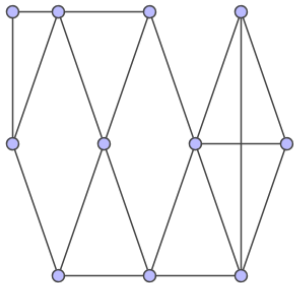
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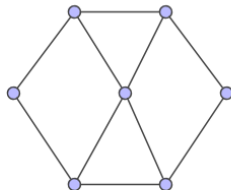
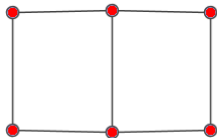
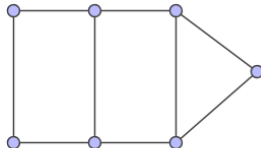
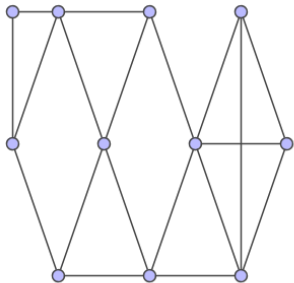
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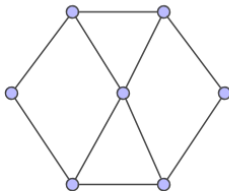
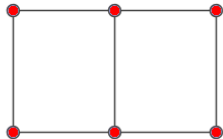
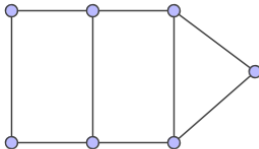
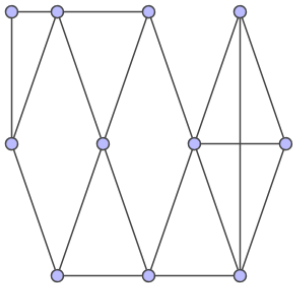
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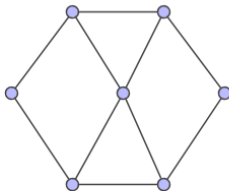
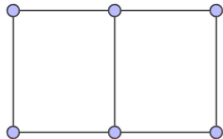
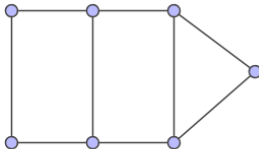
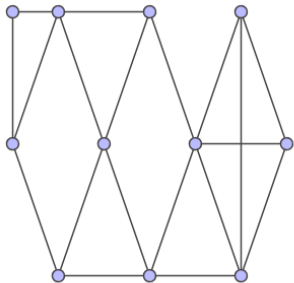
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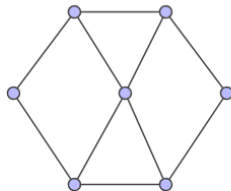
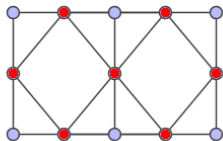
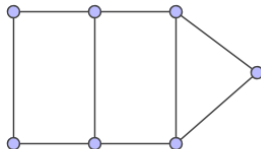
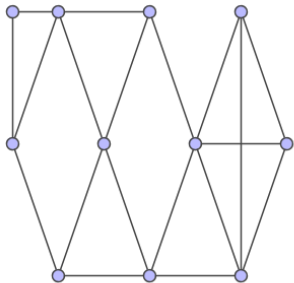
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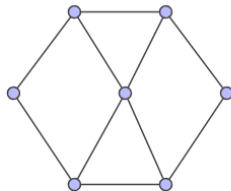
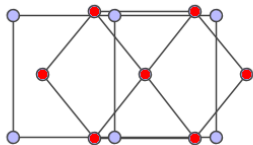
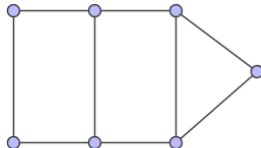
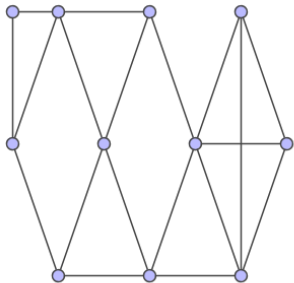
Clique Graphs



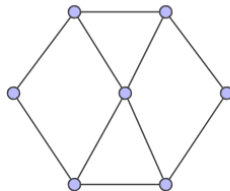
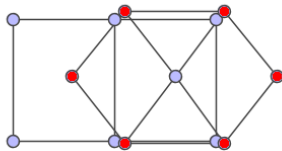
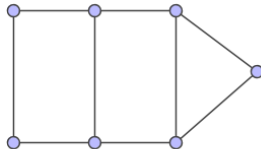
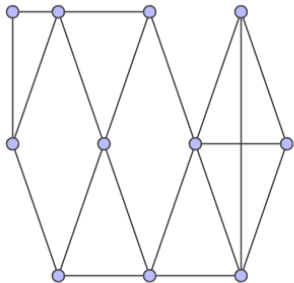
Clique Graphs



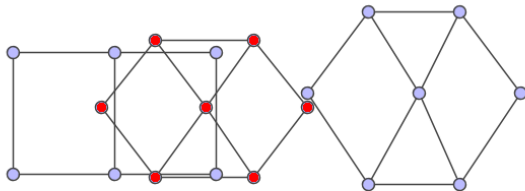
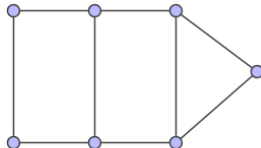
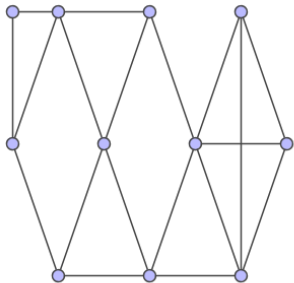
Clique Graphs



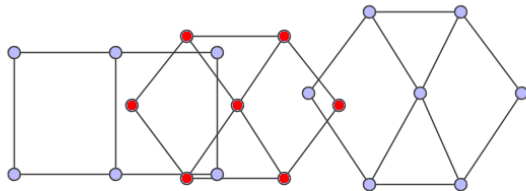
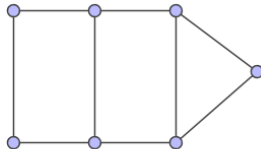
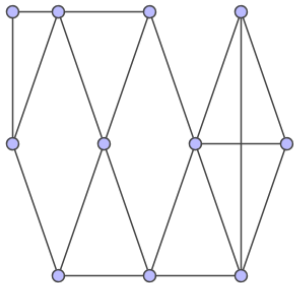
Clique Graphs



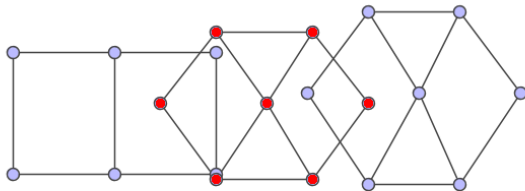
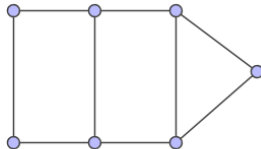
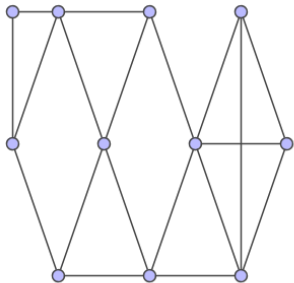
Clique Graphs



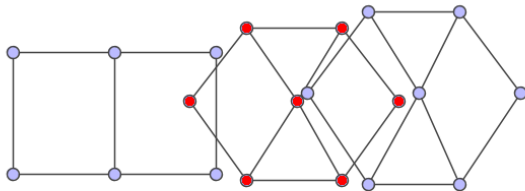
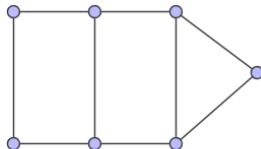
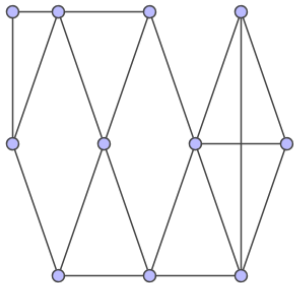
Clique Graphs



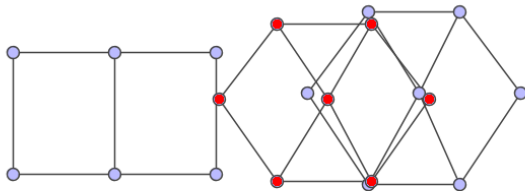
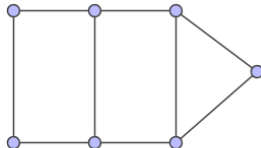
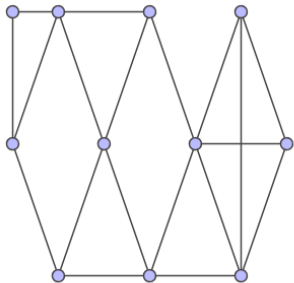
Clique Graphs



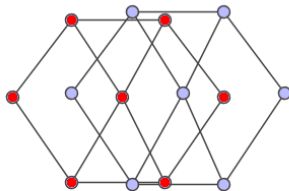
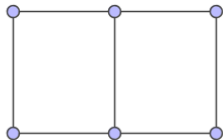
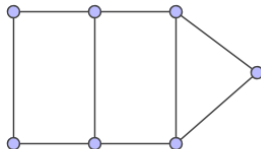
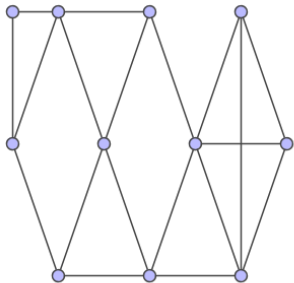
Clique Graphs



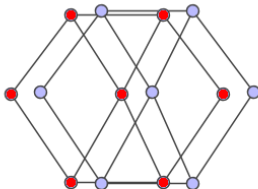
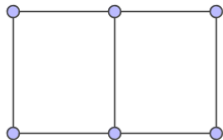
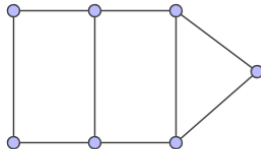
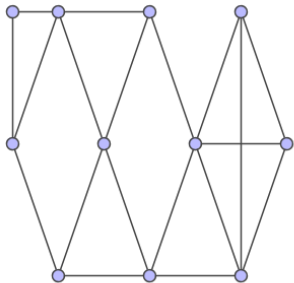
Clique Graphs



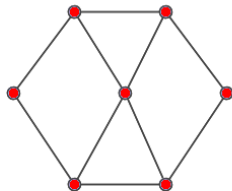
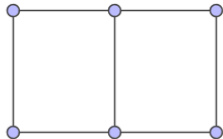
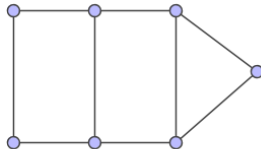
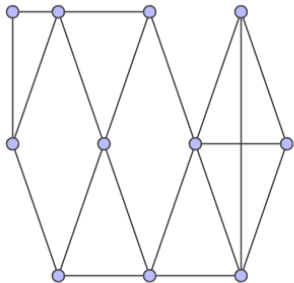
Clique Graphs



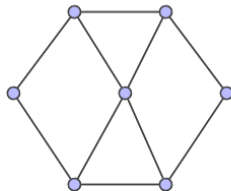
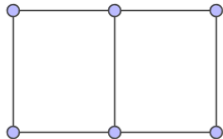
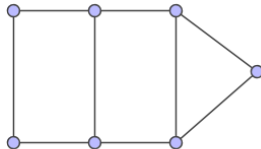
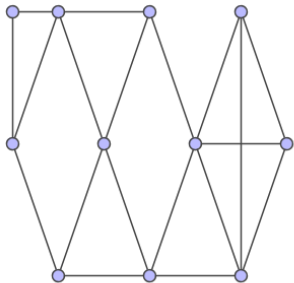
Clique Graphs



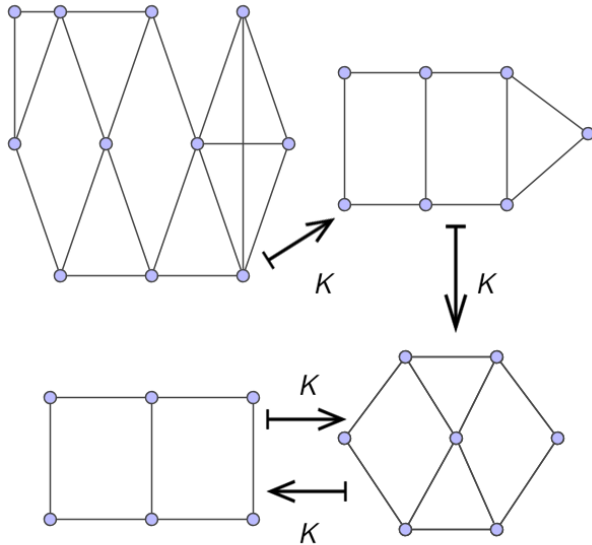
Clique Graphs



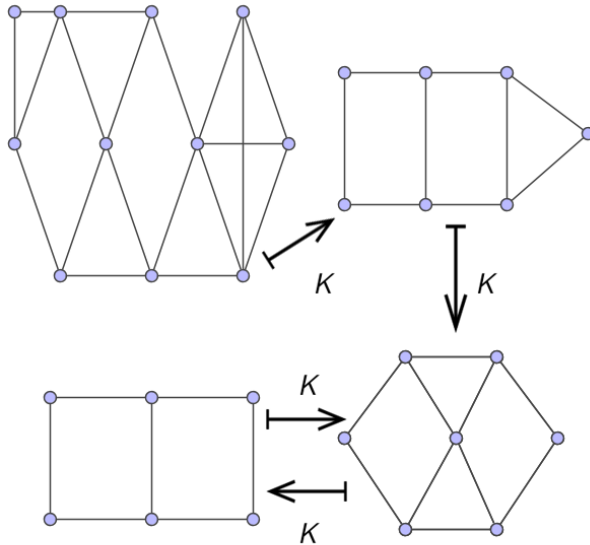
Clique Graphs



Clique Graphs

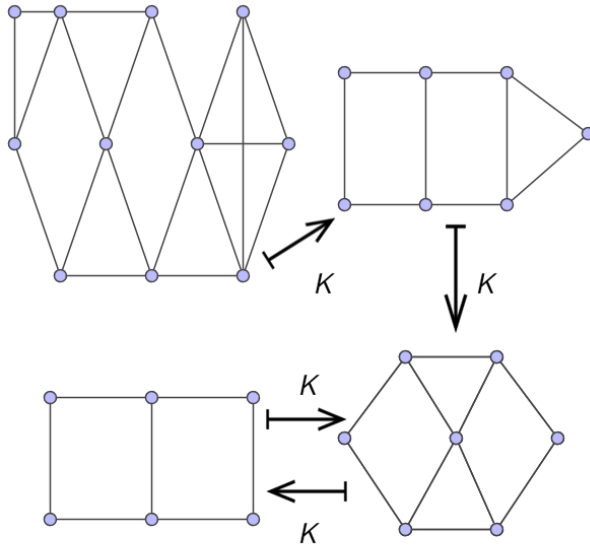


Clique Graphs



K -Convergent:
 $K^n(G) \cong K^m(G)$

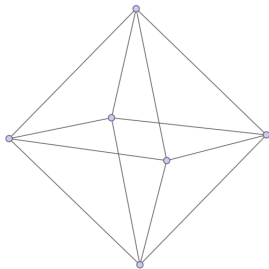
Clique Graphs



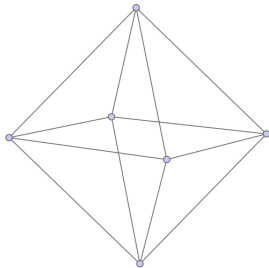
K -Convergent:
 $K^n(G) \cong K^m(G)$

K -Divergent:
 $|K^n(G)| \rightarrow \infty$

Clique Behavior

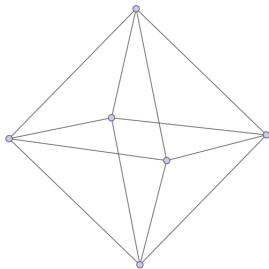


Clique Behavior



$$|O_3| = 6$$

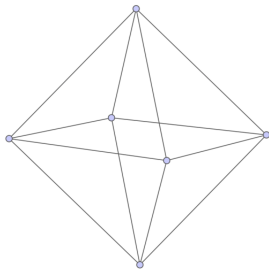
Clique Behavior



$$|O_3| = 6$$

$$|K(O_3)| = 8$$

Clique Behavior

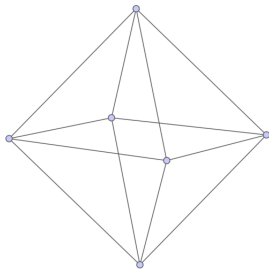


$$|O_3| = 6$$

$$|K(O_3)| = 8$$

$$|K^2(O_3)| = 16$$

Clique Behavior



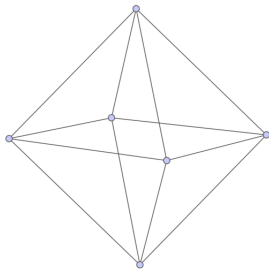
$$|O_3| = 6$$

$$|K(O_3)| = 8$$

$$|K^2(O_3)| = 16$$

$$|K^3(O_3)| = 256$$

Clique Behavior



$$|O_3| = 6$$

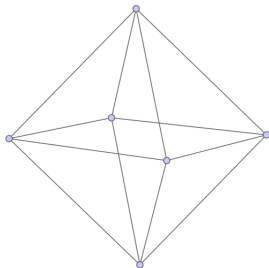
$$|K(O_3)| = 8$$

$$|K^2(O_3)| = 16$$

$$|K^3(O_3)| = 256$$

$$|K^4(O_3)| = 34'028, 236'692, 093'846, 346'337, 460'7431, 768'211, 456$$

Clique Behavior



$$|O_3| = 6$$

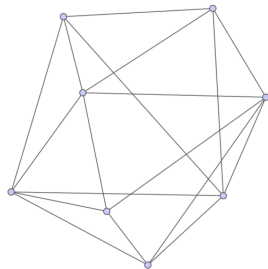
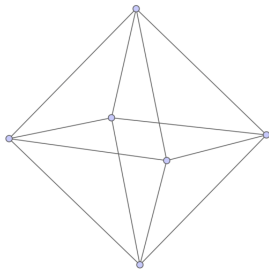
$$|K(O_3)| = 8 = 2^3$$

$$|K^2(O_3)| = 16 = 2^4$$

$$|K^3(O_3)| = 256 = 2^8$$

$$|K^4(O_3)| = 34'028, 236'692, 093'846, 346'337, 460'7431, 768'211, 456 = 2^{128}$$

Clique Behavior



$$|O_3| = 6$$

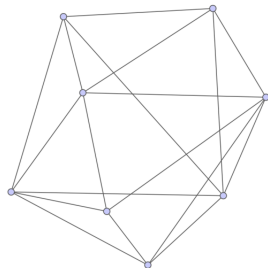
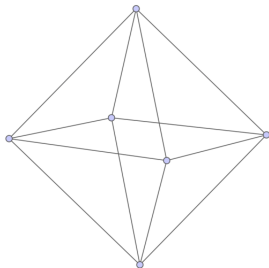
$$|K(O_3)| = 8 = 2^3$$

$$|K^2(O_3)| = 16 = 2^4$$

$$|K^3(O_3)| = 256 = 2^8$$

$$|K^4(O_3)| = 34'028,236'692,093'846,346'337,460'7431,768'211,456 = 2^{128}$$

Clique Behavior



$$|O_3| = 6$$

$$|K(O_3)| = 8 = 2^3$$

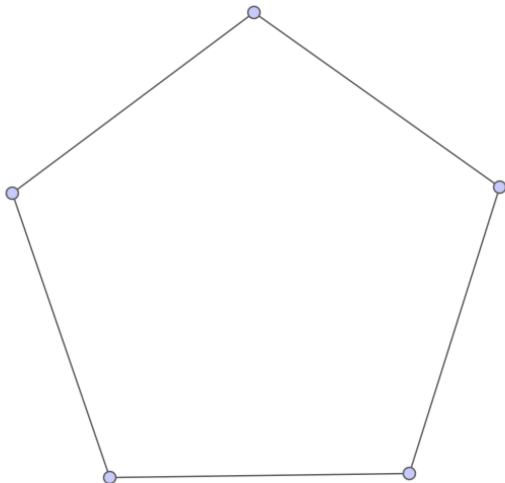
$$|K^2(O_3)| = 16 = 2^4$$

$$|K^3(O_3)| = 256 = 2^8$$

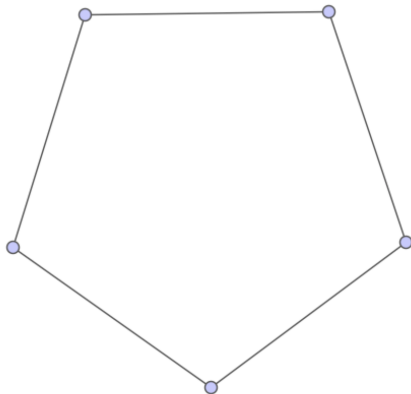
$$|K^4(O_3)| = 34'028, 236'692, 093'846, 346'337, 460'7431, 768'211, 456 = 2^{128}$$

$$\{|K^n(J_{84})|\} = \{8, 12, 20, 56, 1076, > 7.37 \times 10^9, \dots\}$$

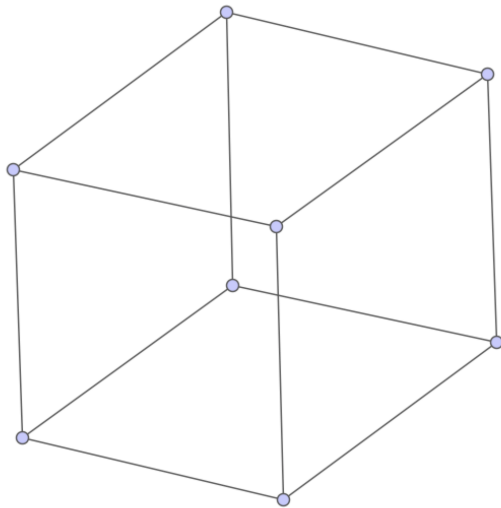
Clique Behavior



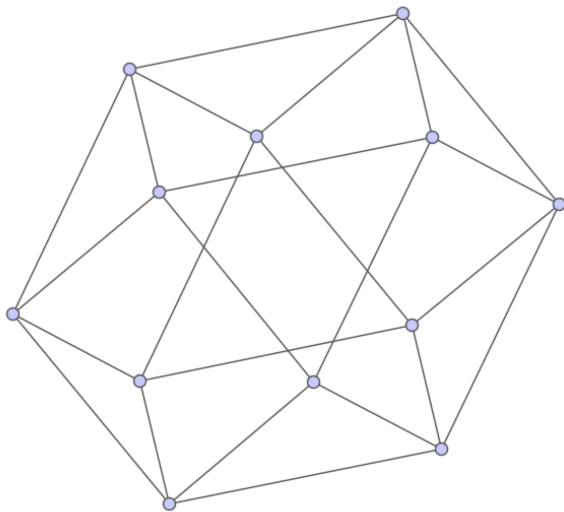
Clique Behavior



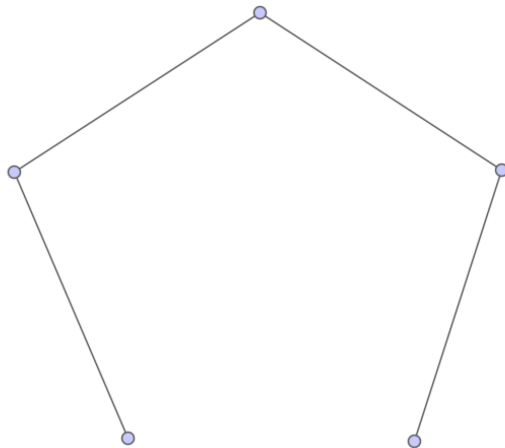
Clique Behavior



Clique Behavior



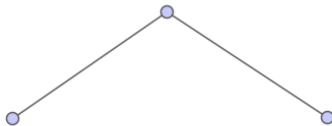
Clique Behavior



Clique Behavior



Clique Behavior



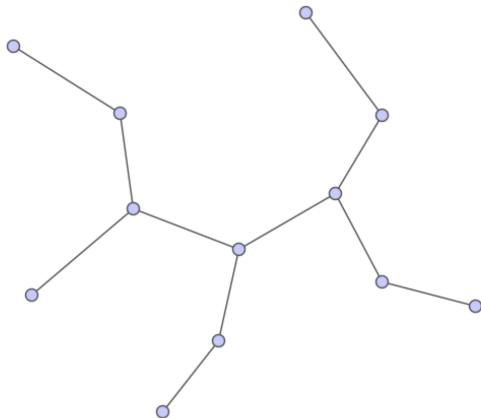
Clique Behavior



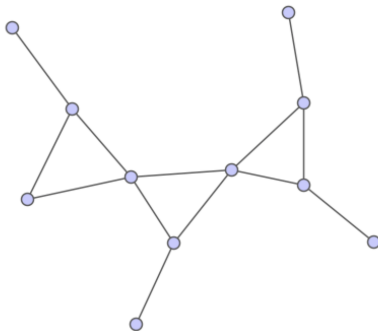
Clique Behavior



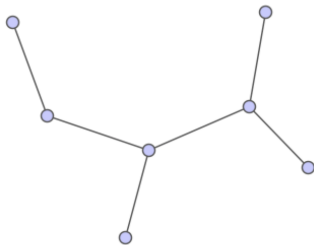
Clique Behavior



Clique Behavior



Clique Behavior



Clique Behavior



Clique Behavior



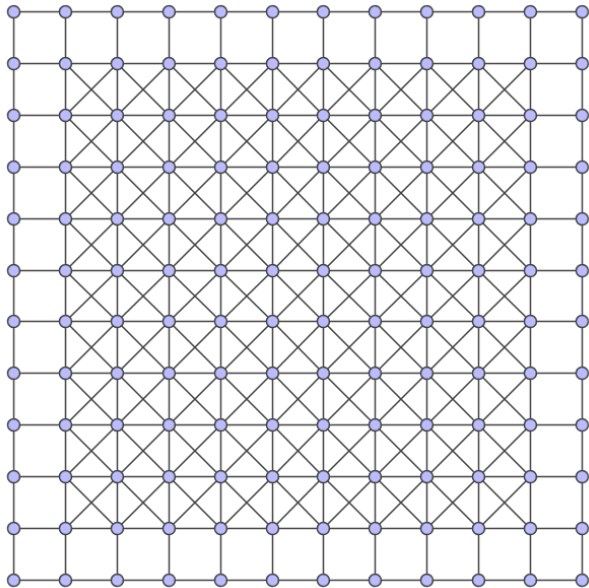
Clique Behavior



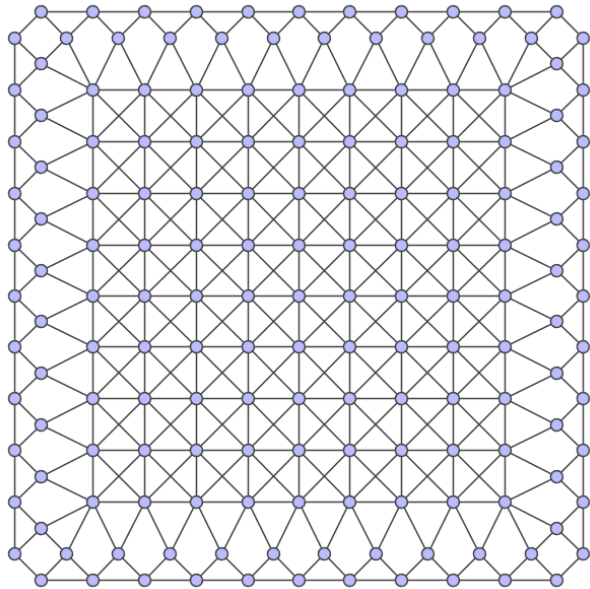
Clique Behavior



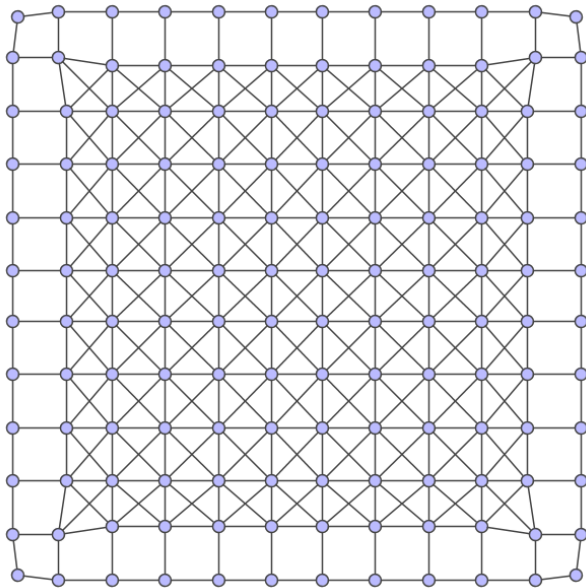
Clique Behavior



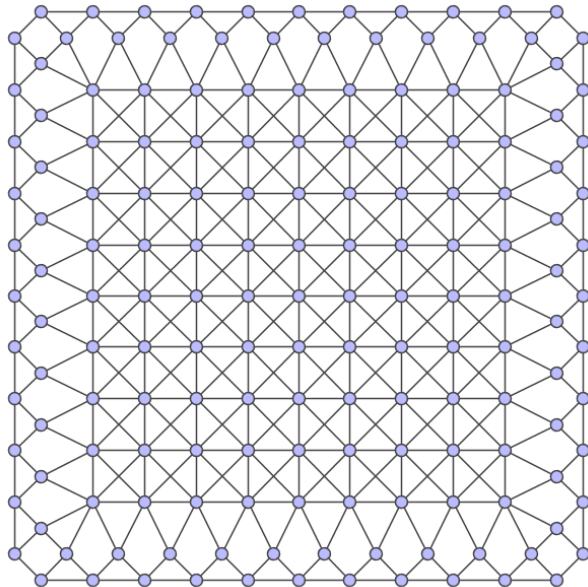
Clique Behavior



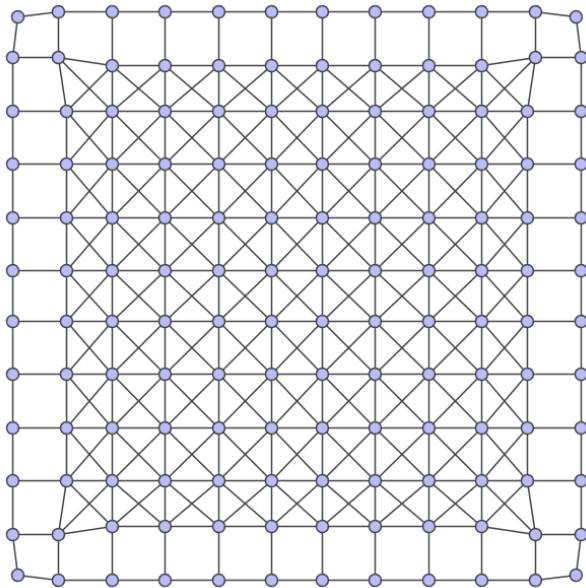
Clique Behavior



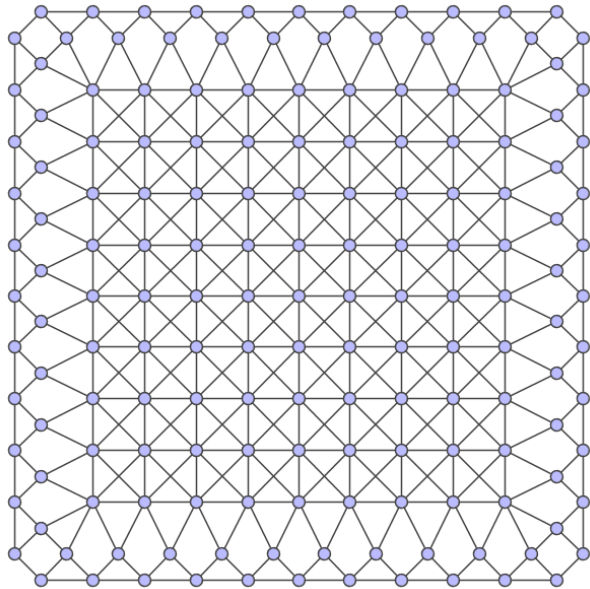
Clique Behavior



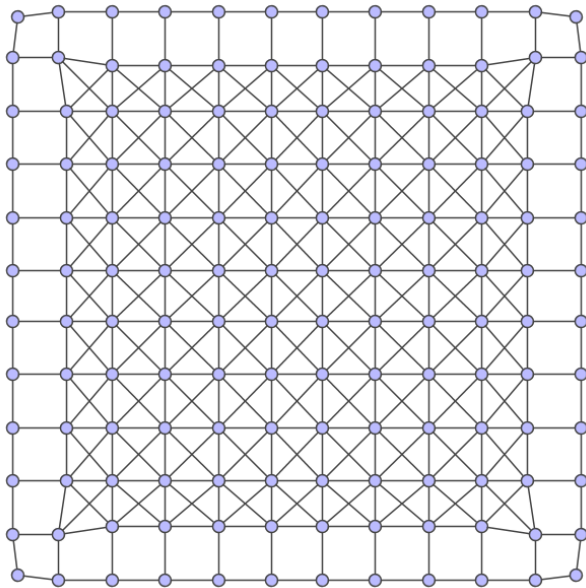
Clique Behavior



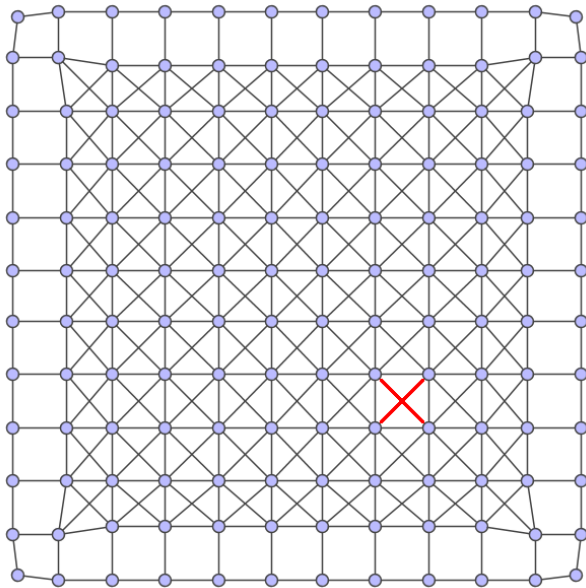
Clique Behavior



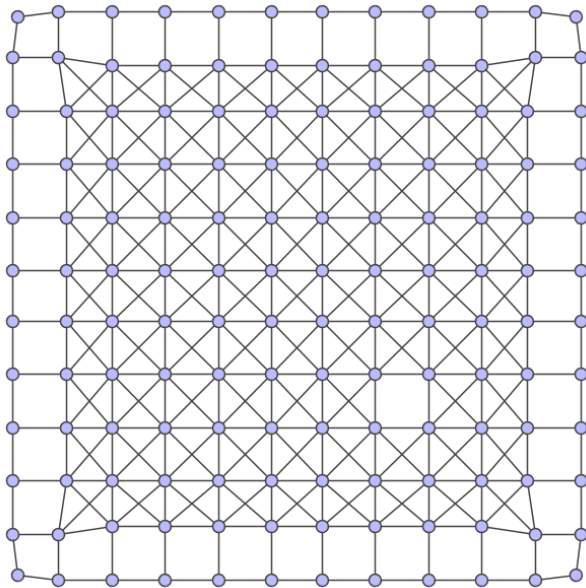
Clique Behavior



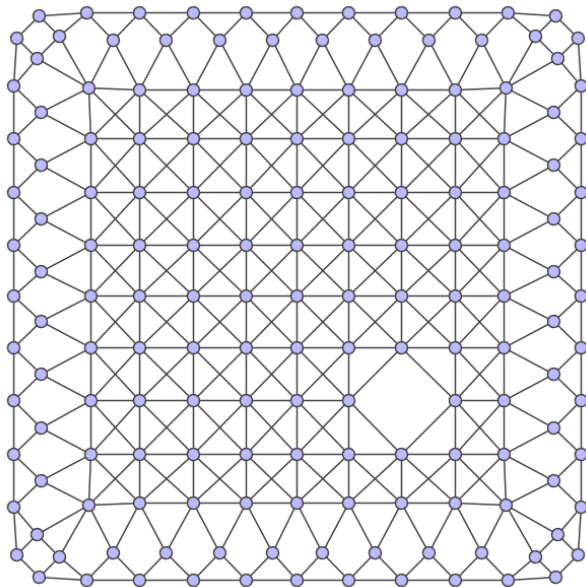
Clique Behavior



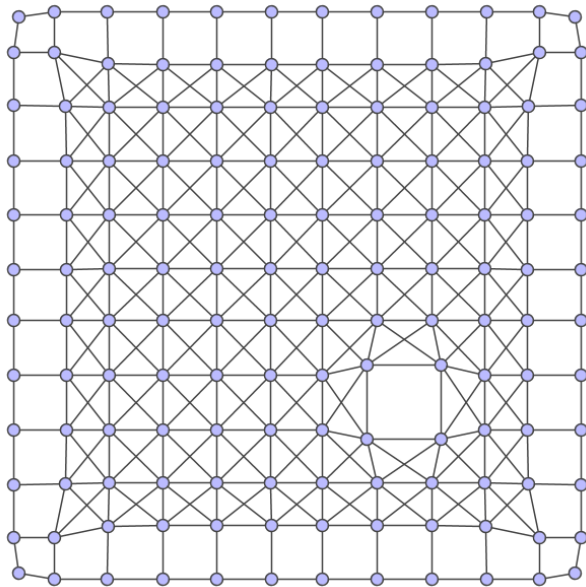
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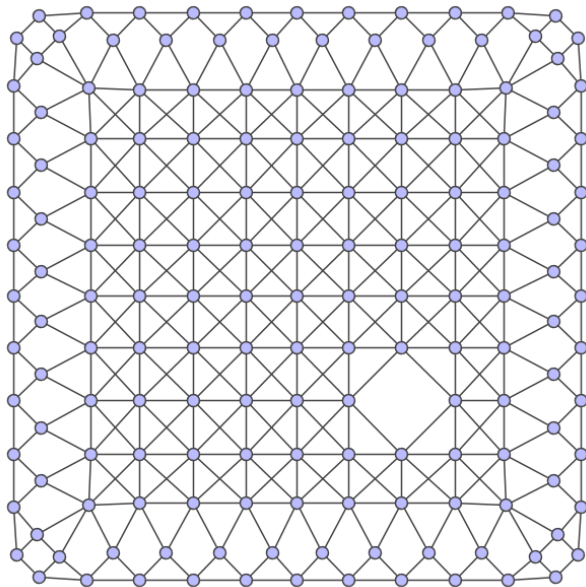
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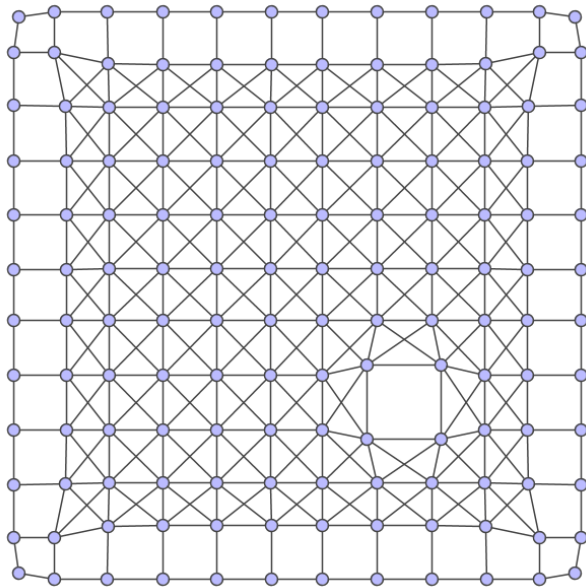
Clique Behavior



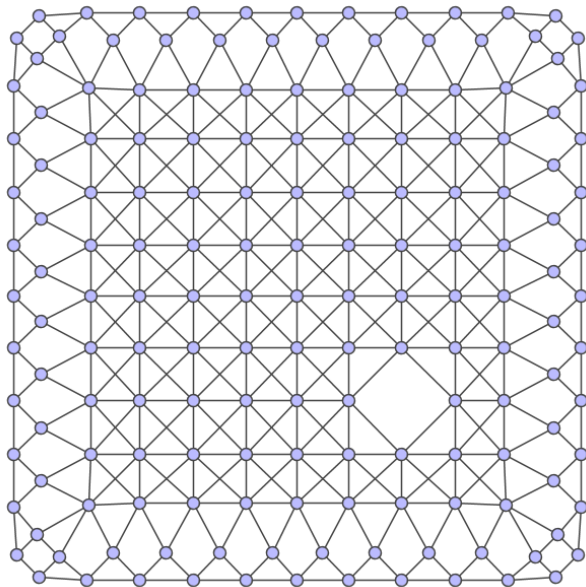
Clique Behavior



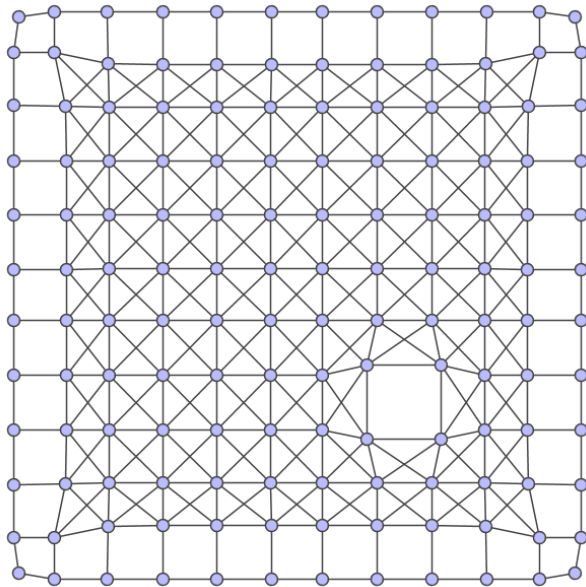
Clique Behavior



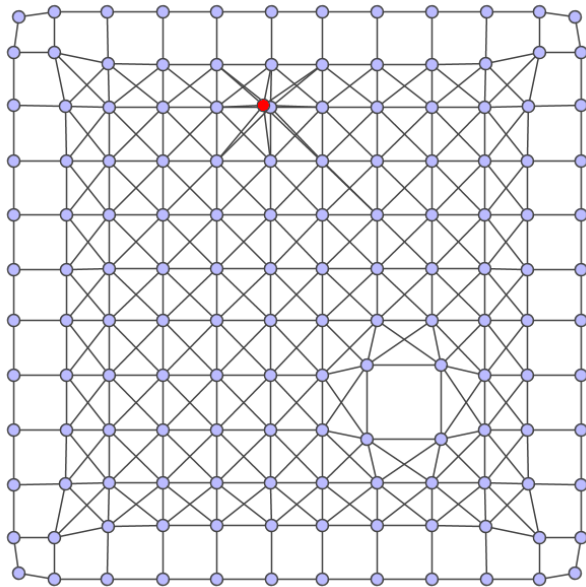
Clique Behavior



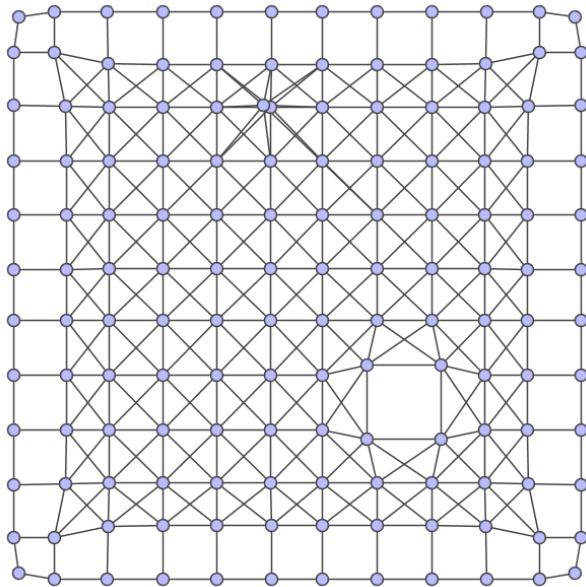
Clique Behavior



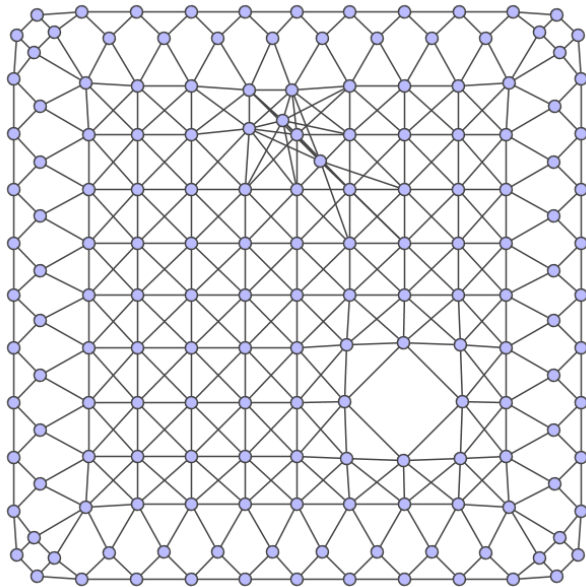
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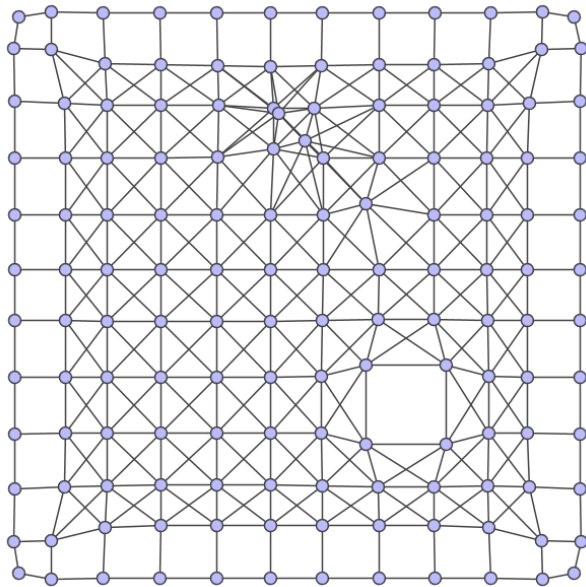
Clique Behavior



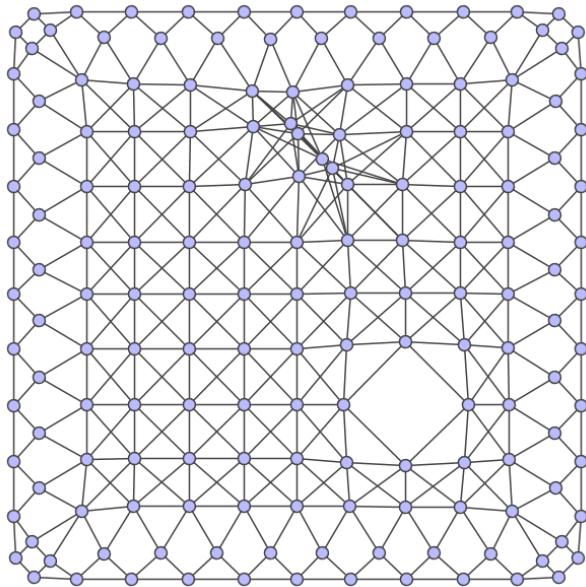
Clique Behavior



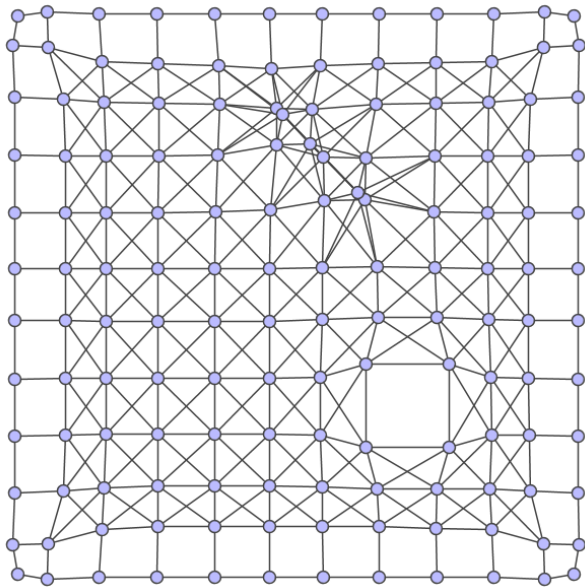
Clique Behavior



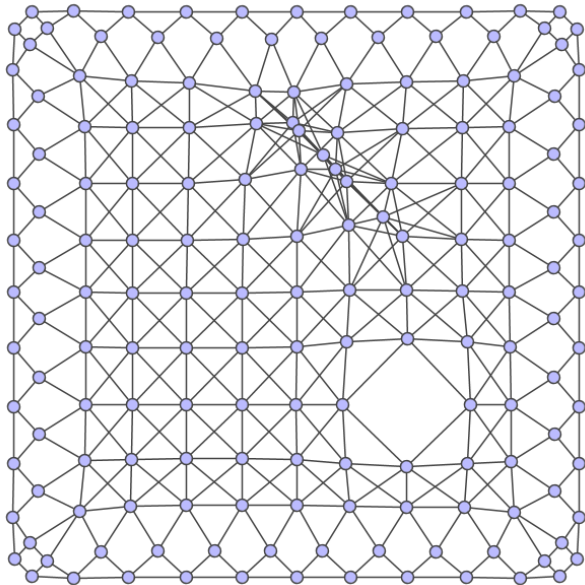
Clique Behavior



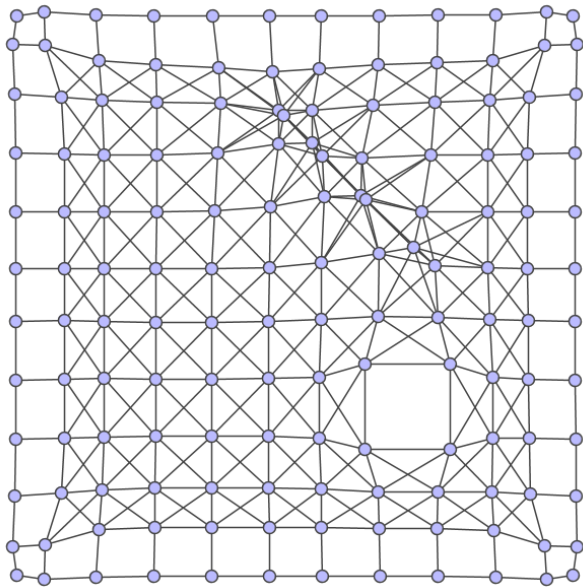
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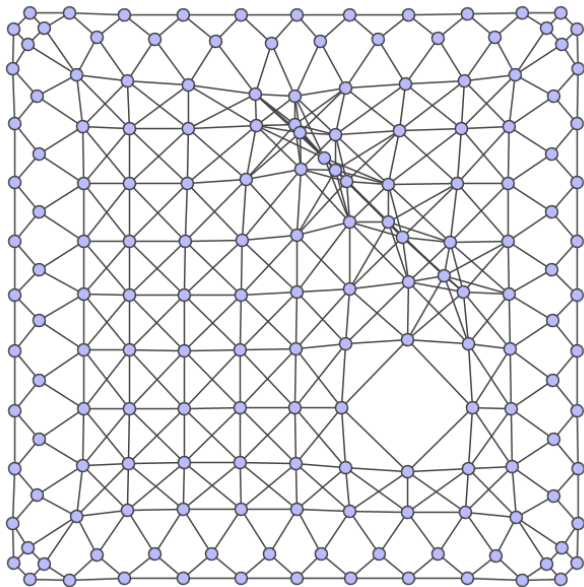
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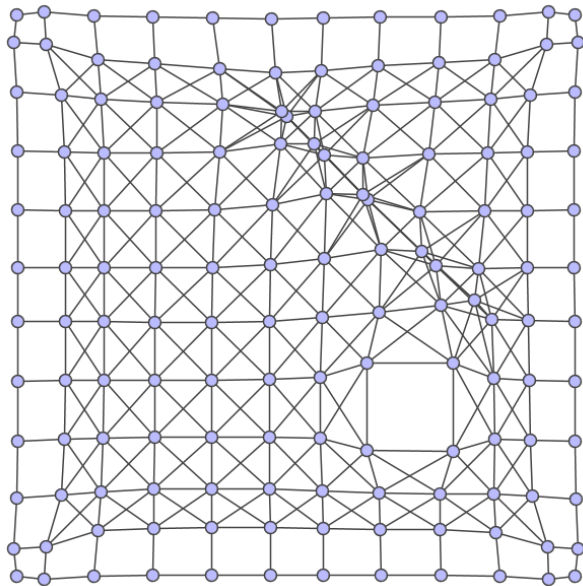
Clique Behavior



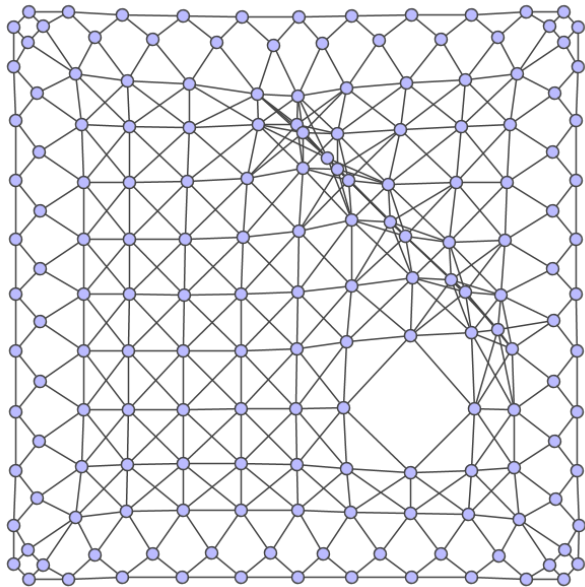
Clique Behavior



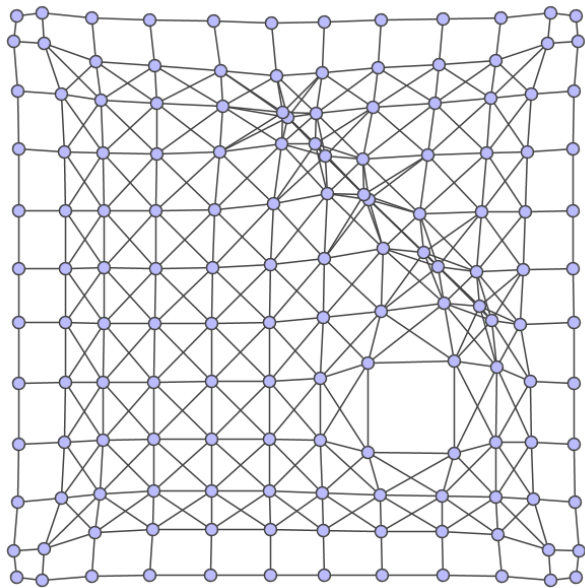
Clique Behavior



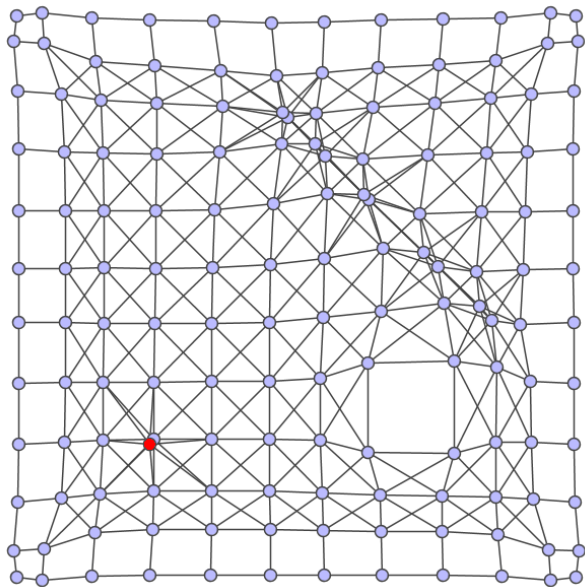
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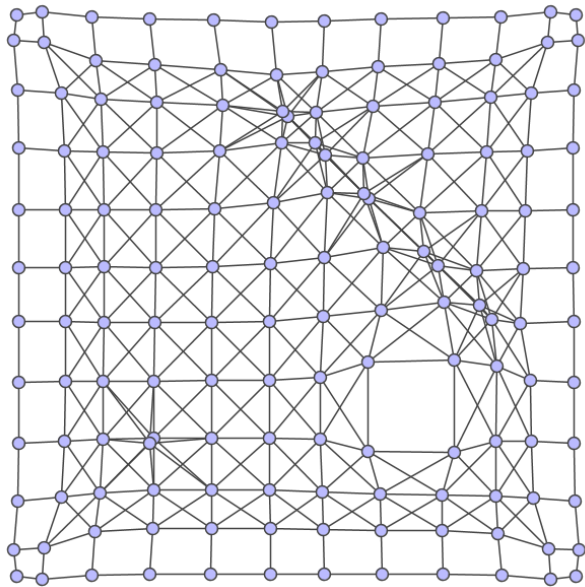
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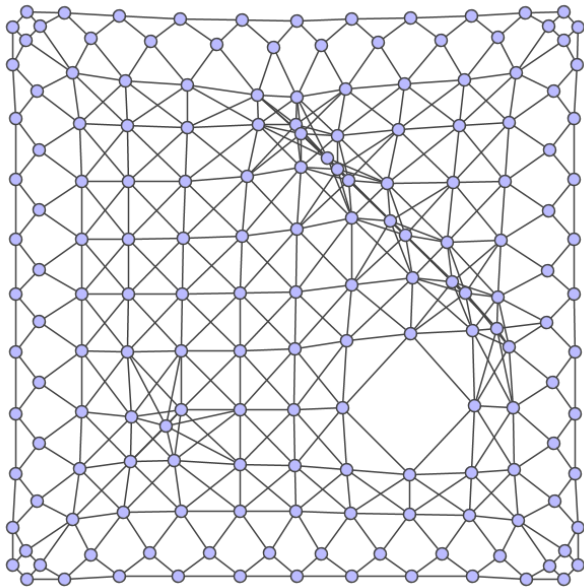
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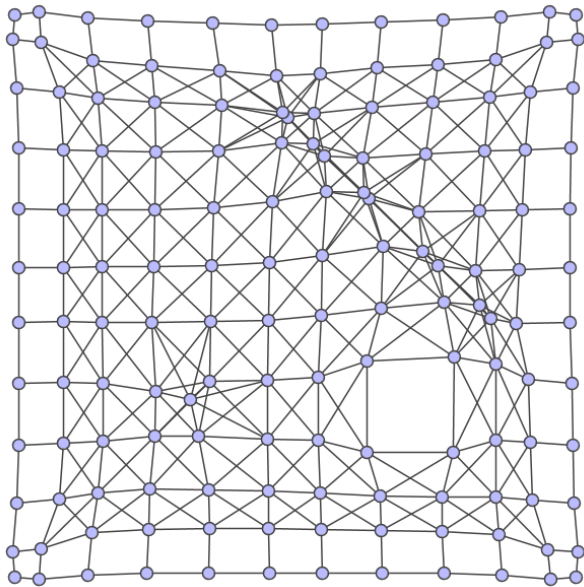
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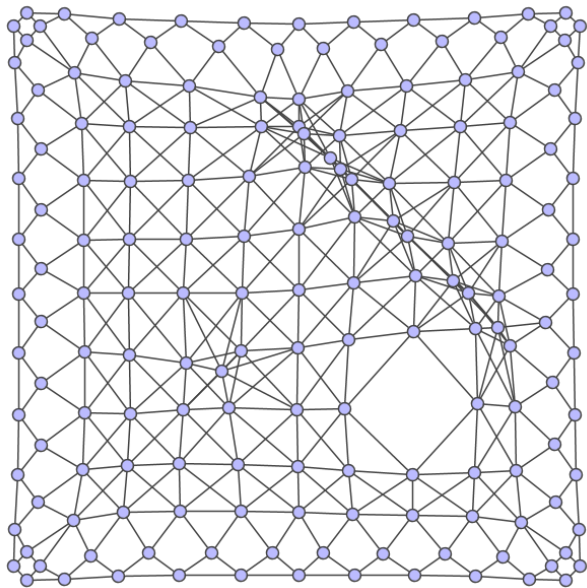
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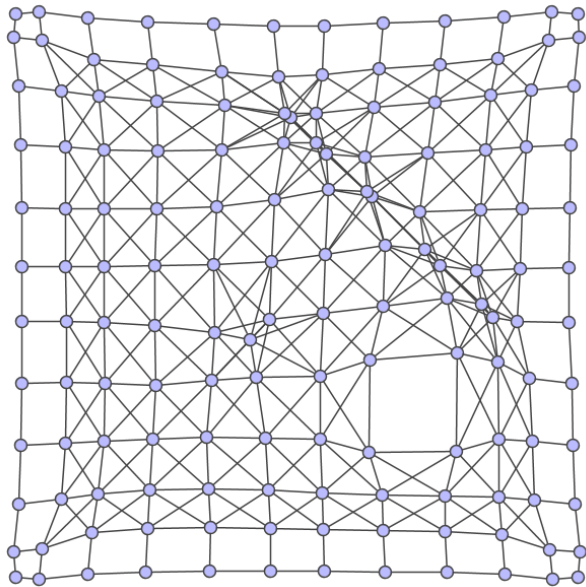
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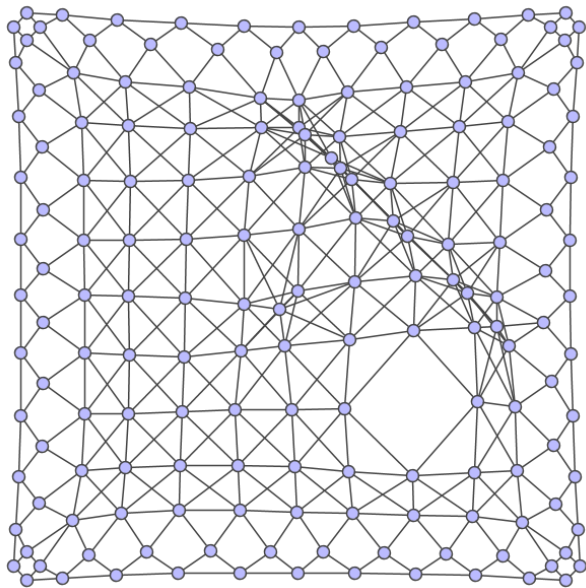
Clique Behavior



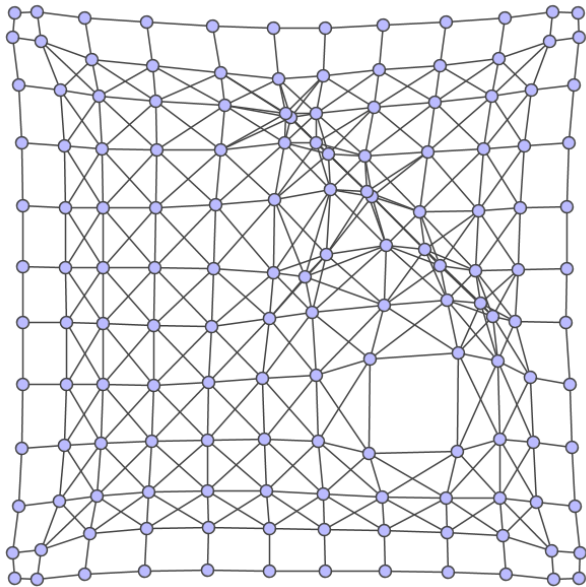
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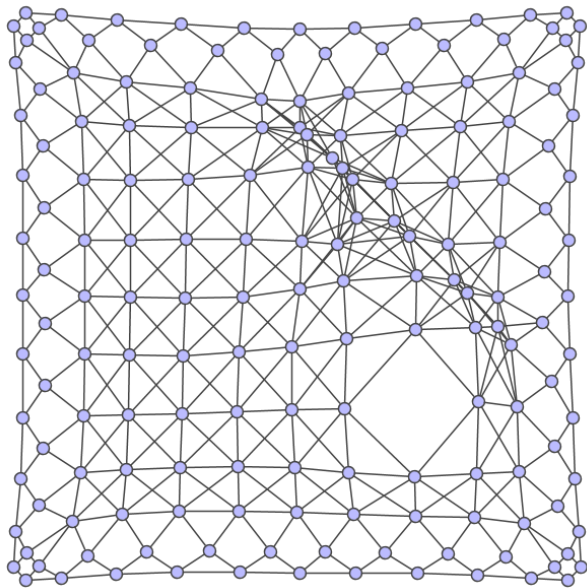
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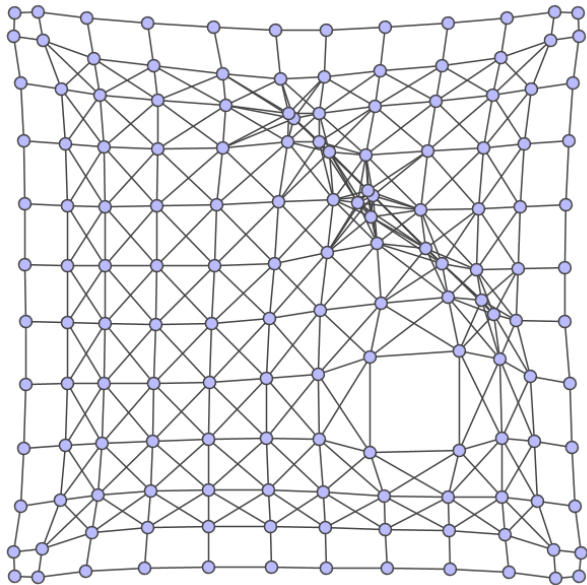
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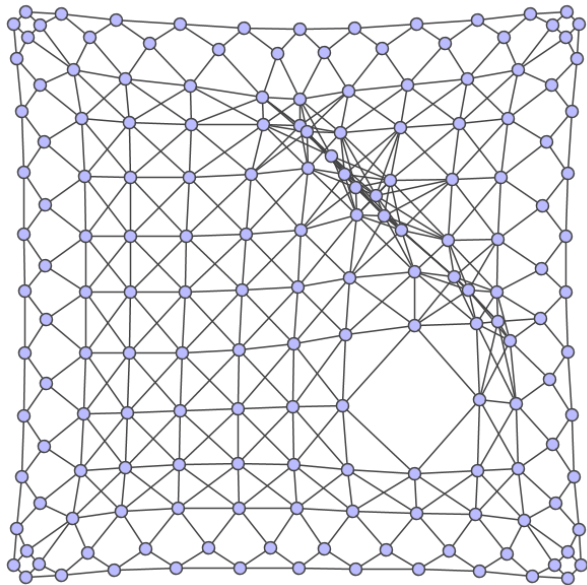
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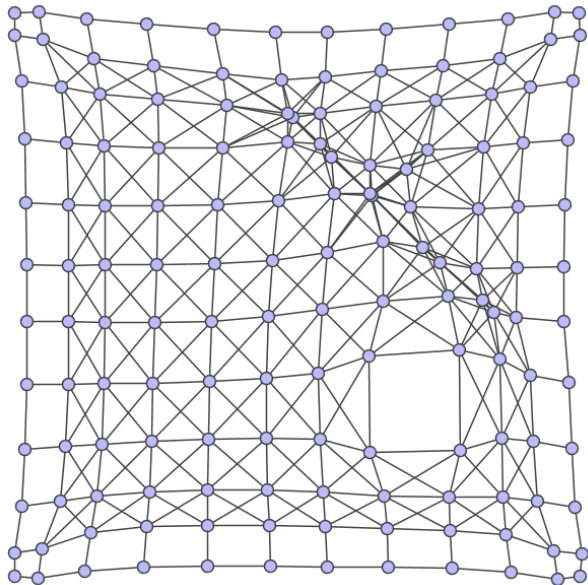
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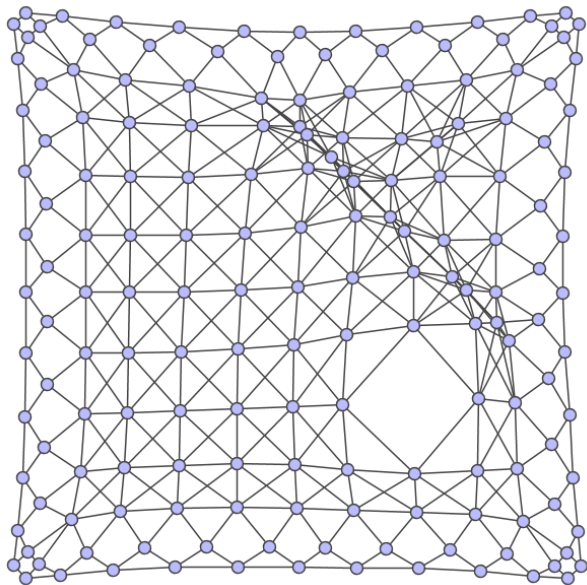
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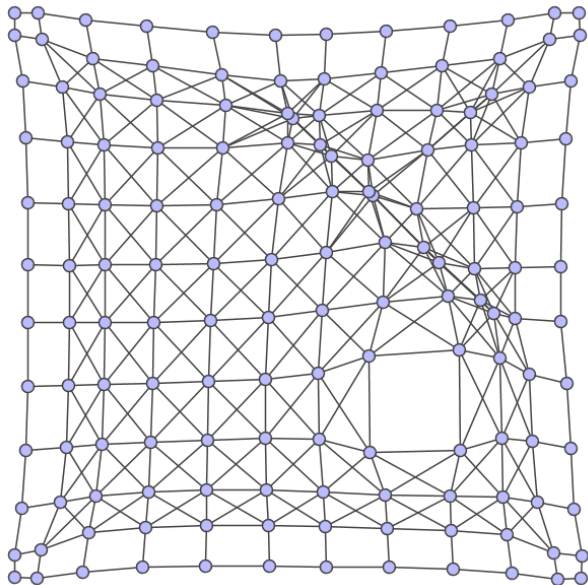
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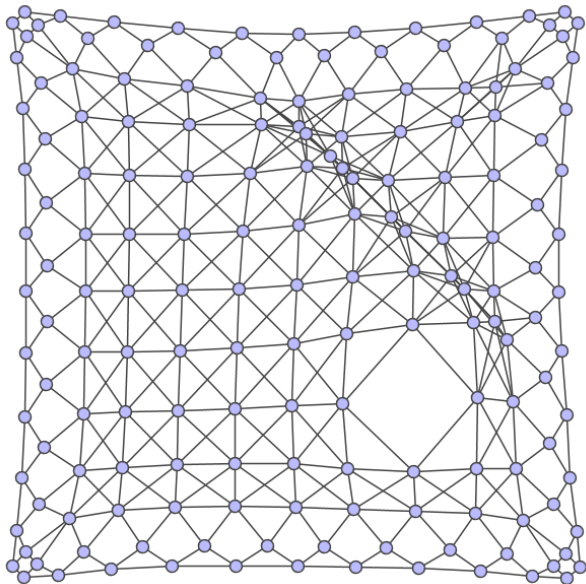
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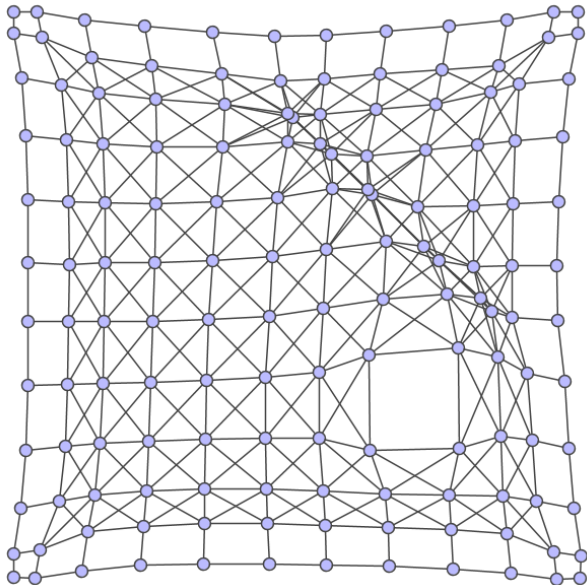
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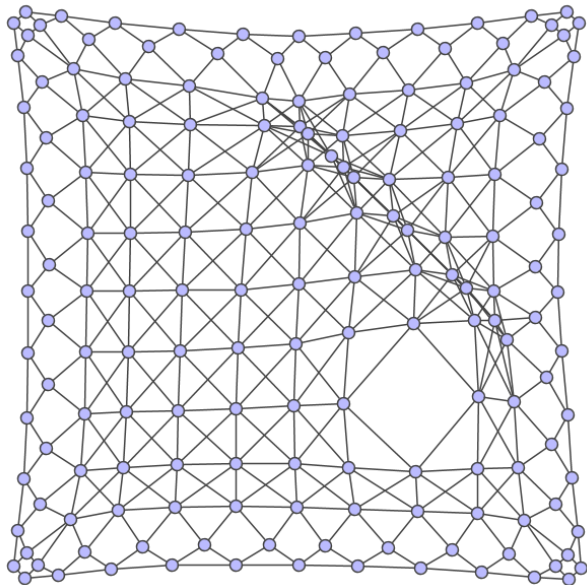
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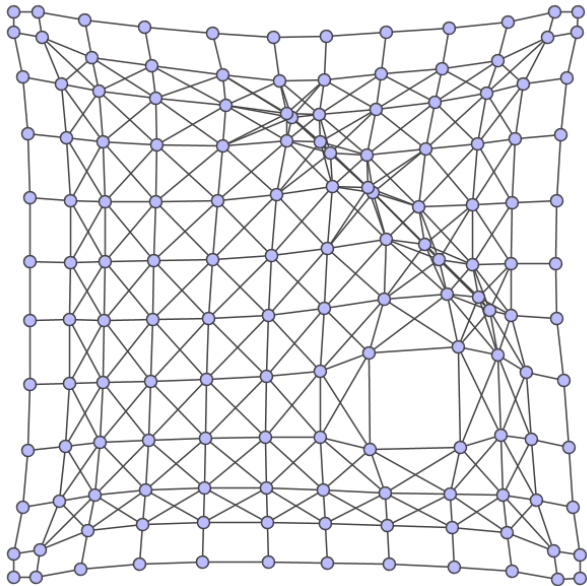
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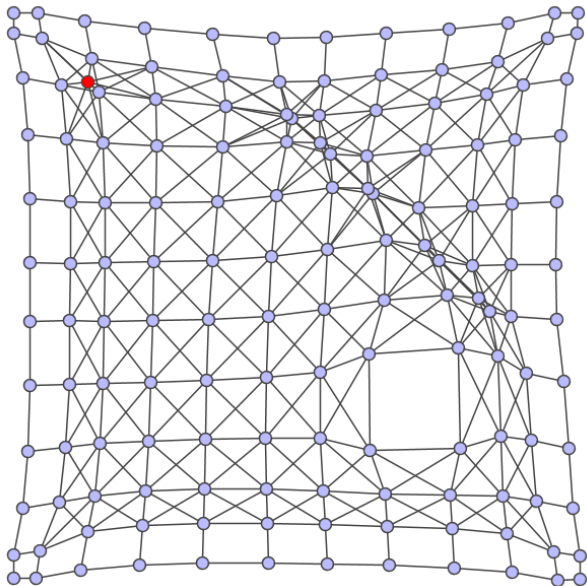
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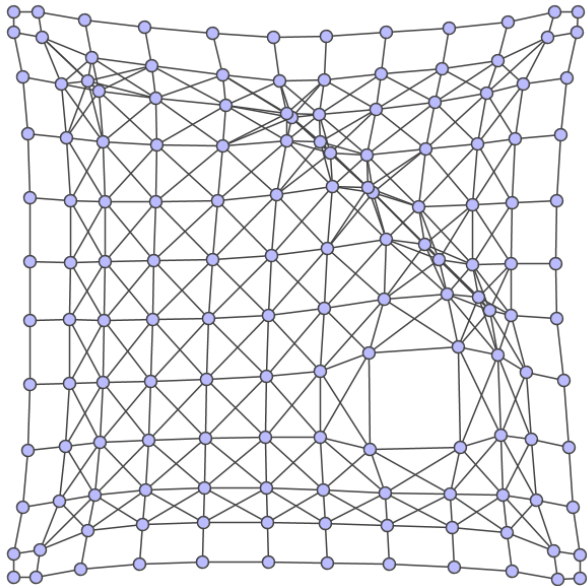
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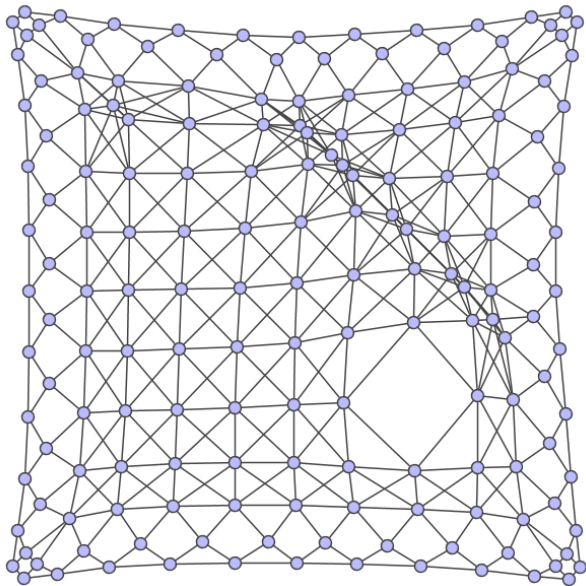
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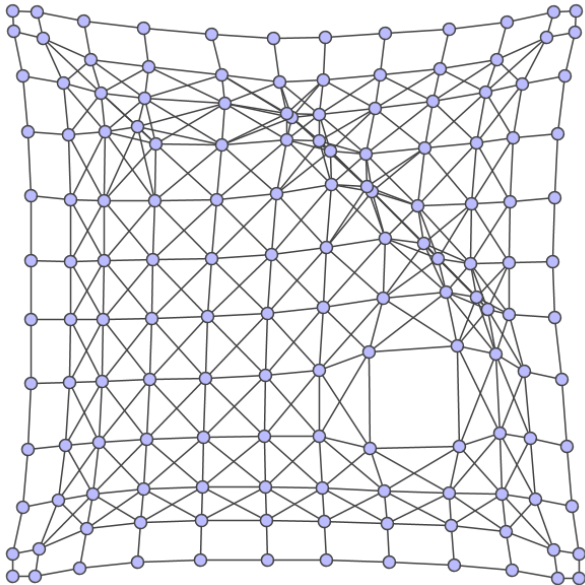
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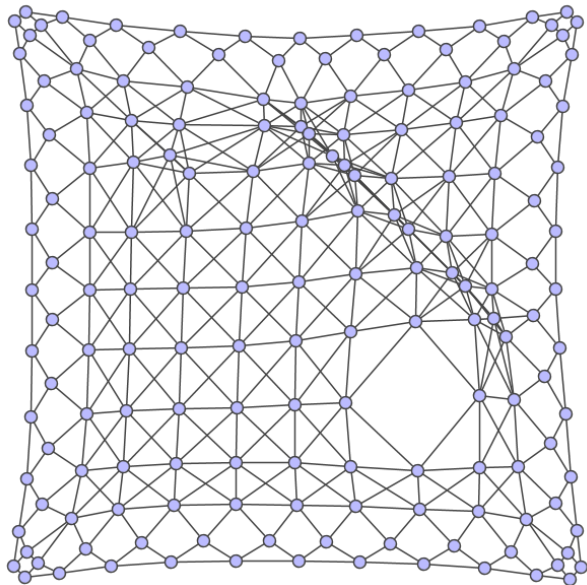
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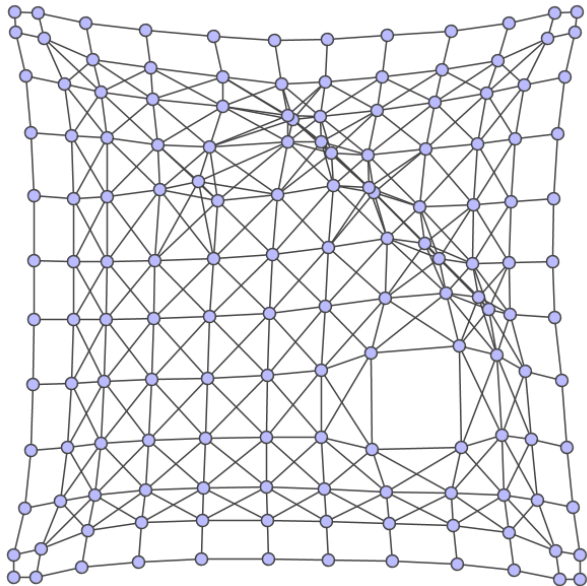
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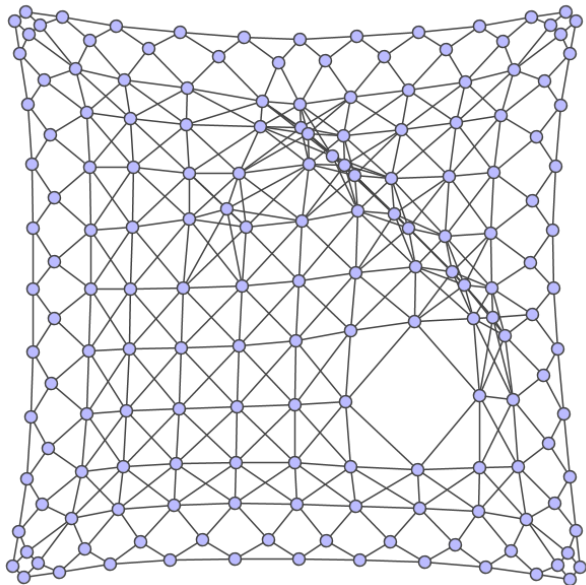
Clique Behavior



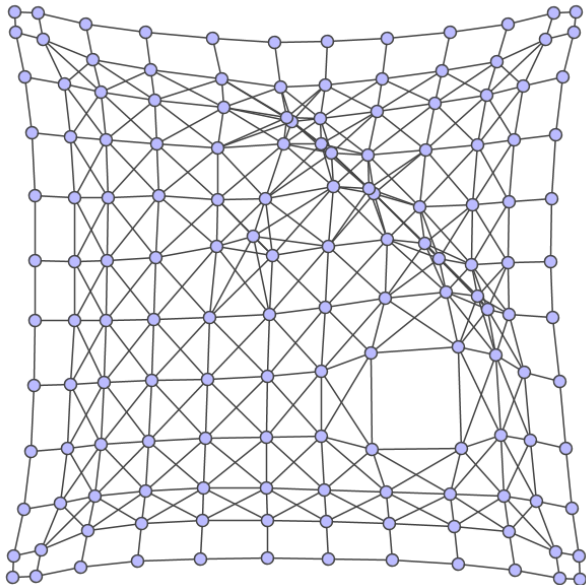
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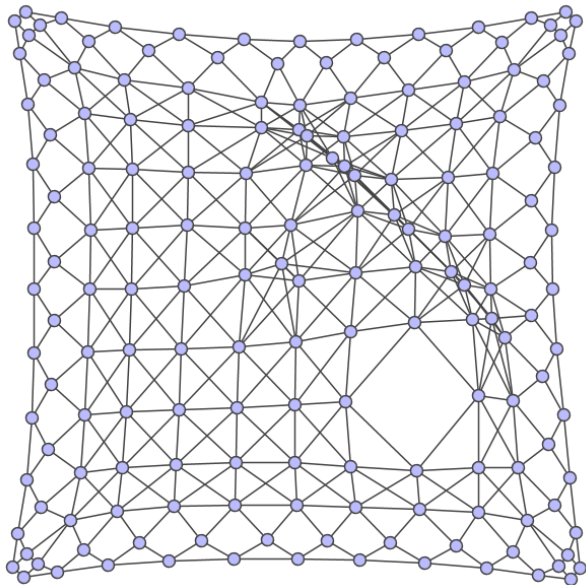
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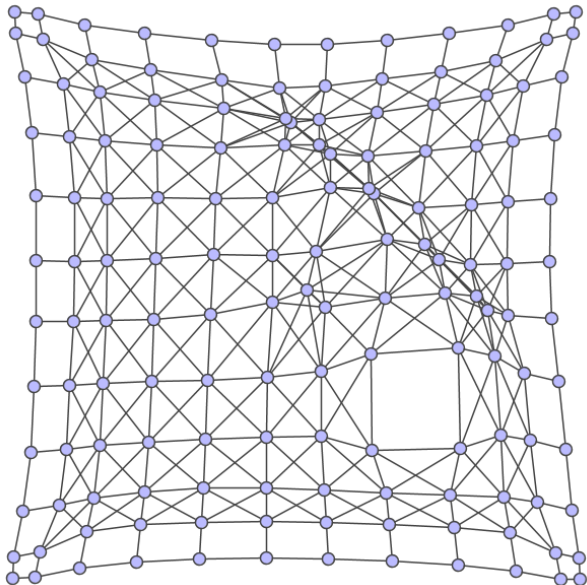
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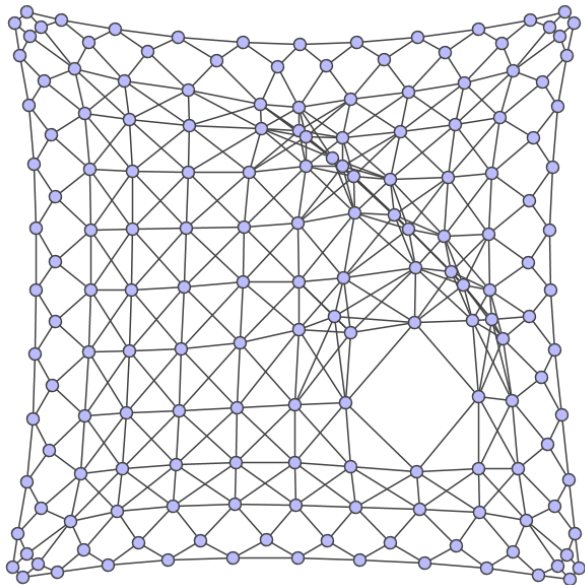
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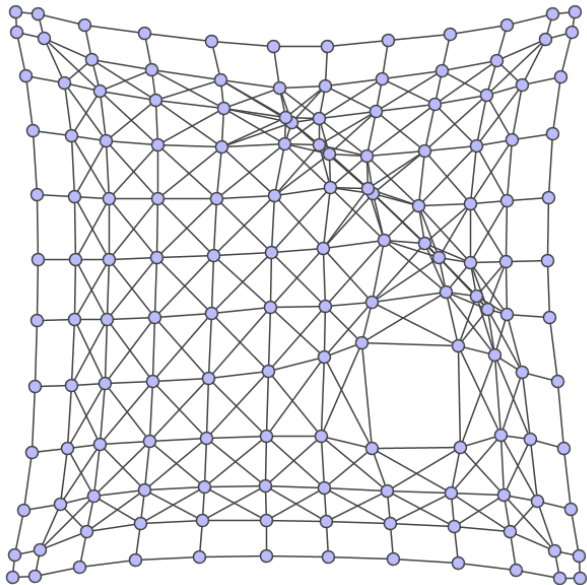
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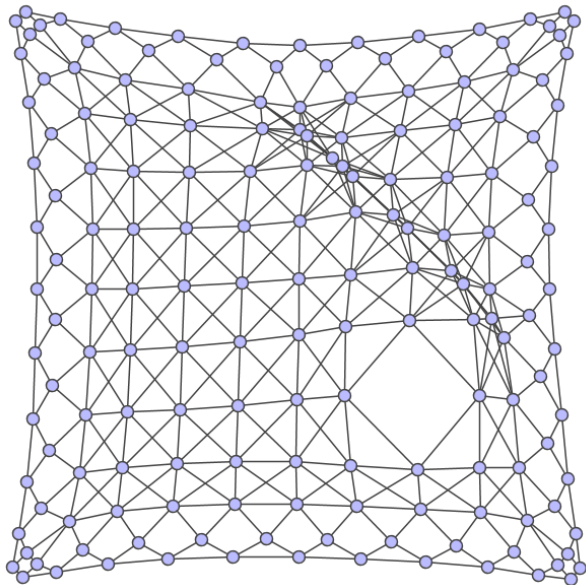
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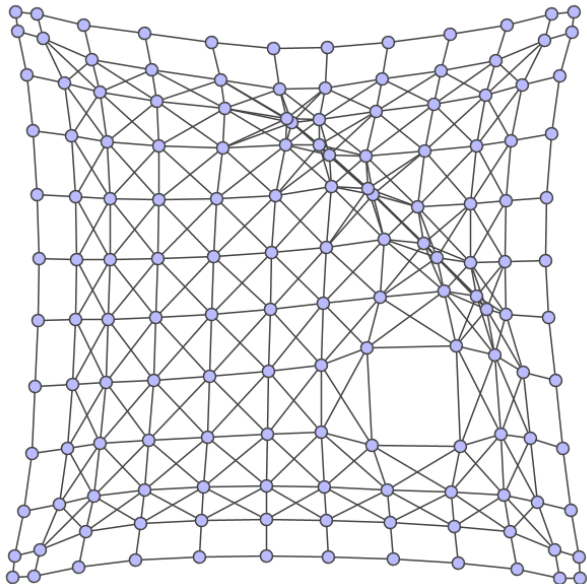
Clique Behavior



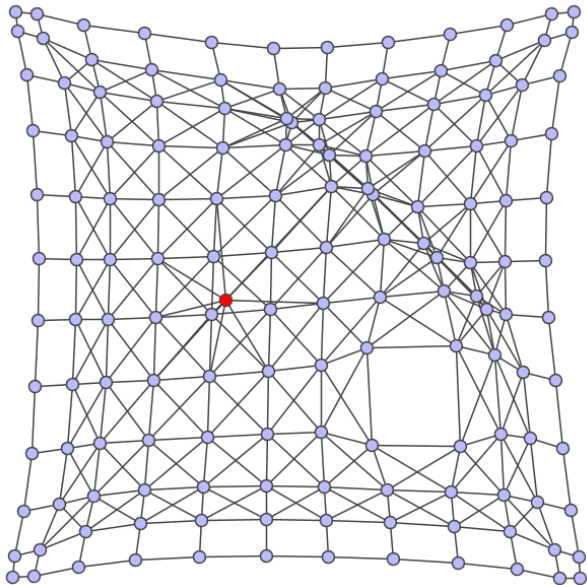
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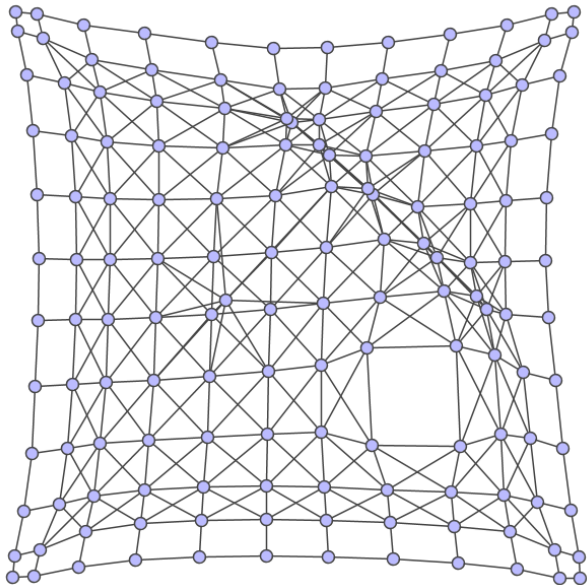
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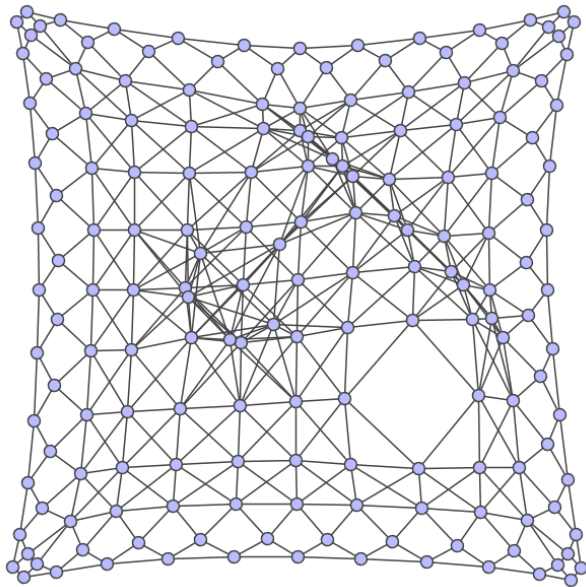
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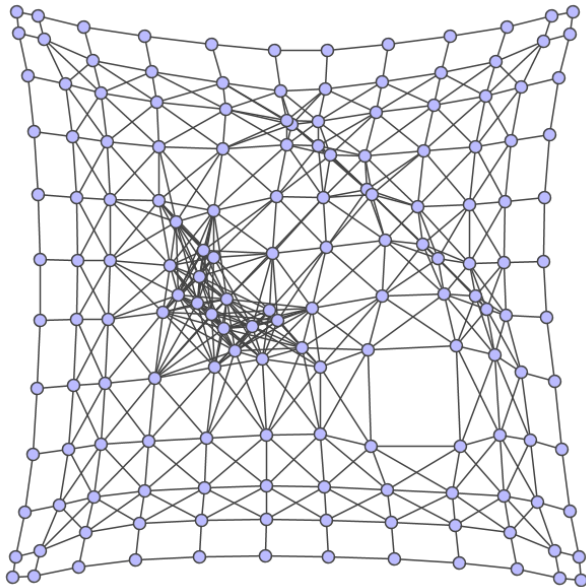
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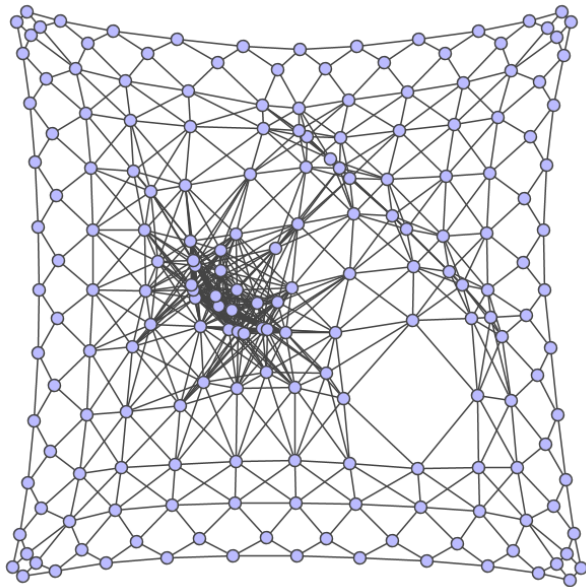
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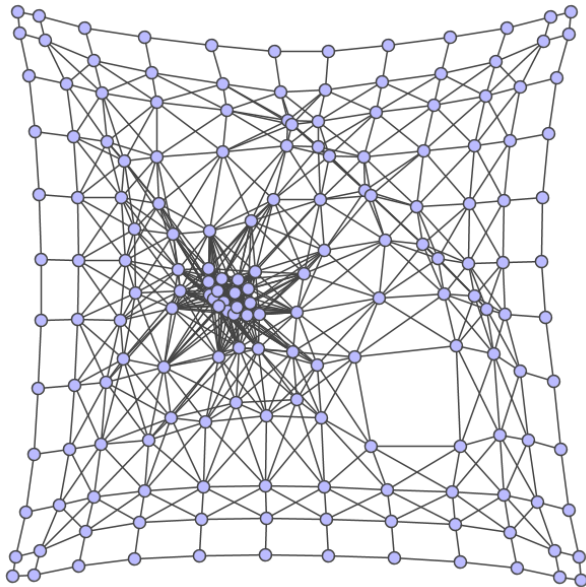
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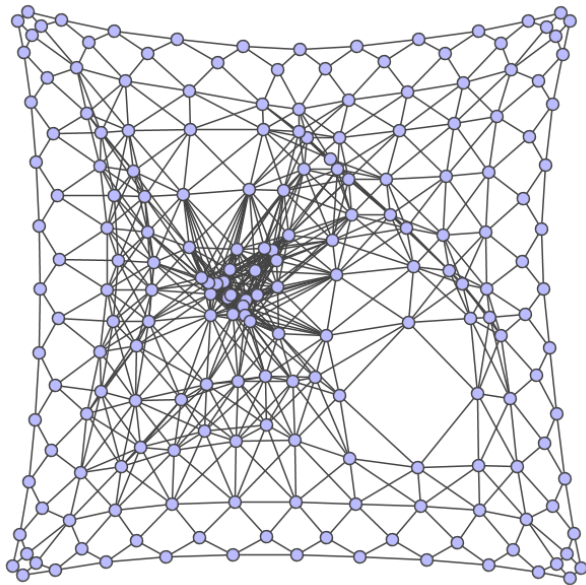
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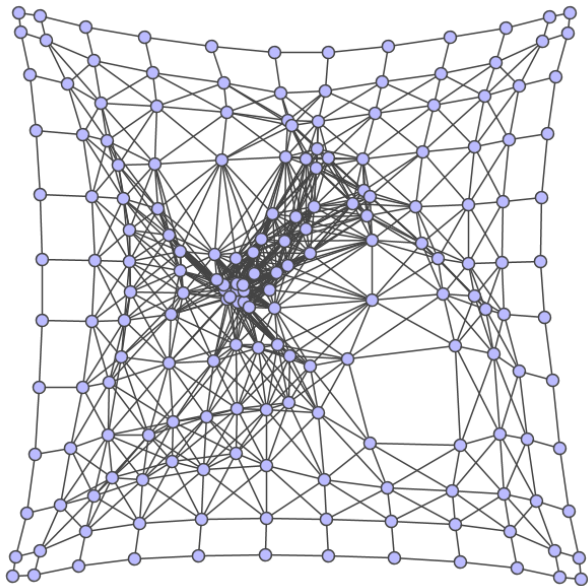
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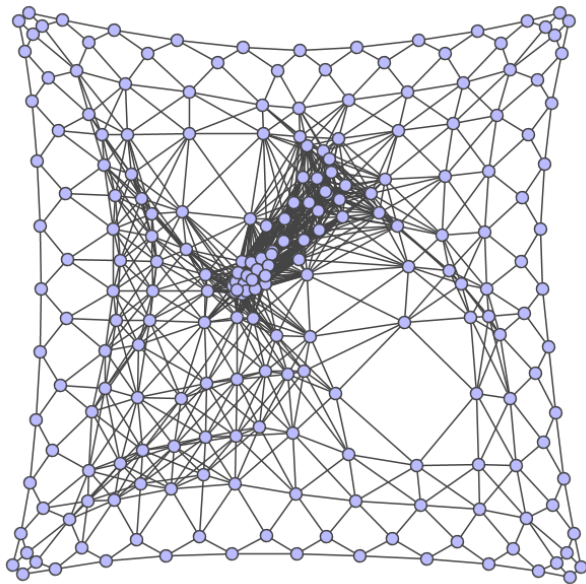
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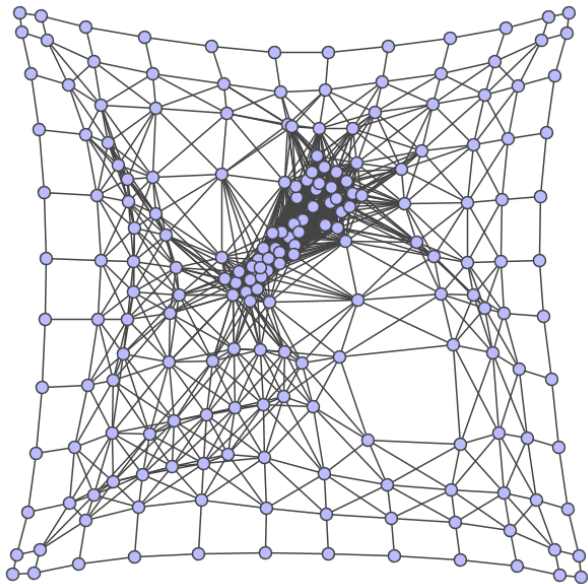
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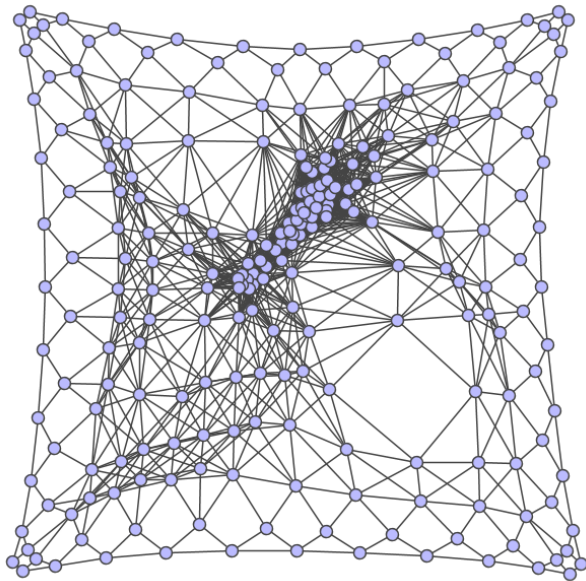
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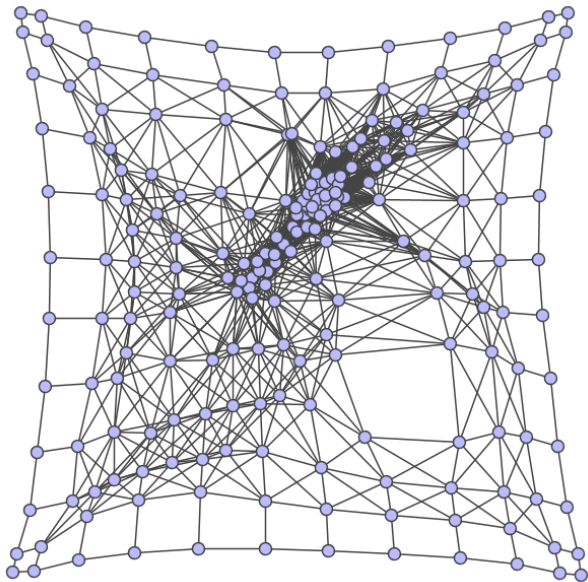
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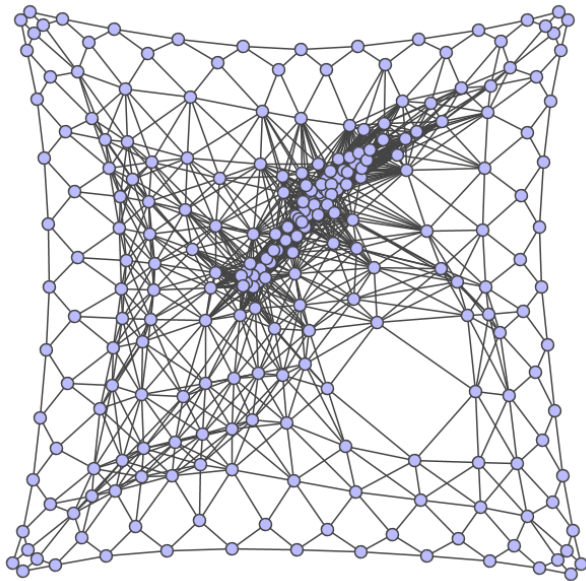
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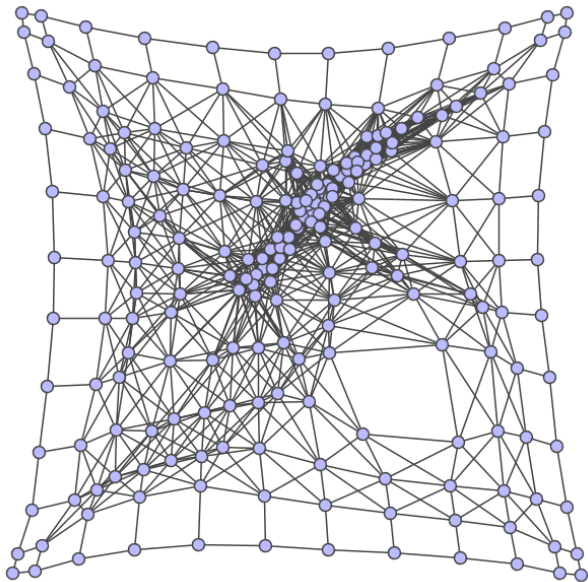
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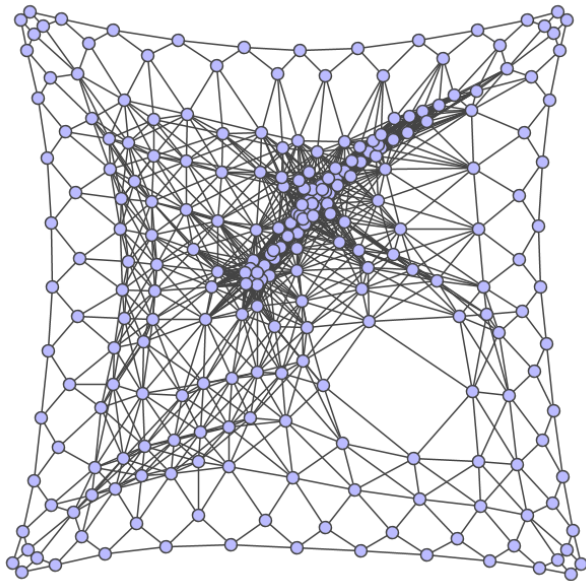
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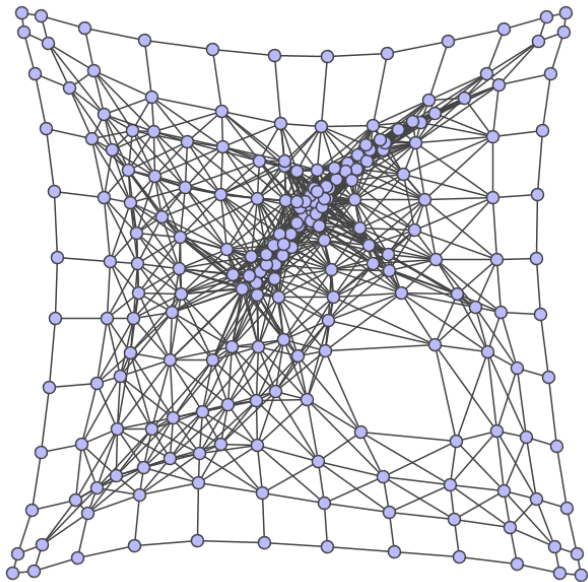
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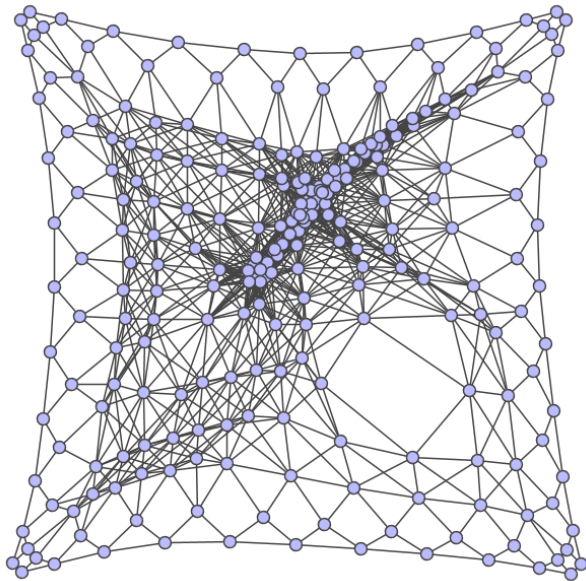
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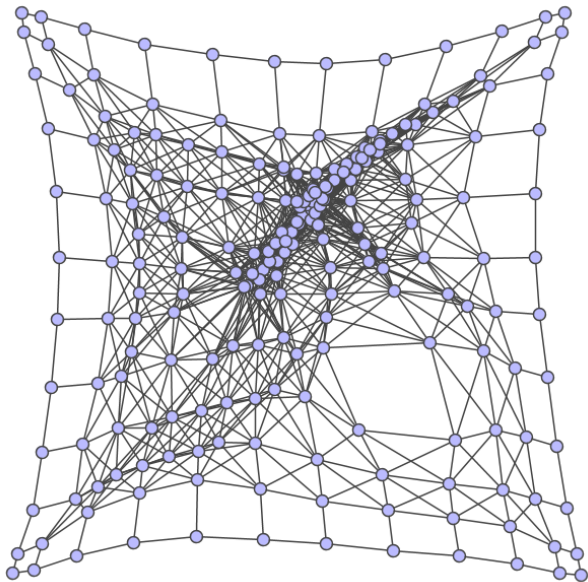
Clique Behavior



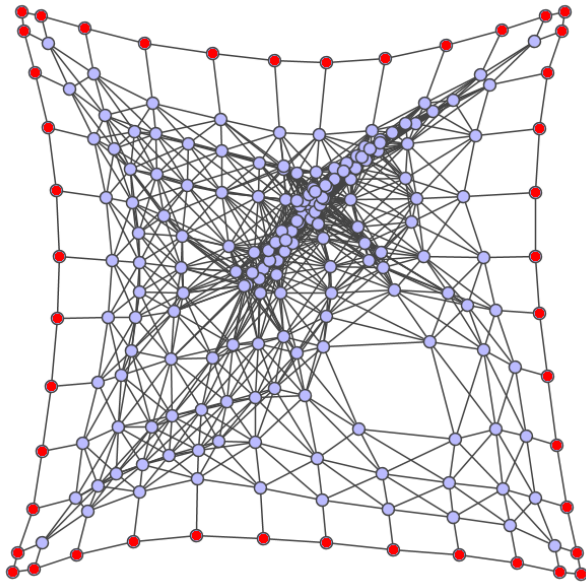
Clique Behavior



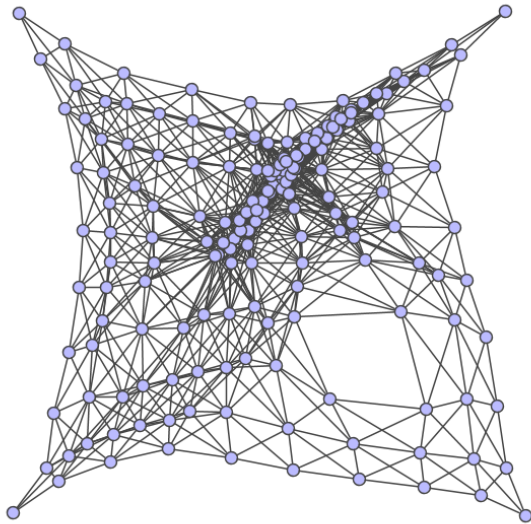
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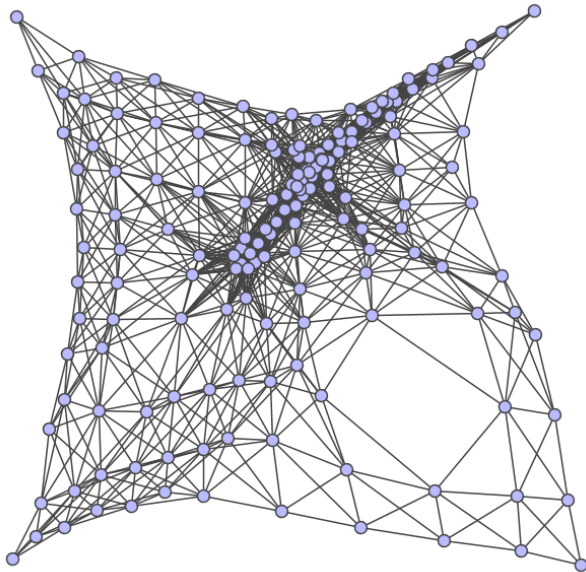
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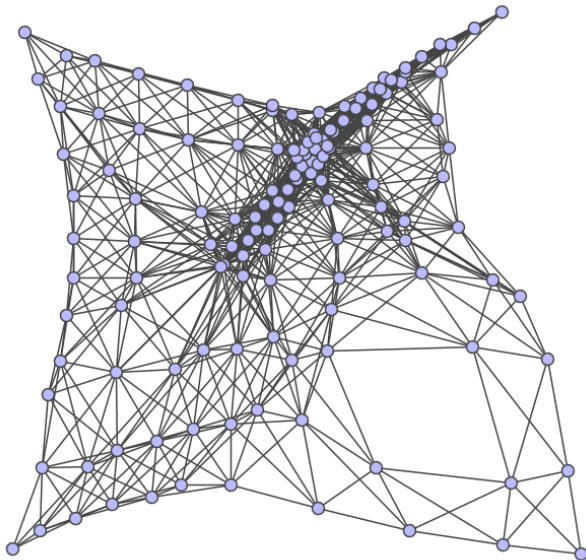
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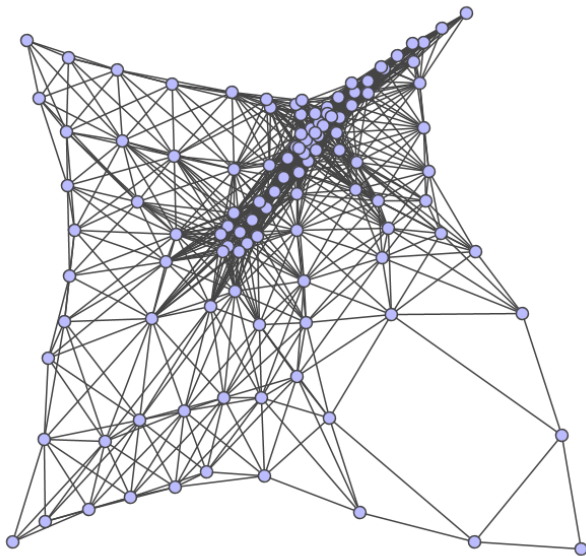
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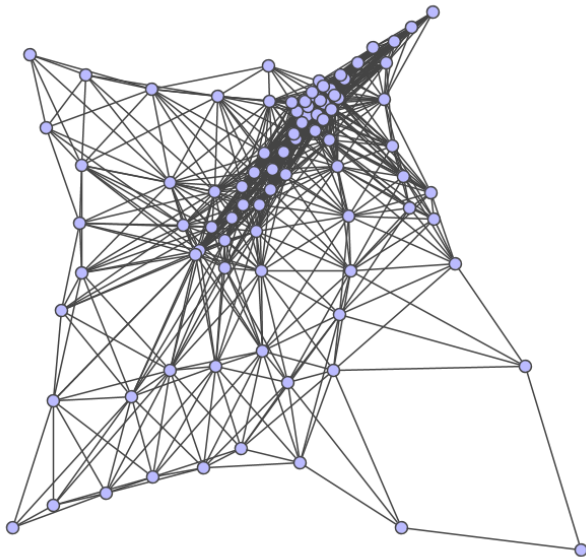
Clique Behavior



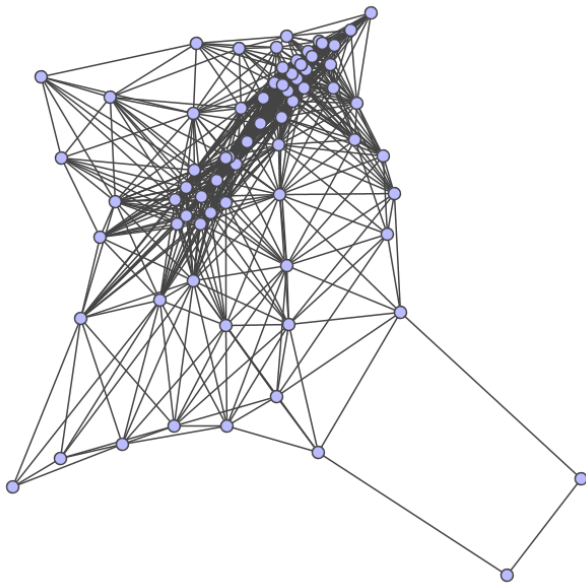
Clique Behavior



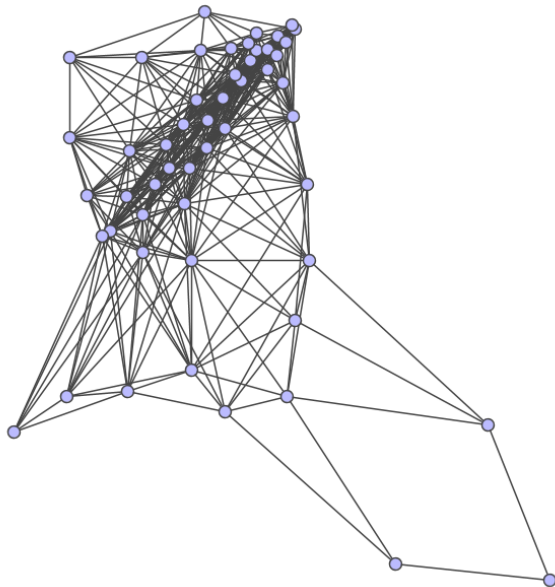
Clique Behavior



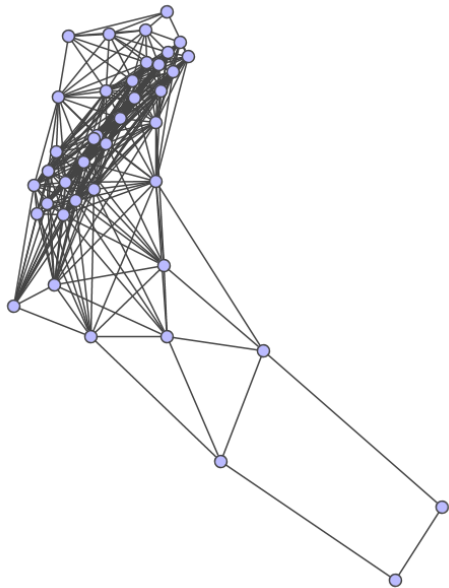
Clique Behavior



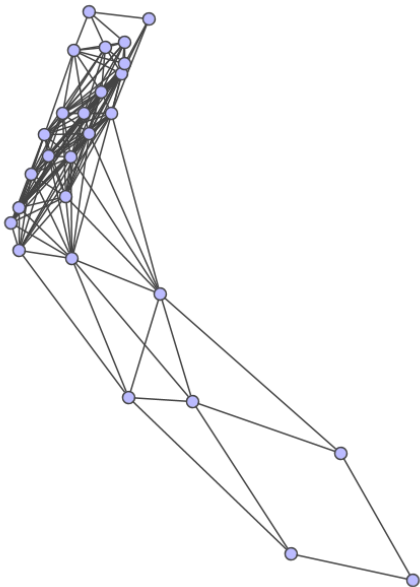
Clique Behavior



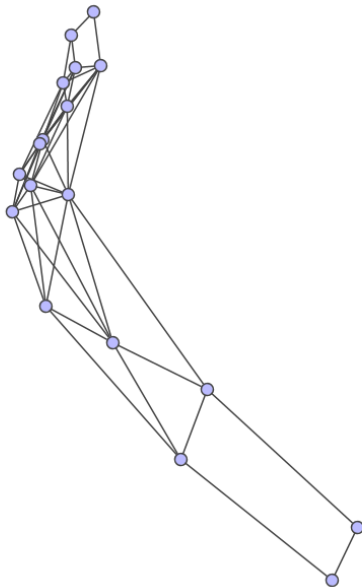
Clique Behavior



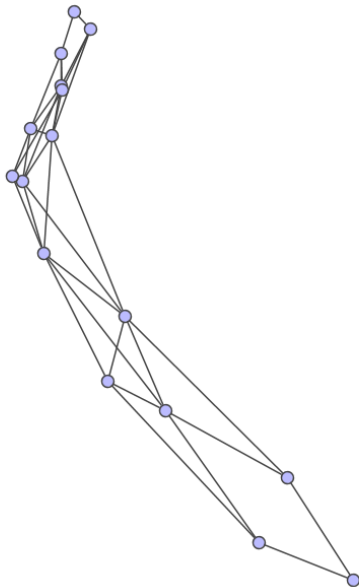
Clique Behavior



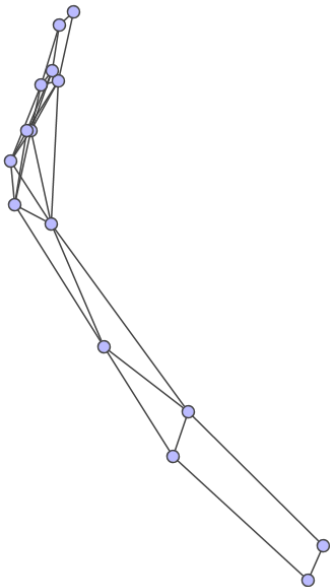
Clique Behavior



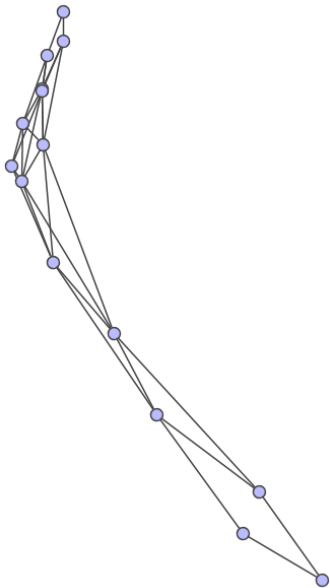
Clique Behavior



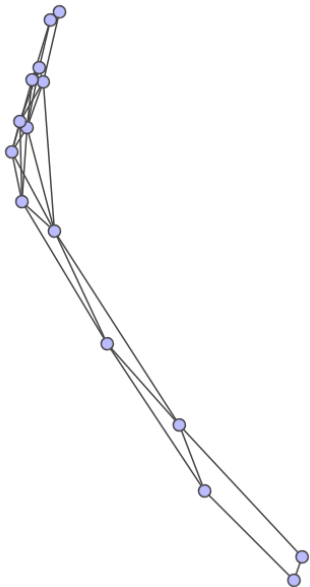
Clique Behavior



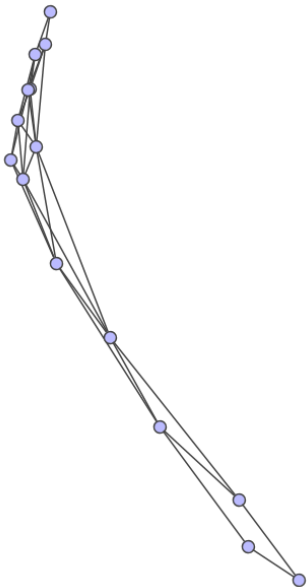
Clique Behavior



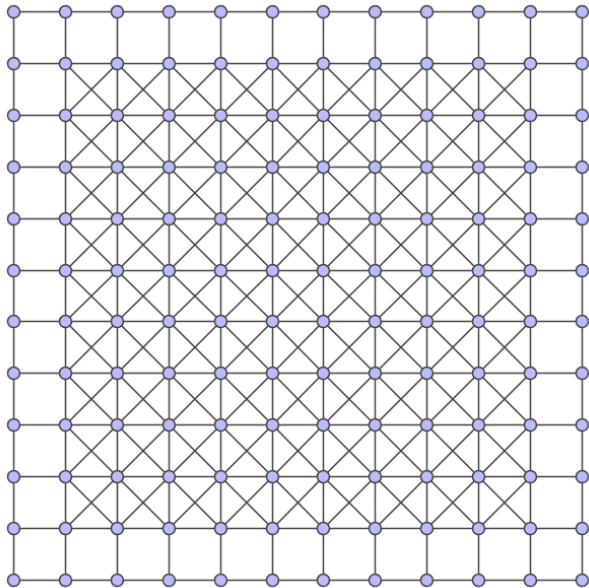
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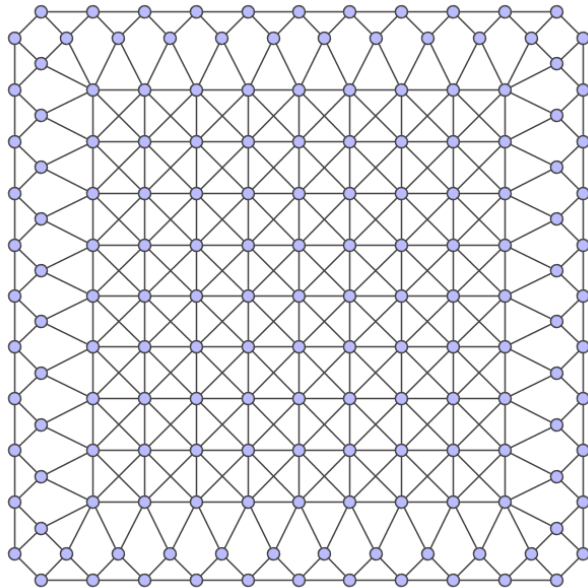
Clique Behavior



Clique Behavior

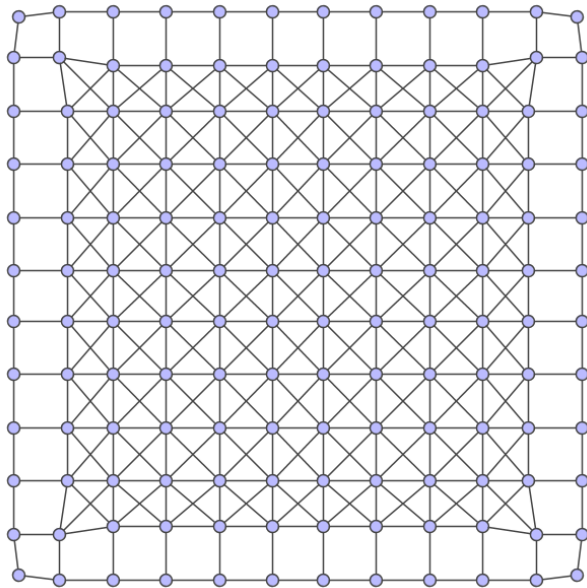


Clique Behavior



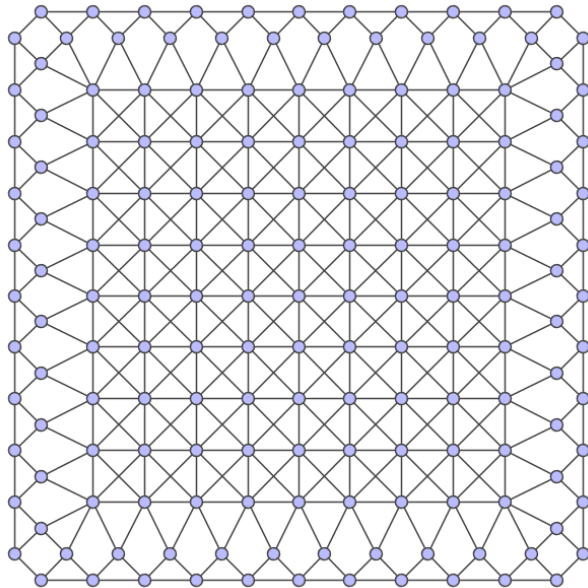
► Hellyness

Clique Behavior



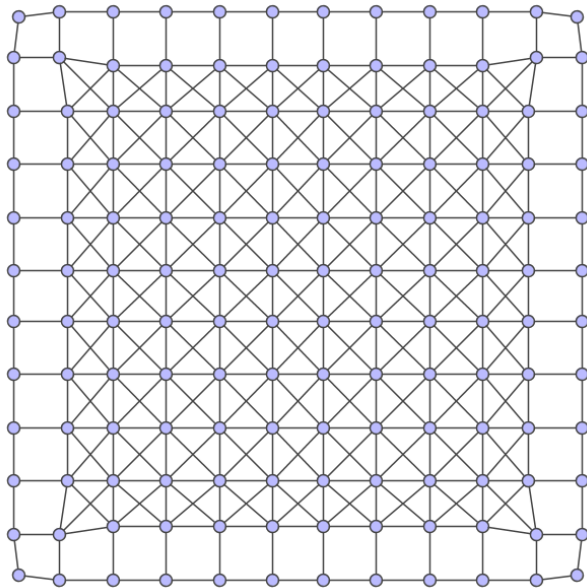
► Hellyness

Clique Behavior



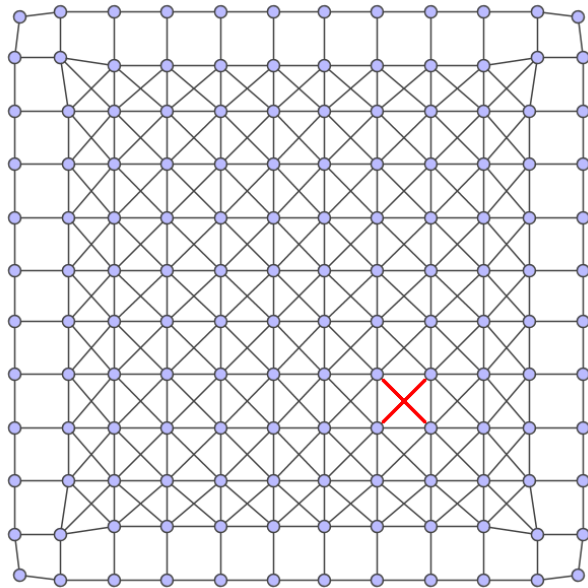
► Hellyness

Clique Behavior



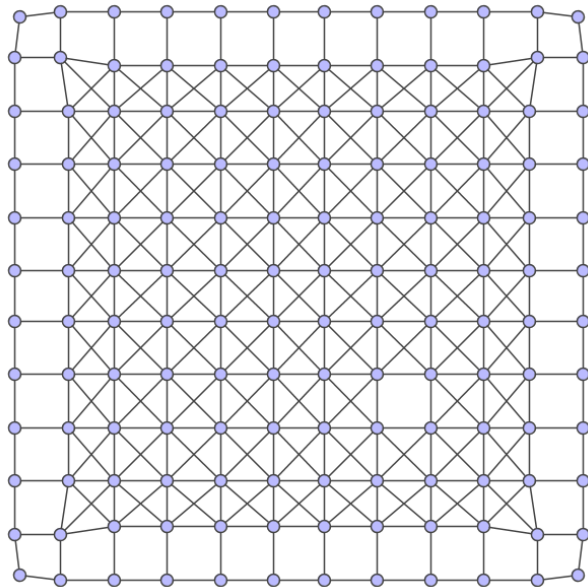
► Hellyness

Clique Behavior



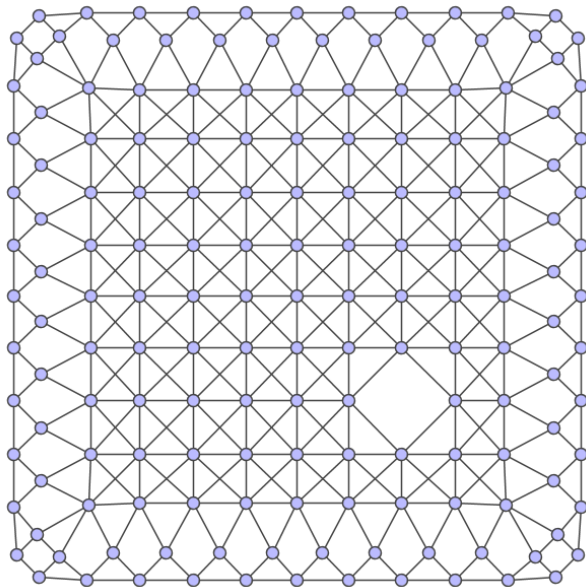
► Hellyness

Clique Behavior



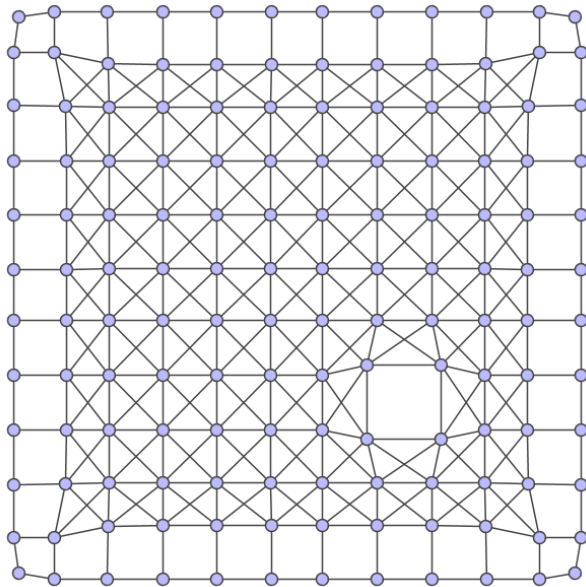
- ▶ Hellyness
- ▶ Fundamental Group

Clique Behavior



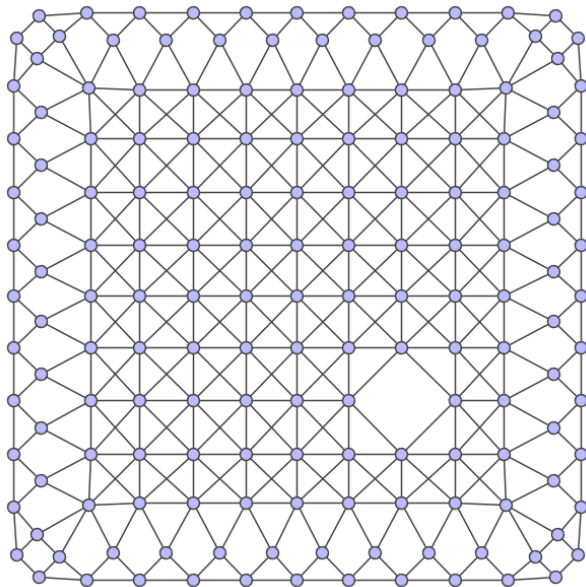
- ▶ Hellyness
- ▶ Fundamental Group

Clique Behavior



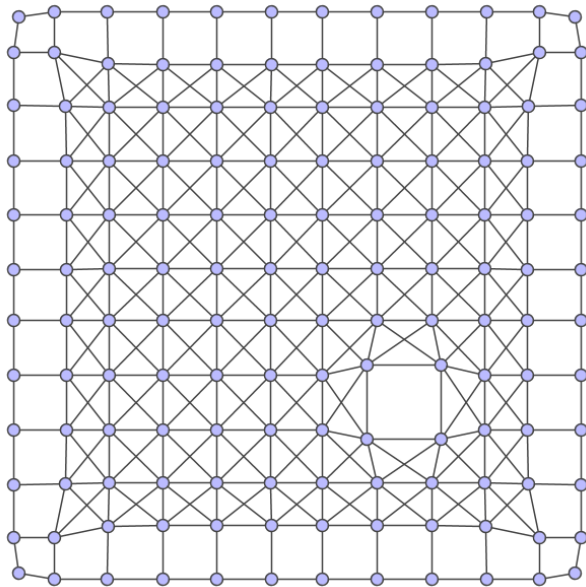
- ▶ Hellyness
- ▶ Fundamental Group

Clique Behavior



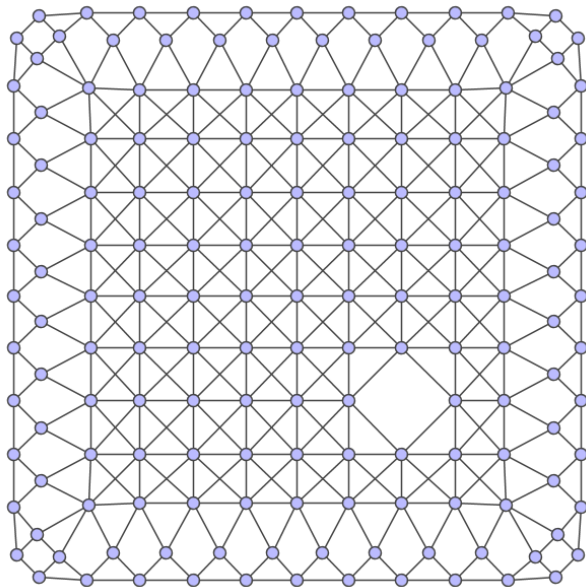
- ▶ Hellyness
- ▶ Fundamental Group

Clique Behavior



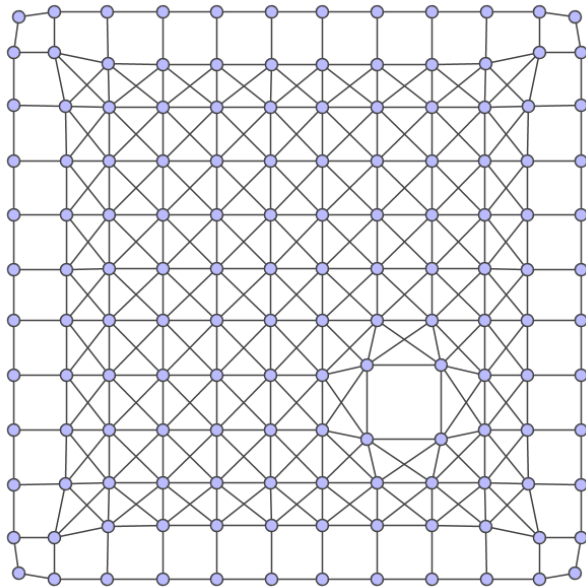
- ▶ Hellyness
- ▶ Fundamental Group

Clique Behavior



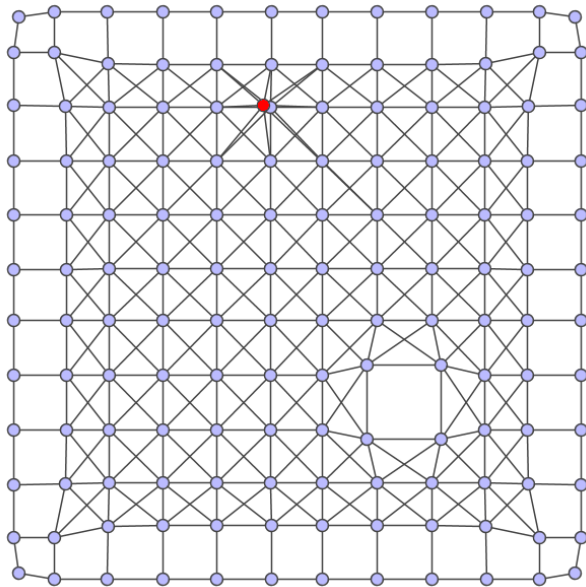
- ▶ Hellyness
- ▶ Fundamental Group

Clique Behavior



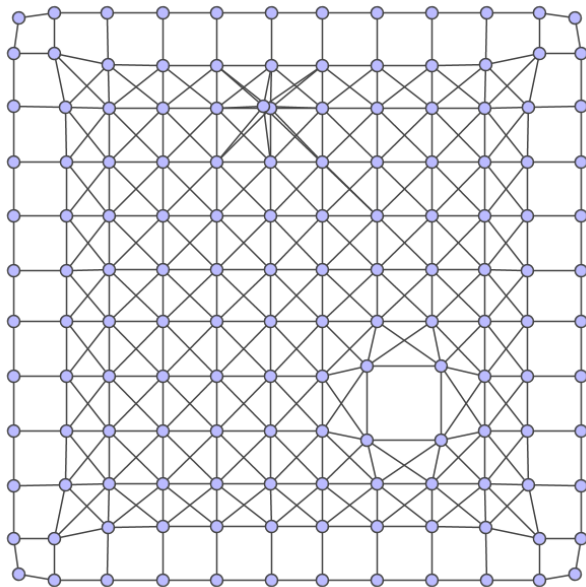
- ▶ Hellyness
- ▶ Fundamental Group

Clique Behavior



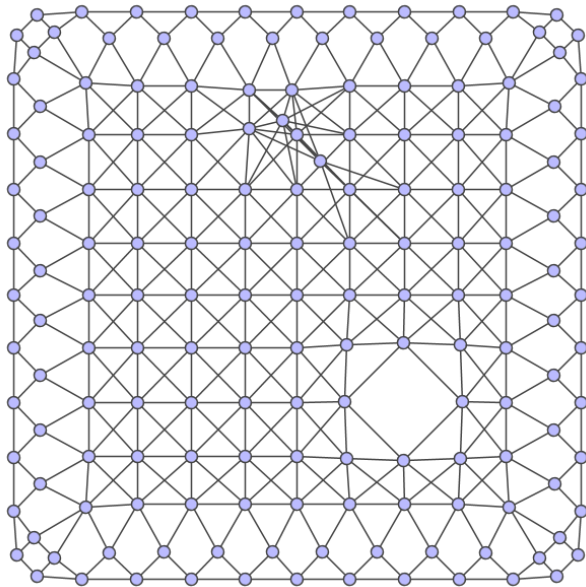
- ▶ Hellyness
- ▶ Fundamental Group

Clique Behavior



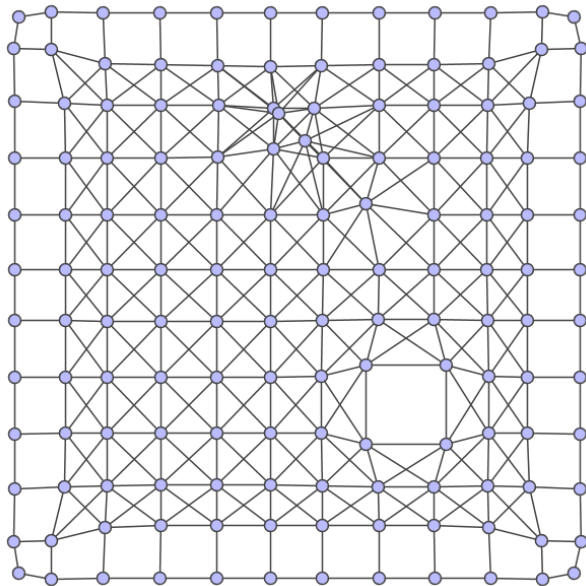
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



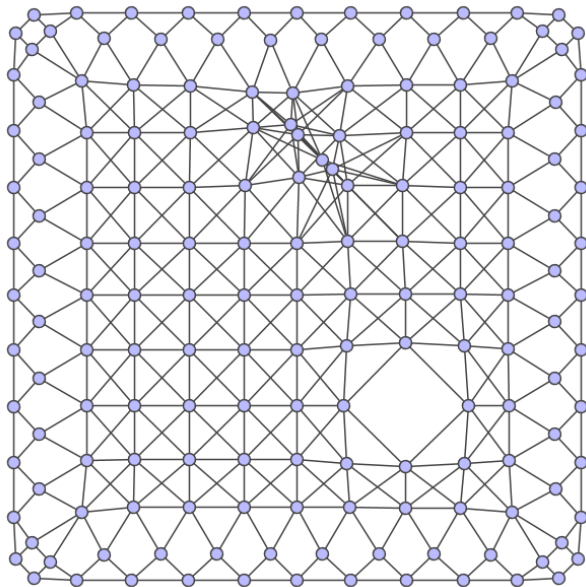
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



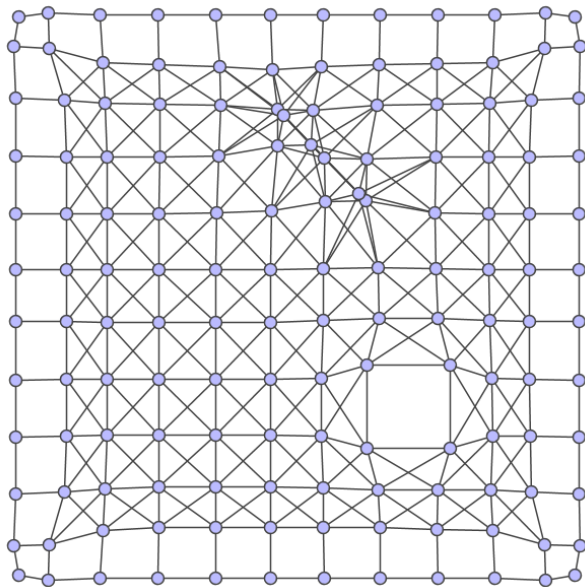
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



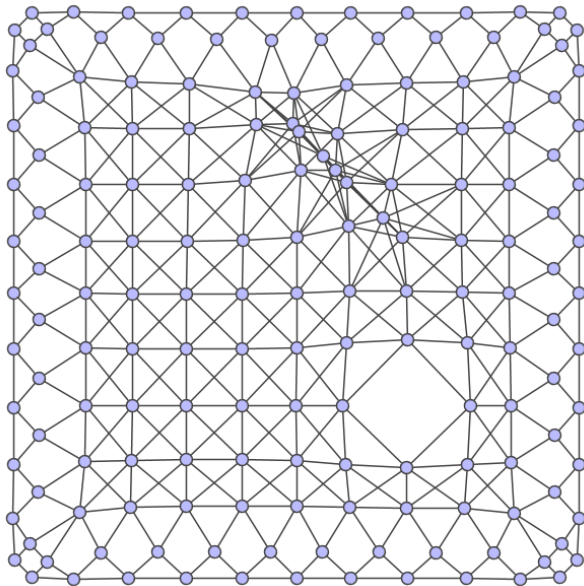
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



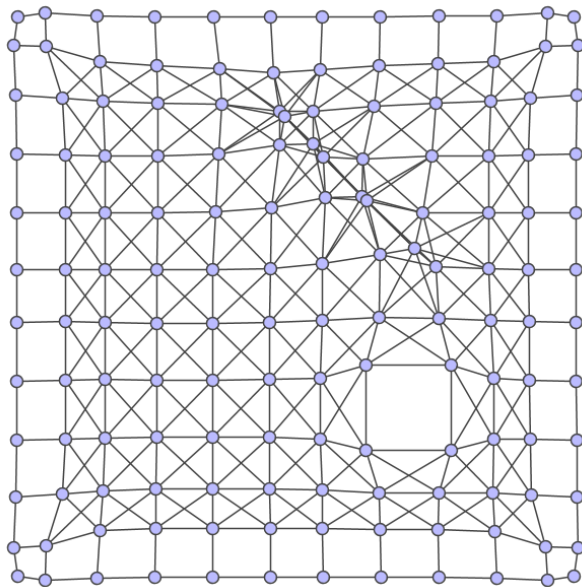
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



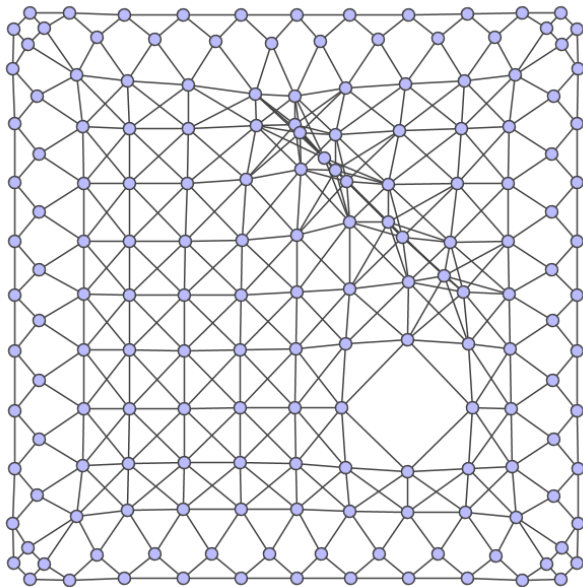
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



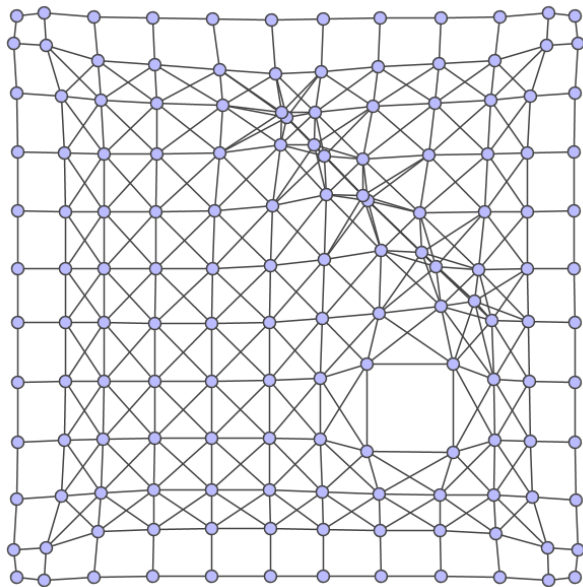
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



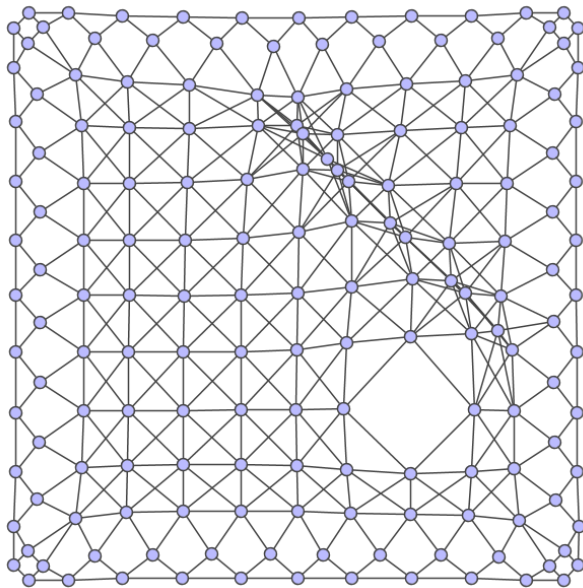
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



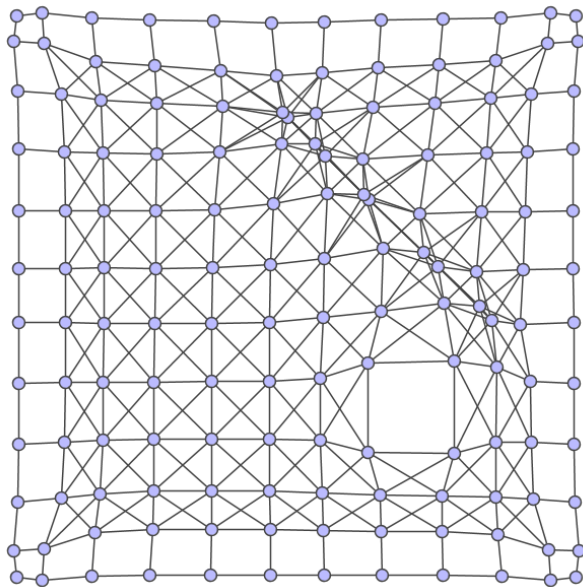
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



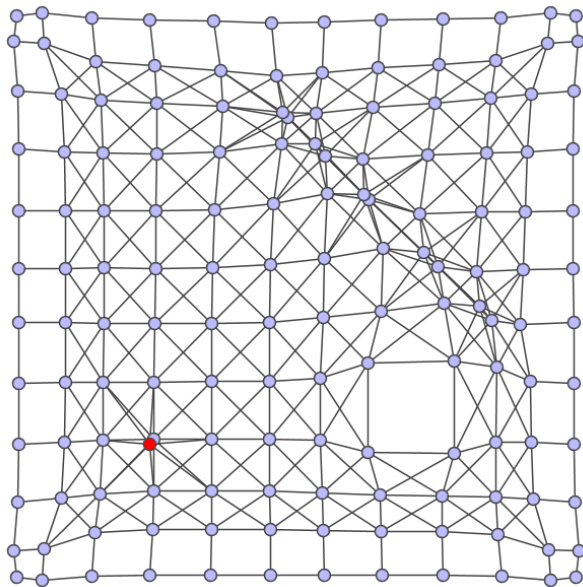
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



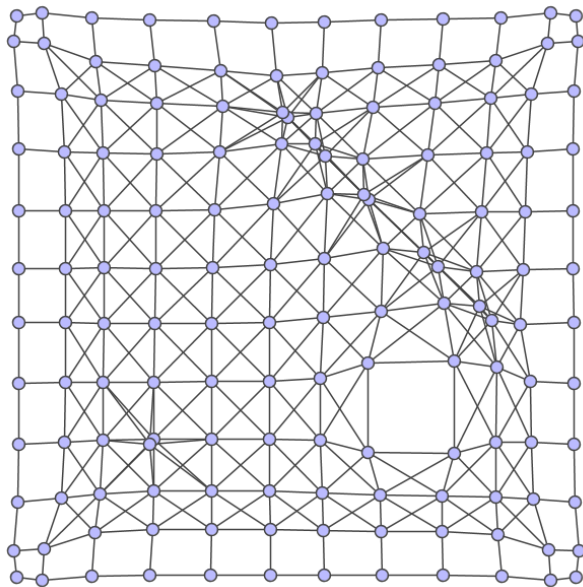
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



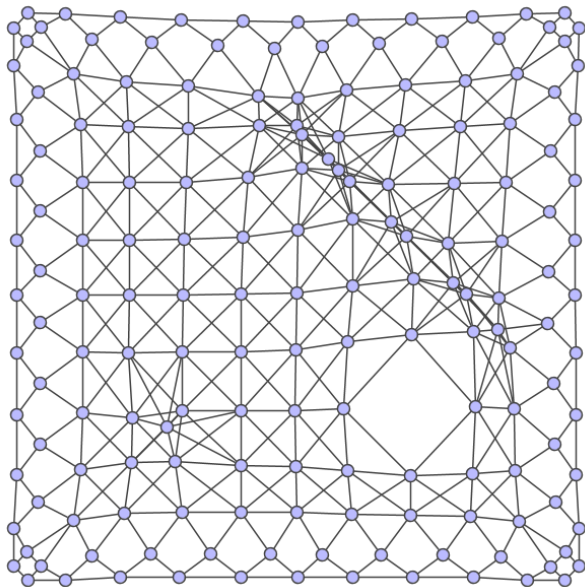
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



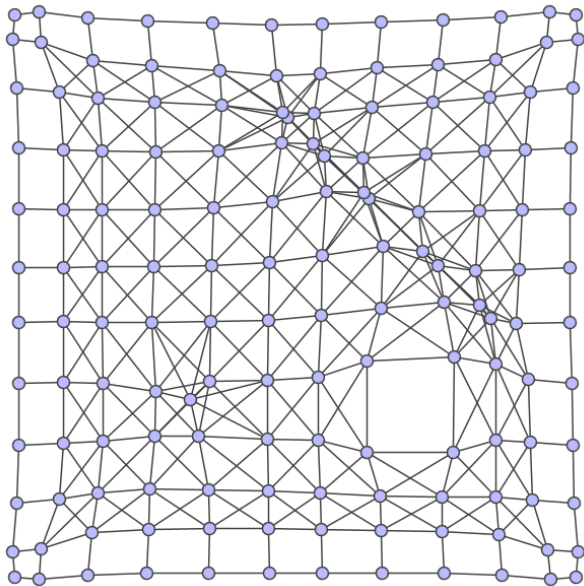
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- ▶ Local Cutpoints

Clique Behavior



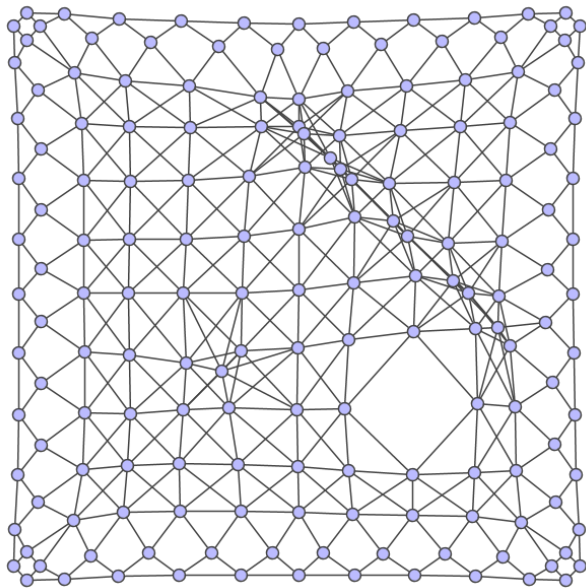
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



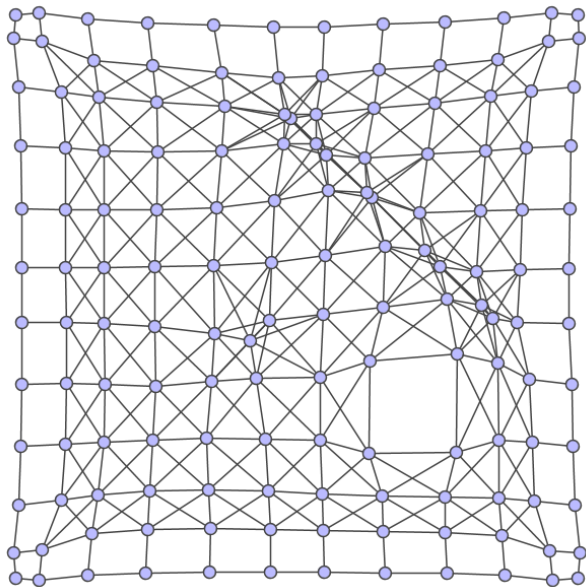
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



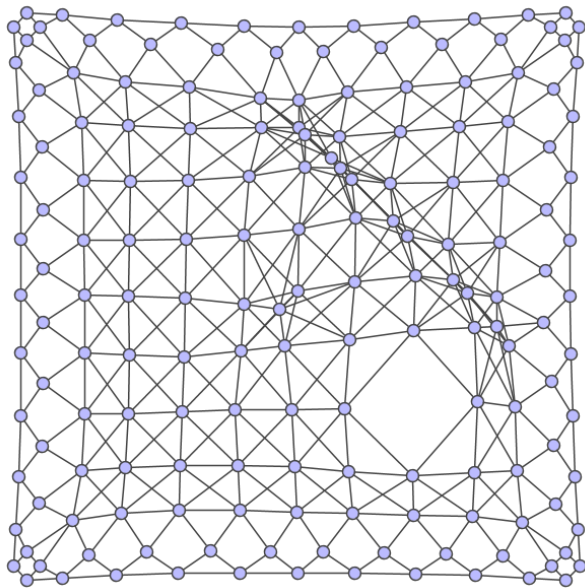
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



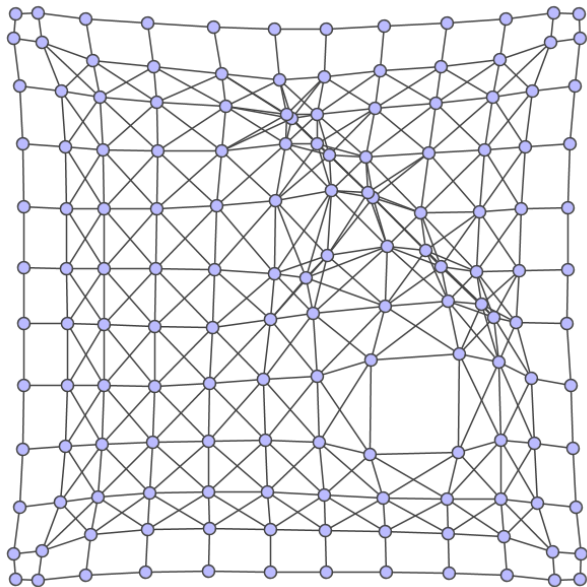
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- ▶ Local Cutpoints

Clique Behavior



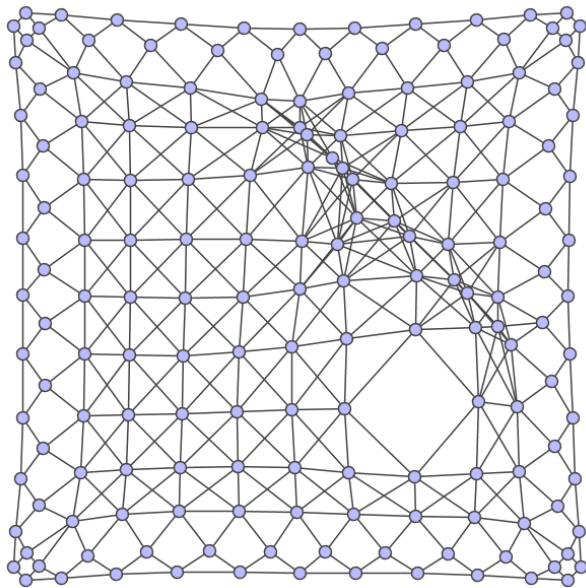
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



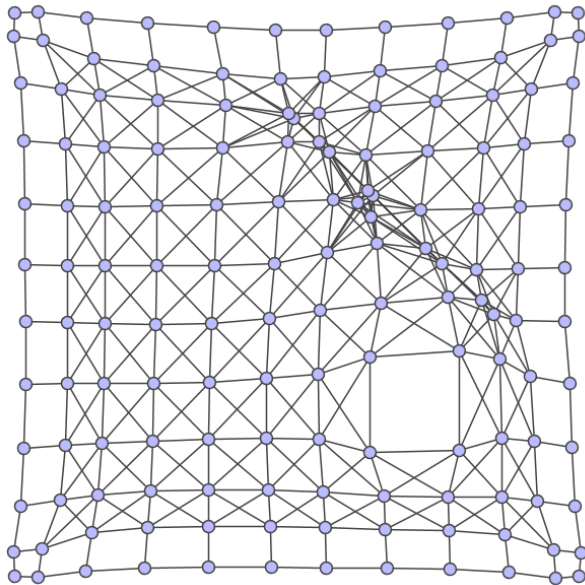
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- ▶ Local Cutpoints

Clique Behavior



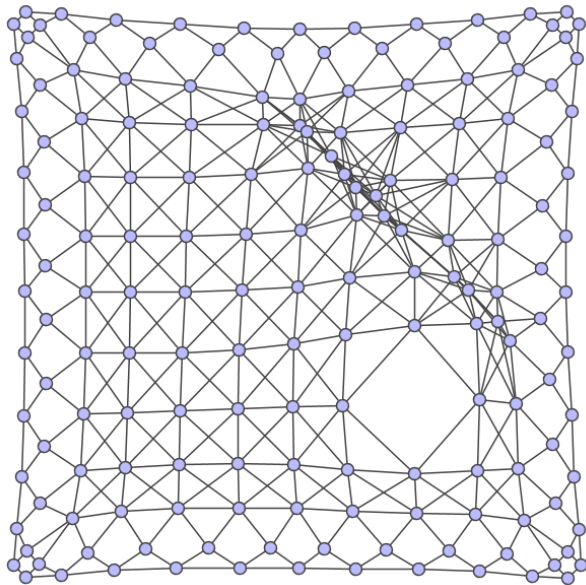
- ▶ Hellyness
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



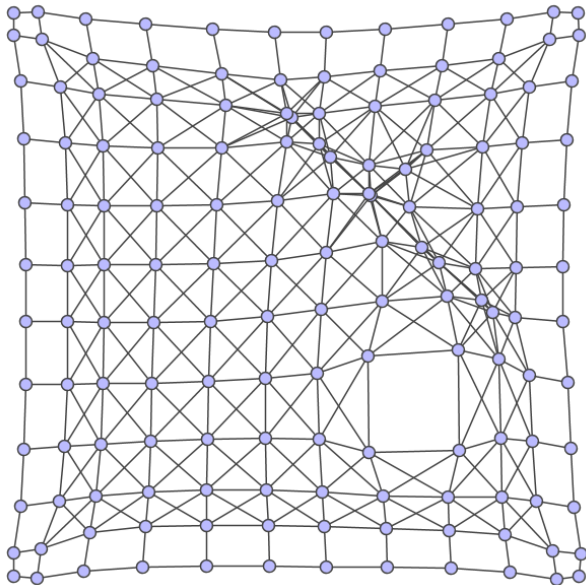
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



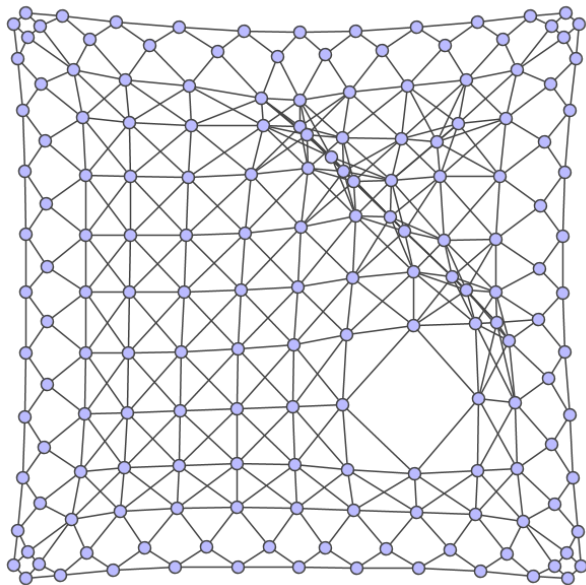
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



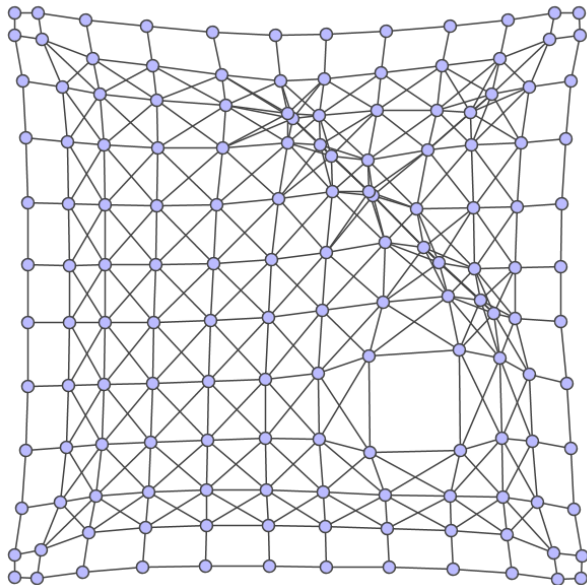
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



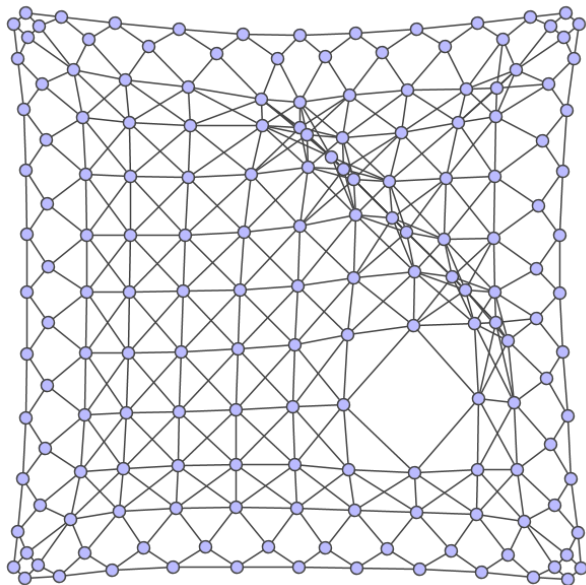
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



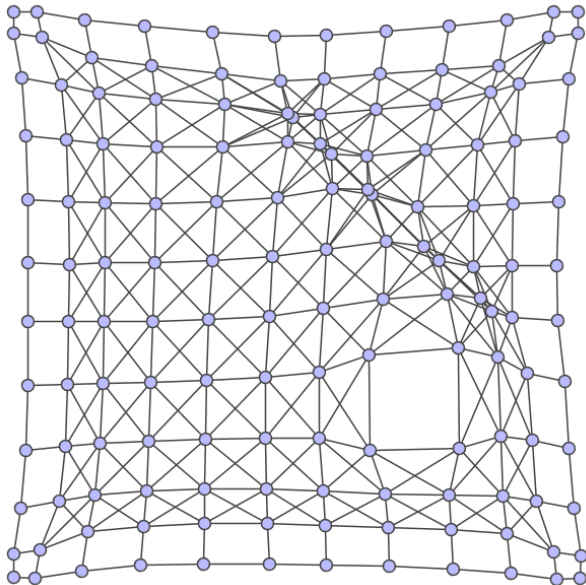
- ▶ Hellyness
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



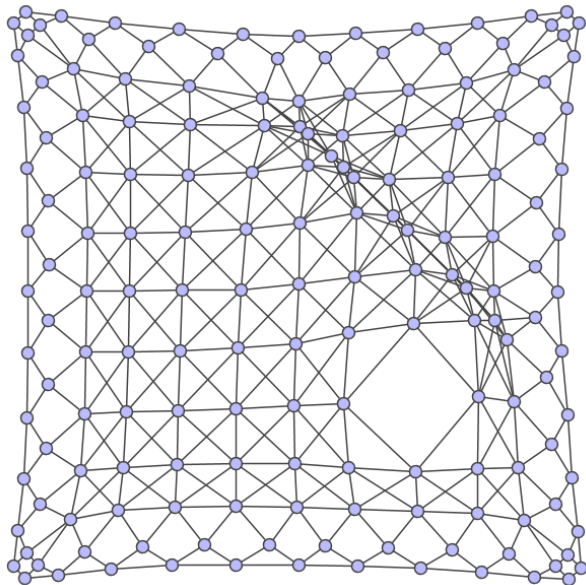
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



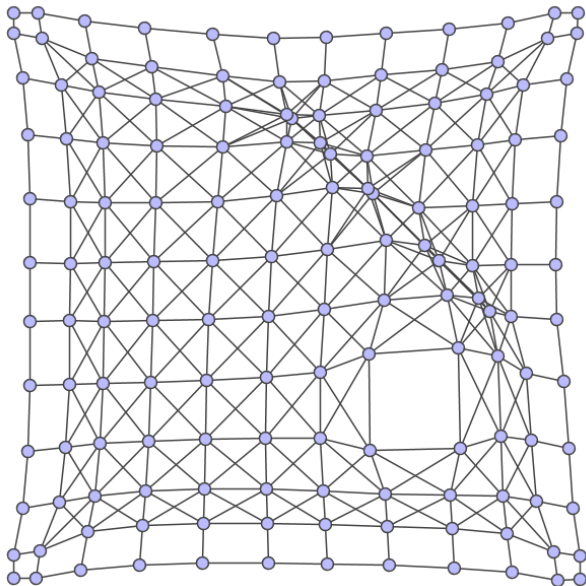
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



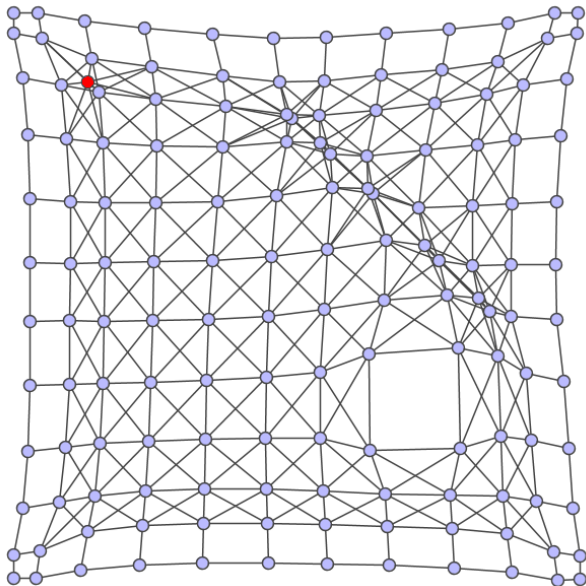
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



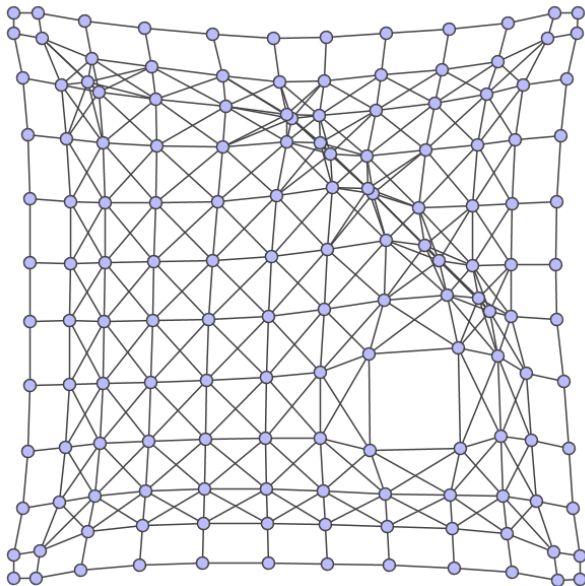
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



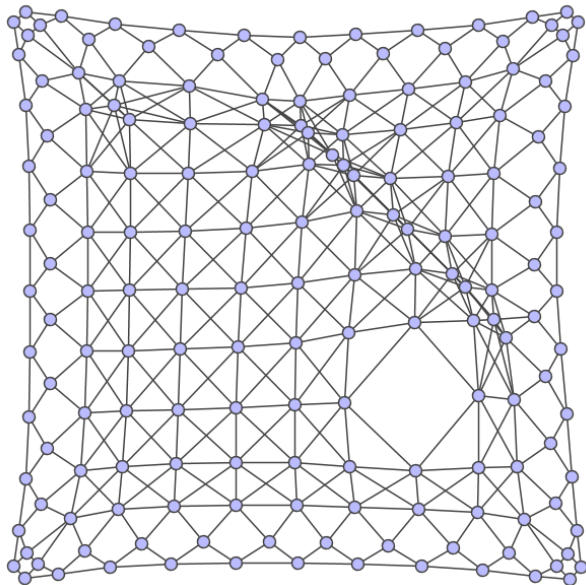
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



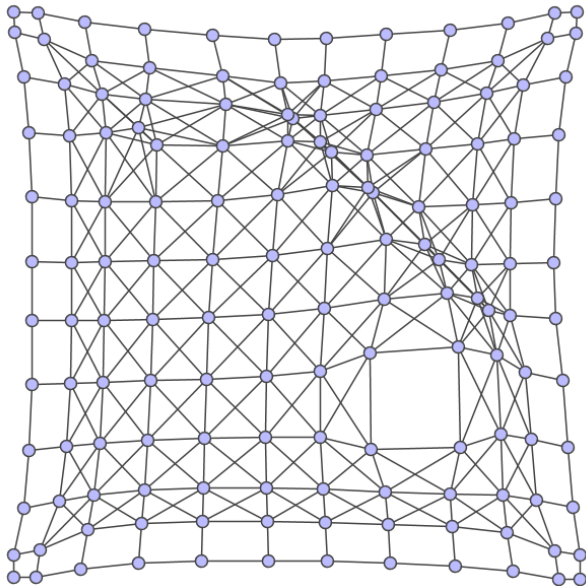
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



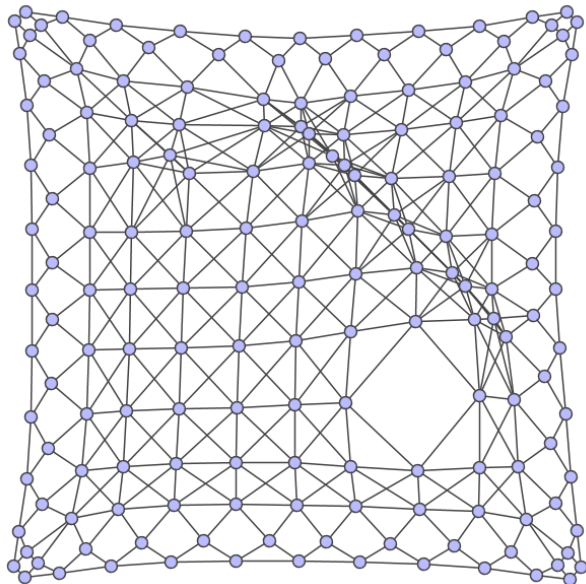
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



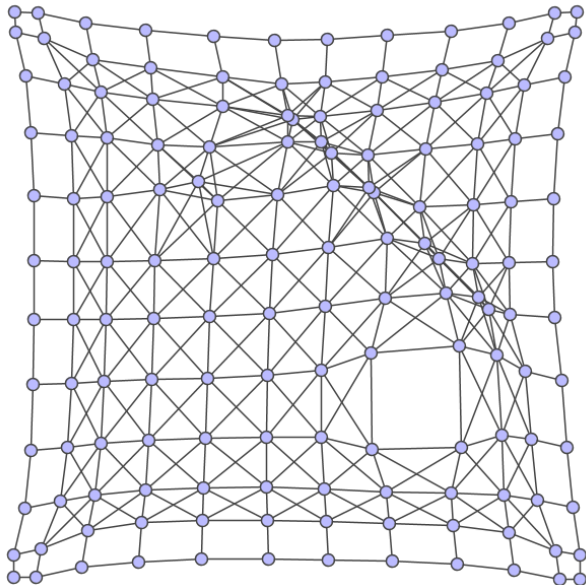
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



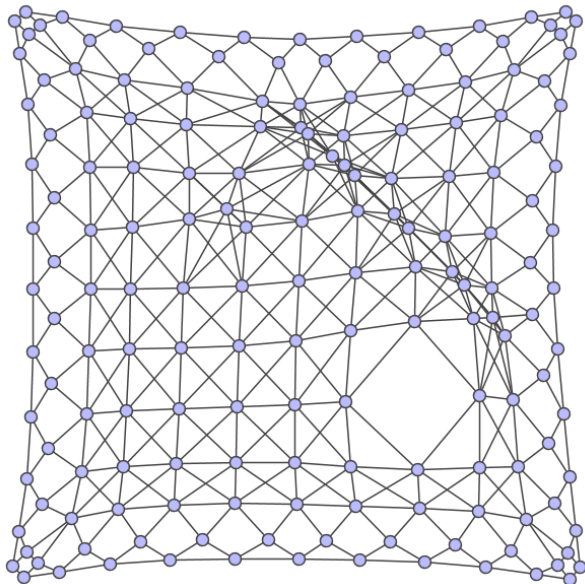
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



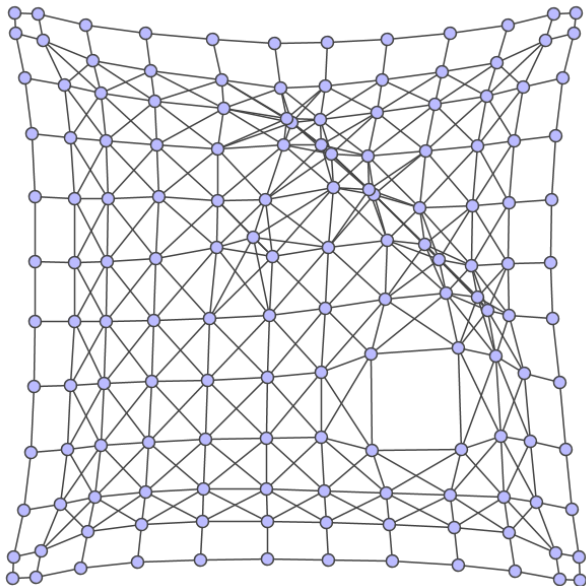
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



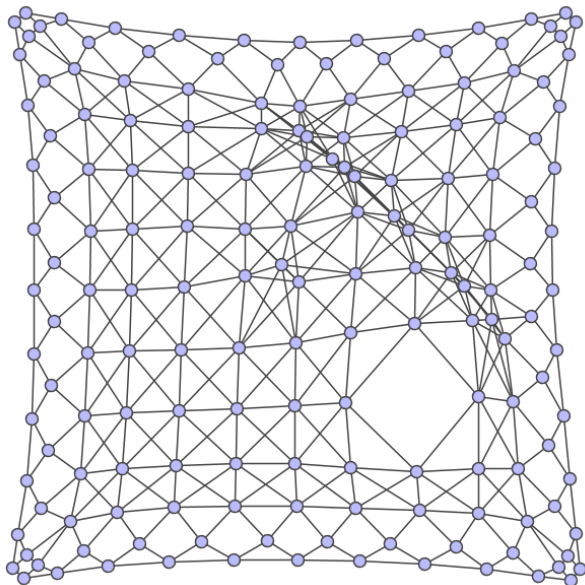
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



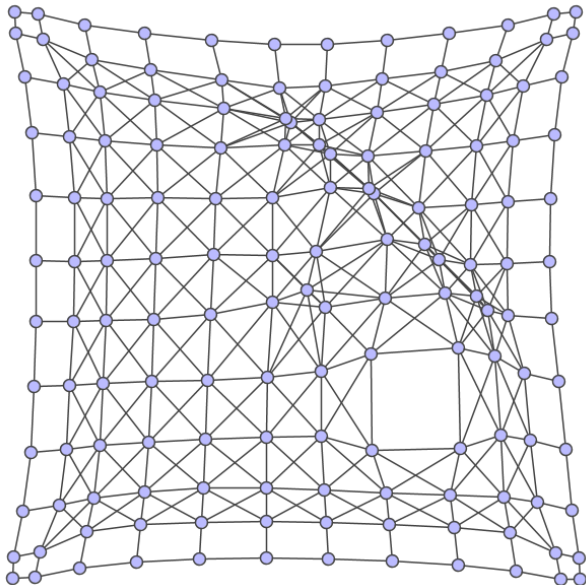
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- ▶ Local Cutpoints

Clique Behavior



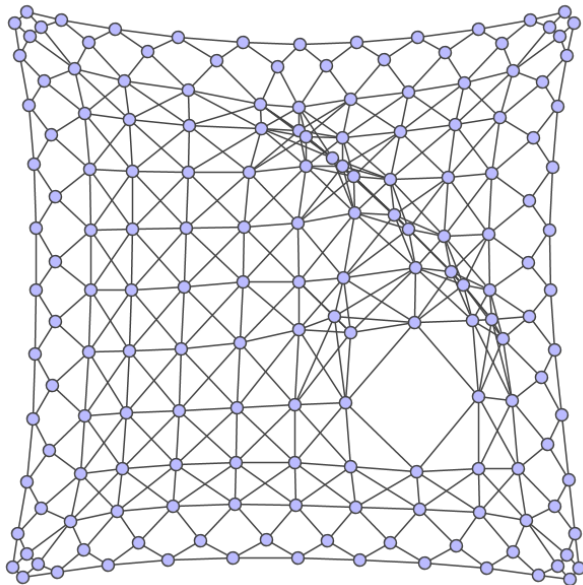
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints

Clique Behavior



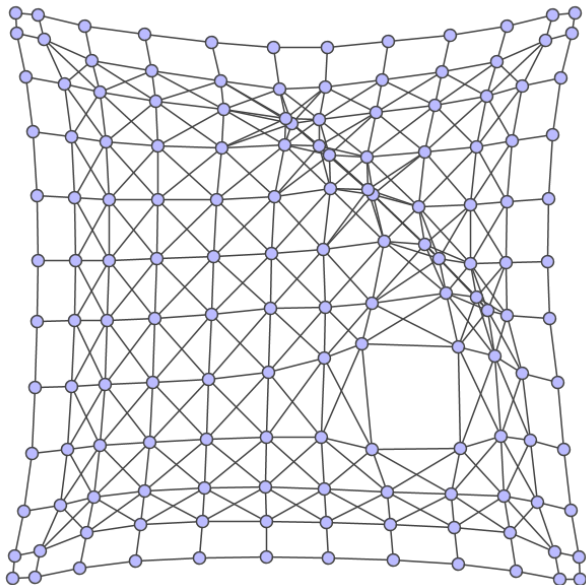
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- ▶ Local Cutpoints

Clique Behavior



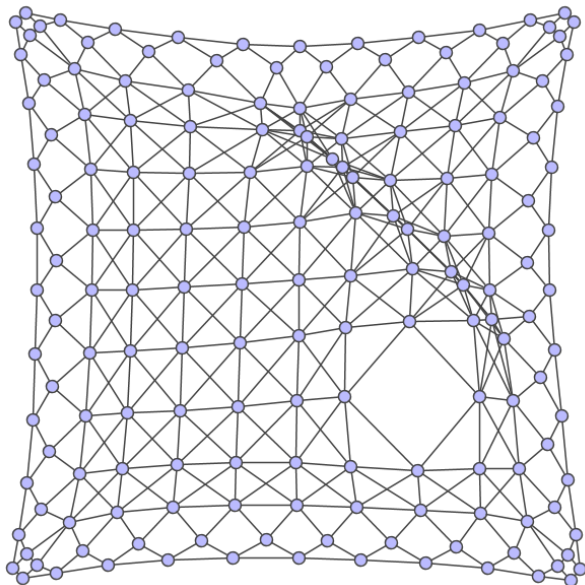
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- ▶ Local Cutpoints

Clique Behavior



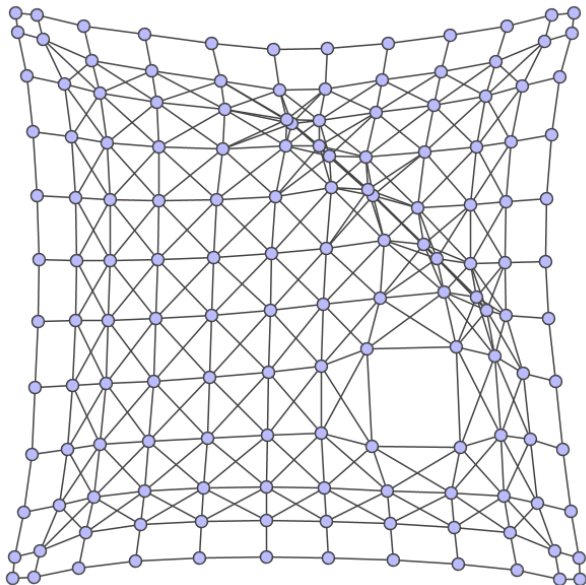
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- ▶ Local Cutpoints

Clique Behavior



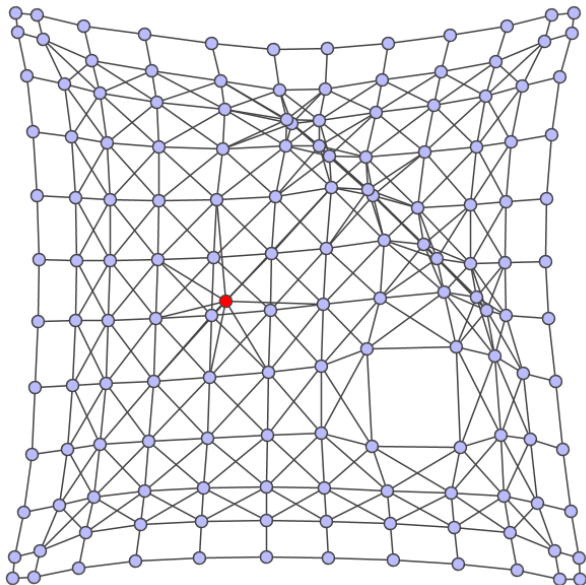
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- ▶ Local Cutpoints

Clique Behavior



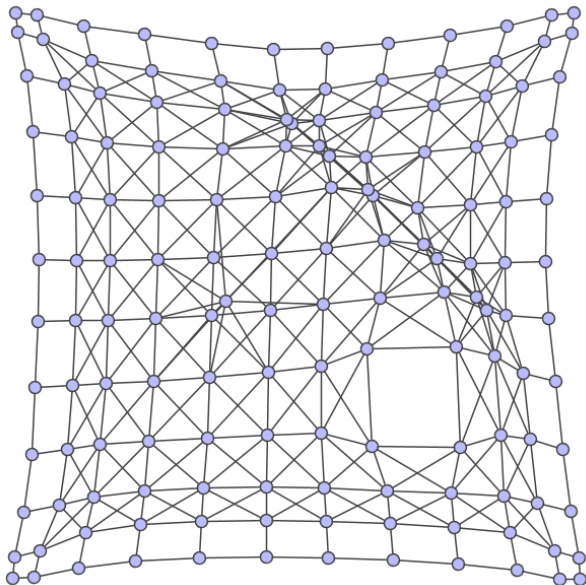
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- ▶ Local Cutpoints

Clique Behavior



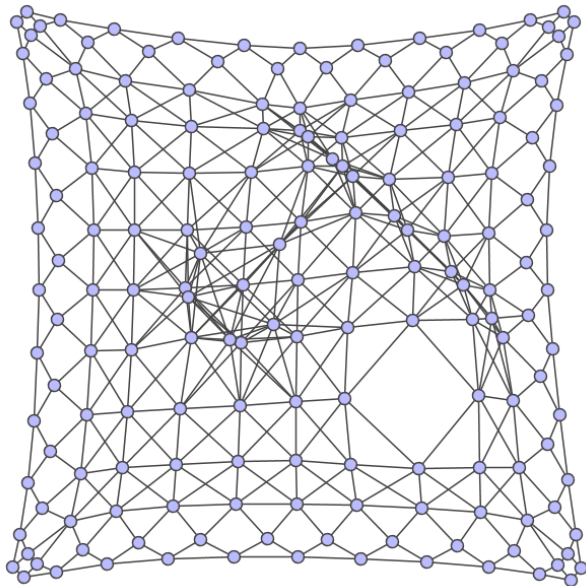
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- ▶ Local Cutpoints

Clique Behavior



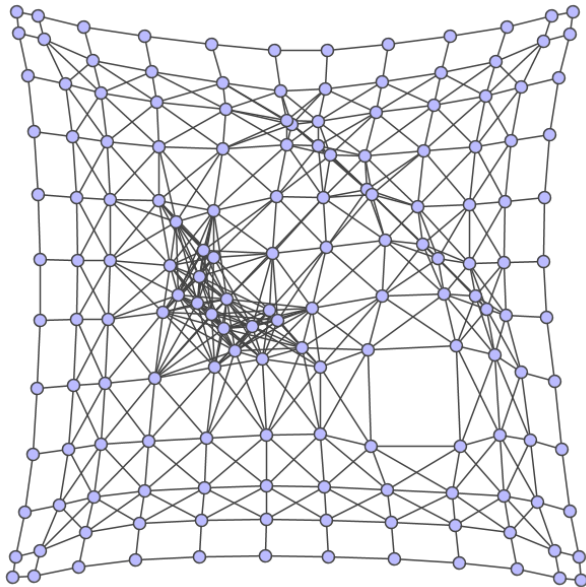
- ▶ Hellyness
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????

Clique Behavior



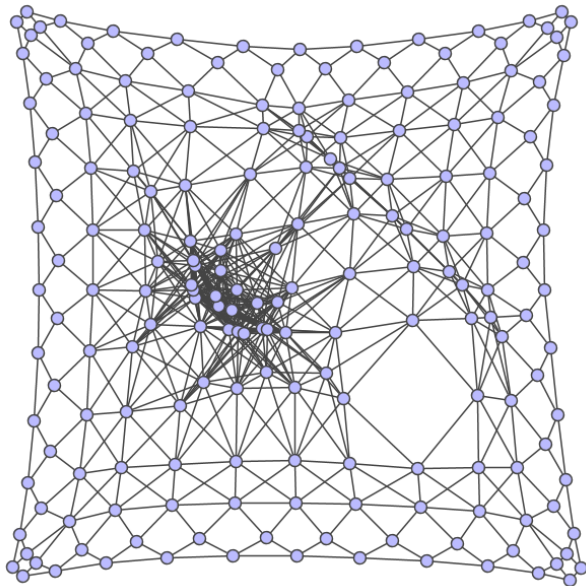
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- ▶ ????

Clique Behavior



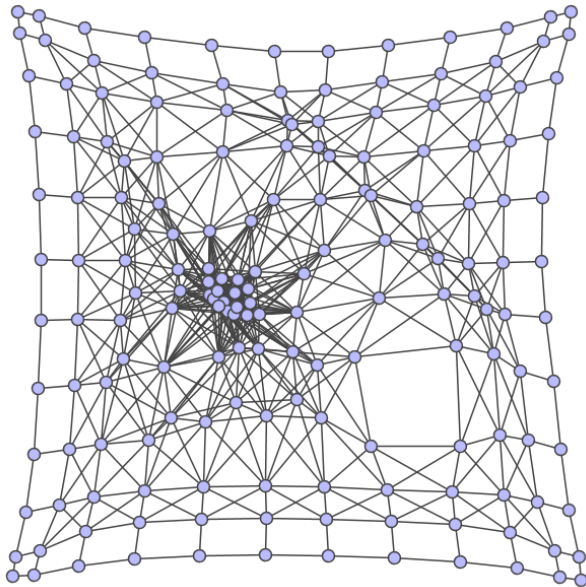
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- ▶ ????

Clique Behavior



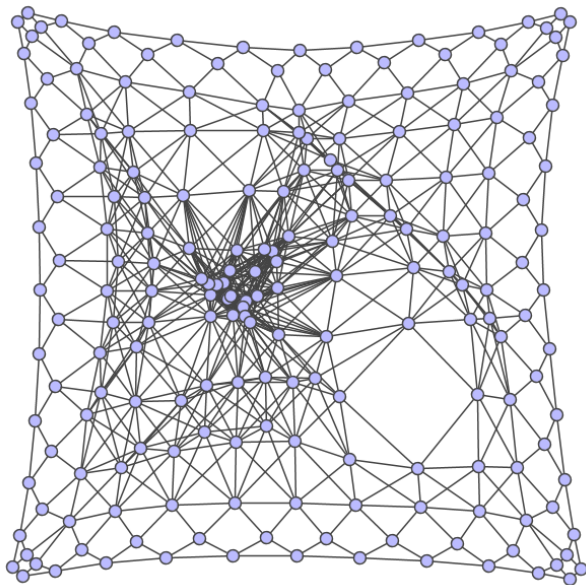
- ▶ Hellyness
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- ▶ Local Cutpoints
- ▶ ????

Clique Behavior



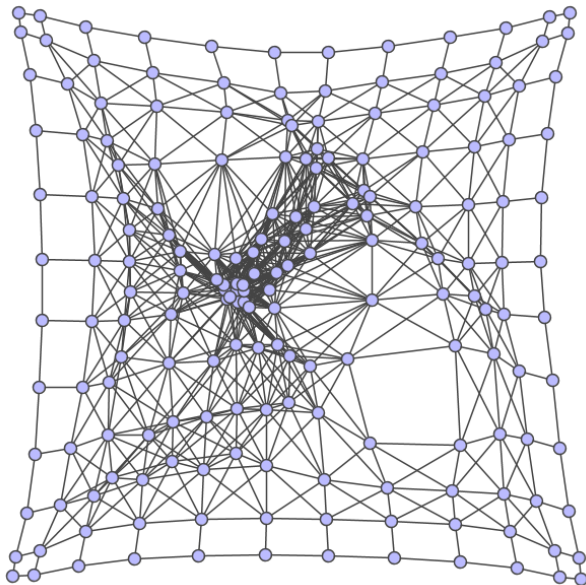
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- ▶ ????

Clique Behavior



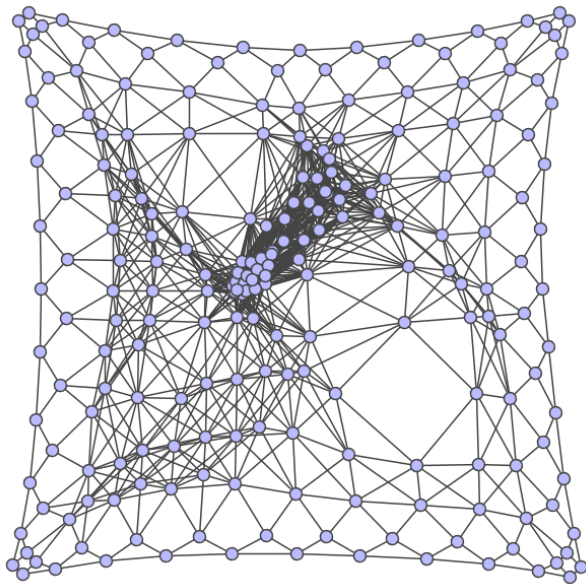
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Clique Behavior



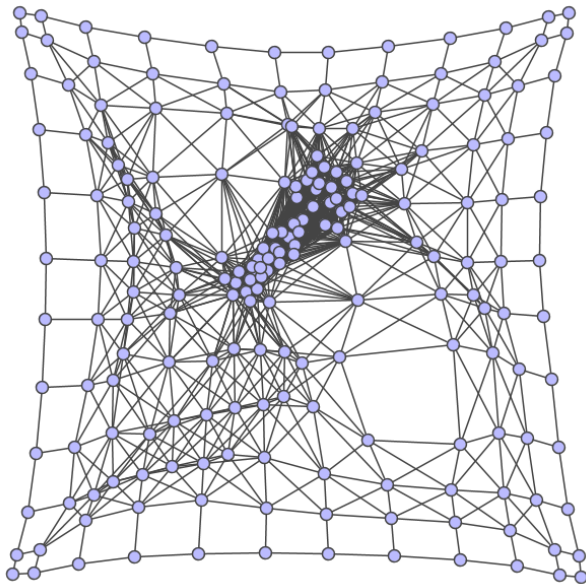
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- ▶ ????

Clique Behavior



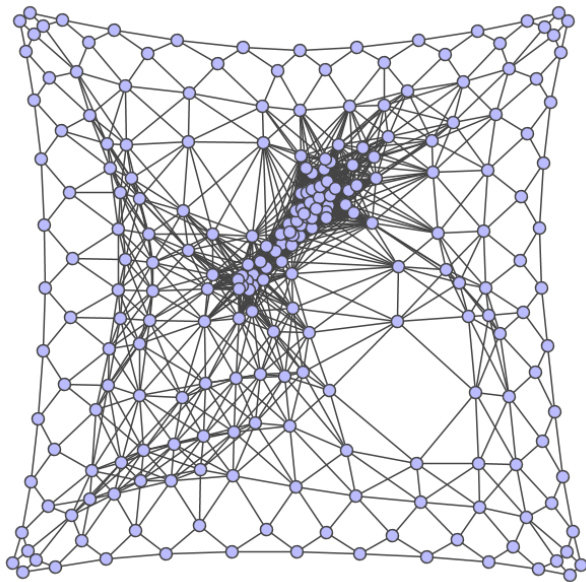
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- ▶ ????

Clique Behavior



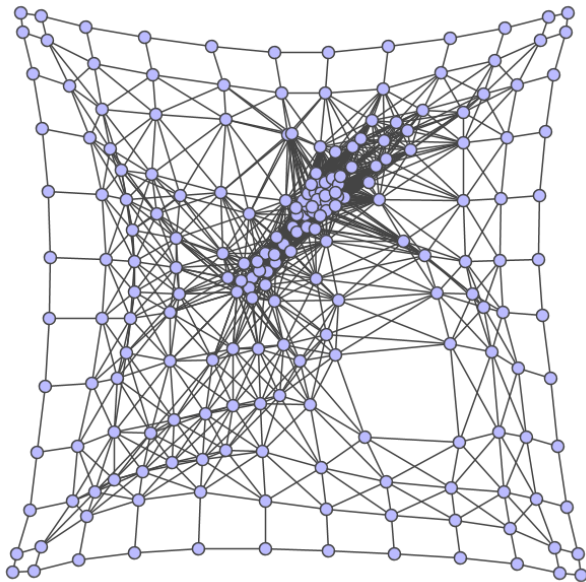
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- ▶ Local Cutpoints
- ▶ ????

Clique Behavior



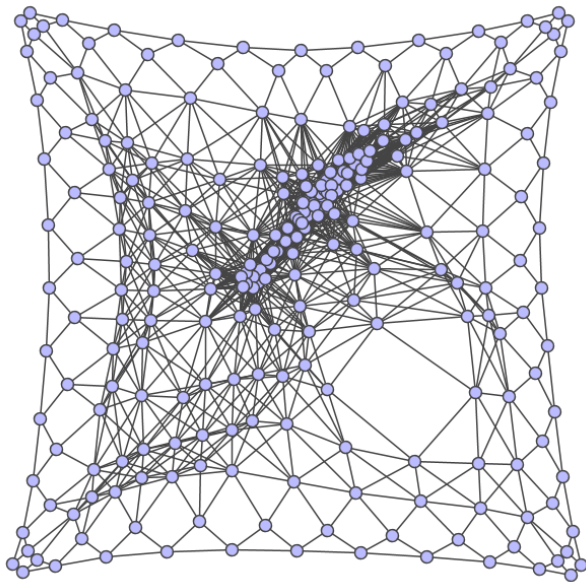
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- ▶ Local Cutpoints
- ▶ ????

Clique Behavior



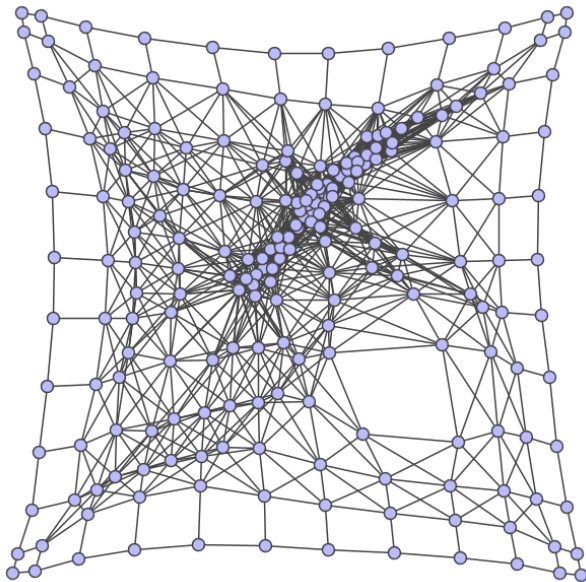
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- ▶ Local Cutpoints
- ▶ ????

Clique Behavior



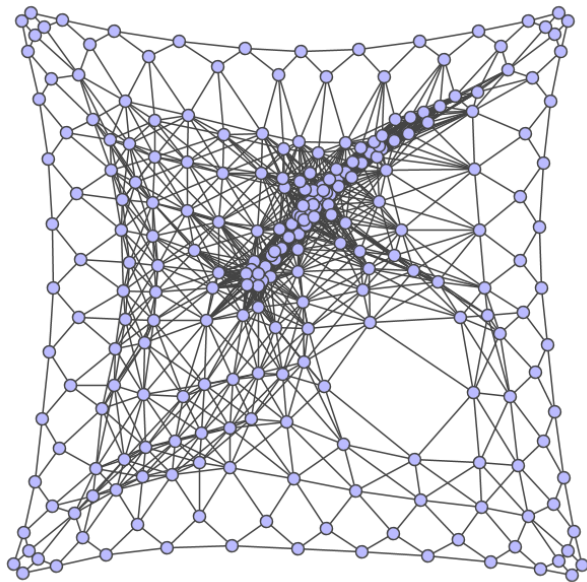
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- ▶ Local Cutpoints
- ▶ ????

Clique Behavior



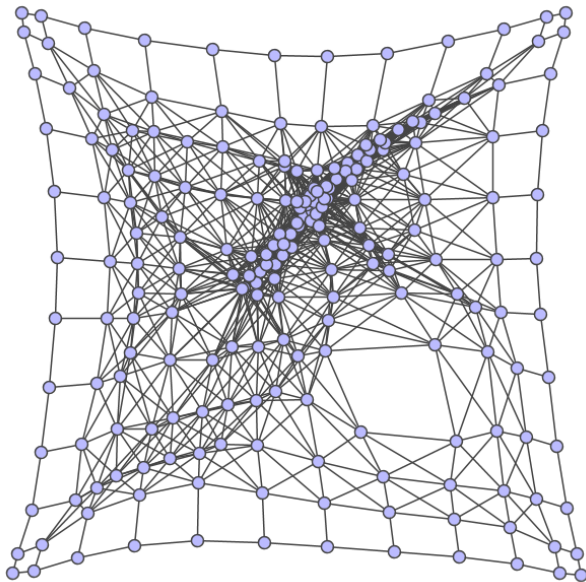
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- ▶ Local Cutpoints
- ▶ ????

Clique Behavior



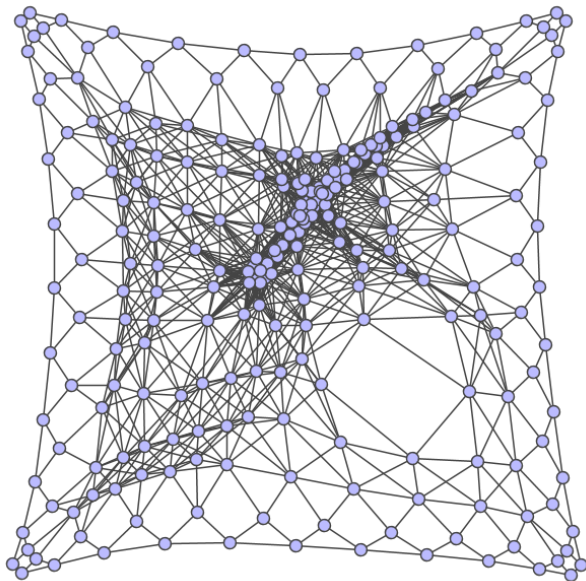
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- ▶ Local Cutpoints
- ▶ ????

Clique Behavior



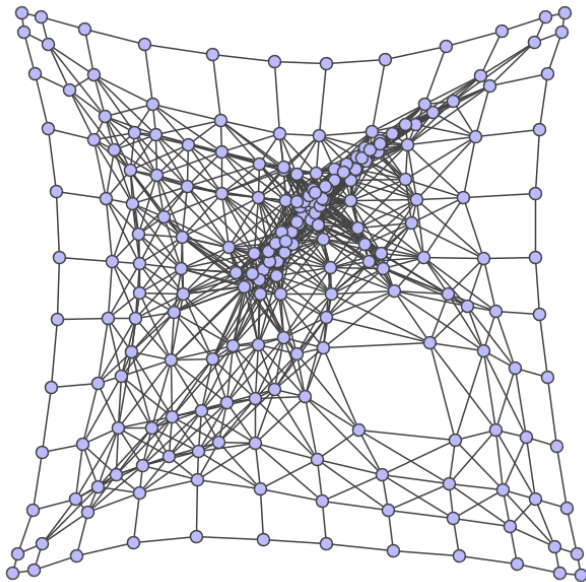
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- ▶ ????

Clique Behavior



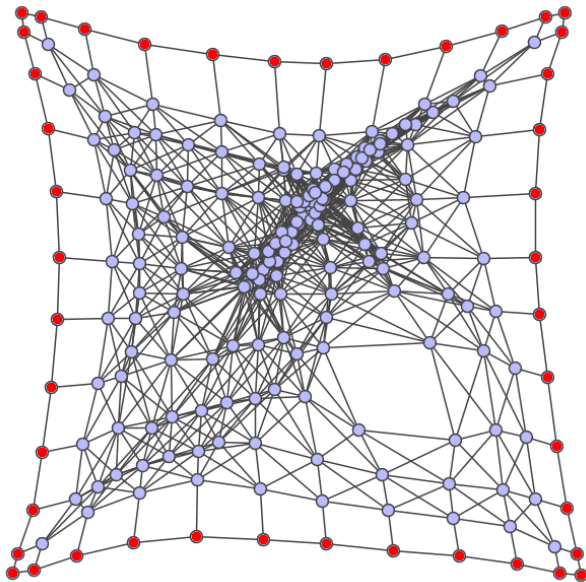
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Clique Behavior



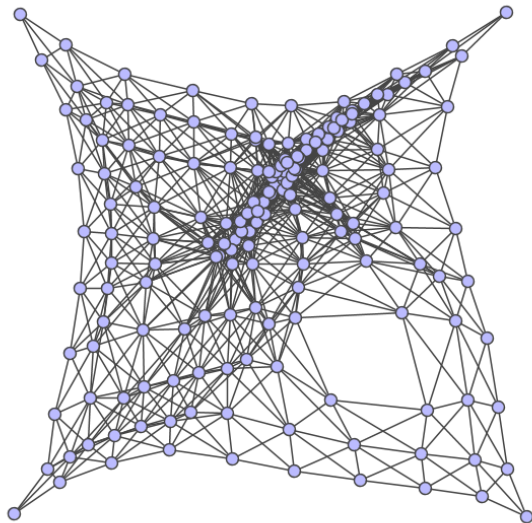
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- ▶ ????

Clique Behavior



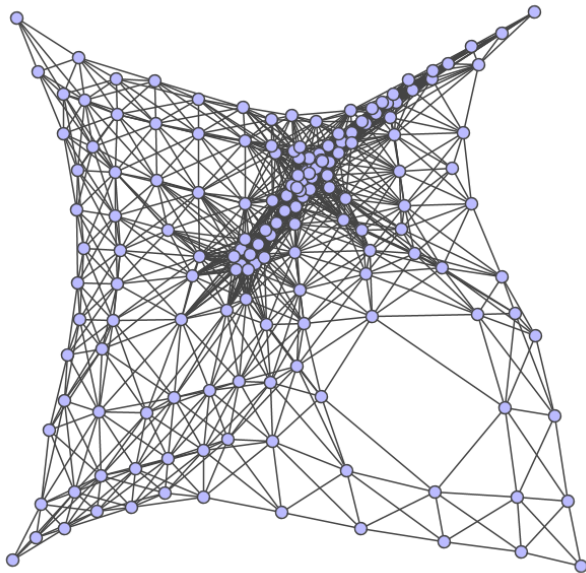
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- ▶ ????

Clique Behavior



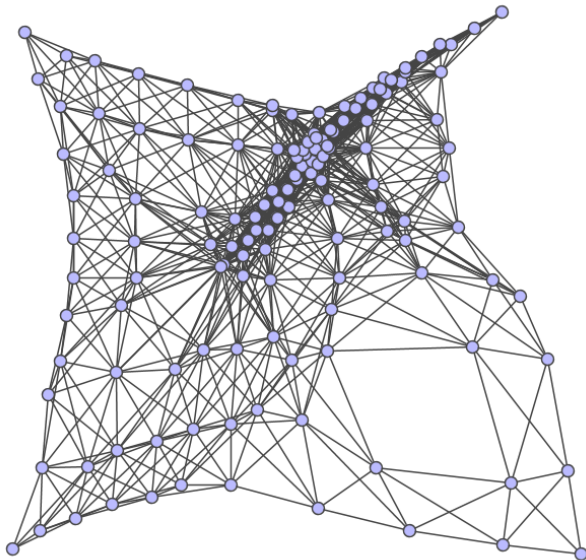
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



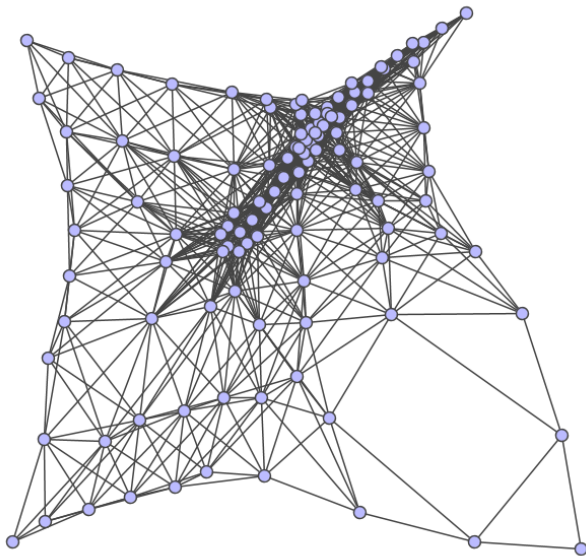
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- ▶ Fundamental Group
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- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



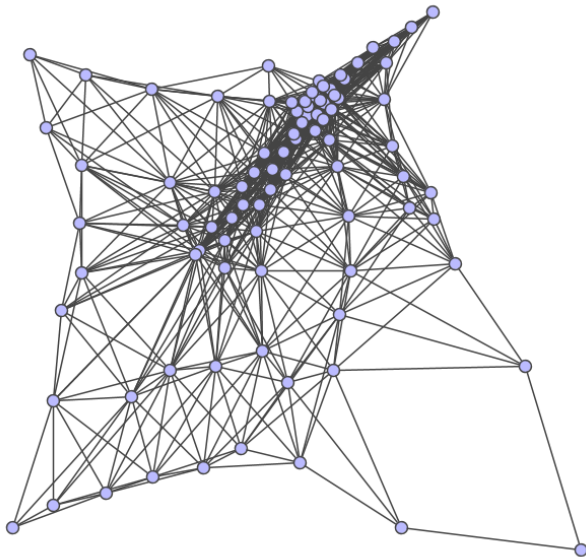
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



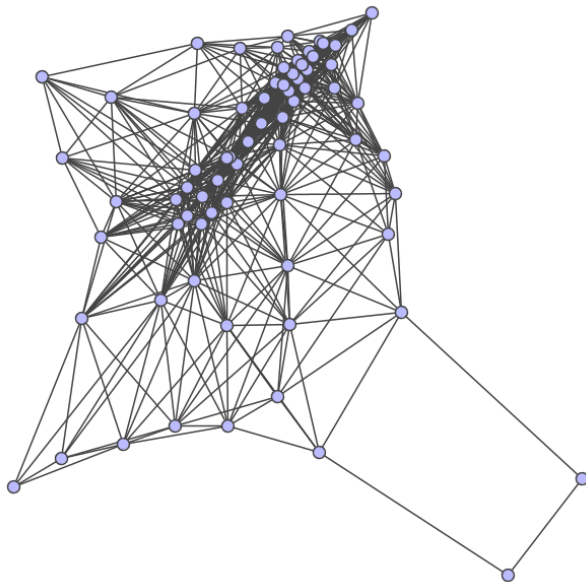
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



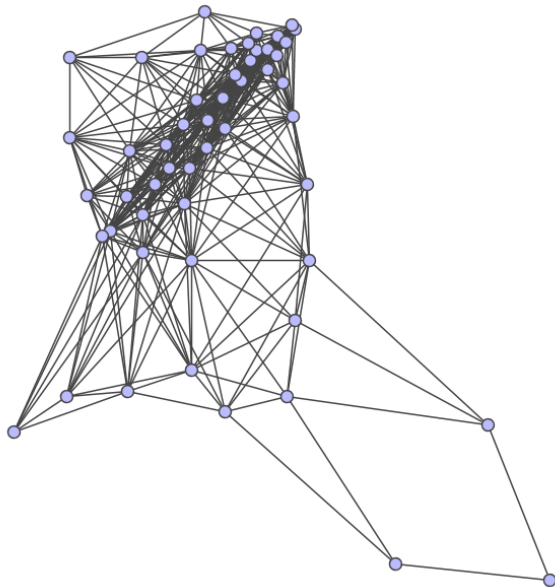
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



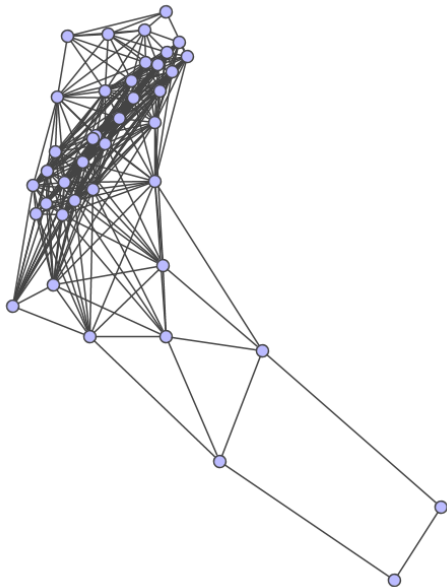
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- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



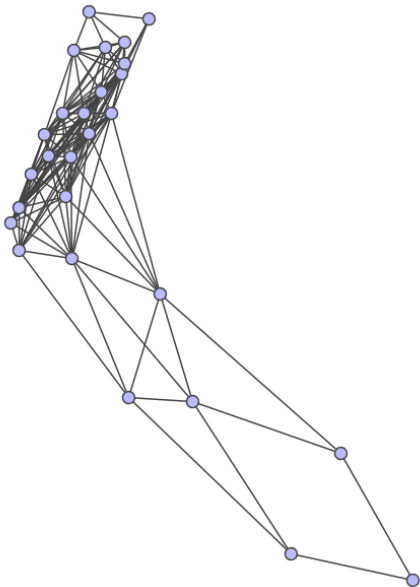
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- ▶ ????
- ▶ Dismantlings

Clique Behavior



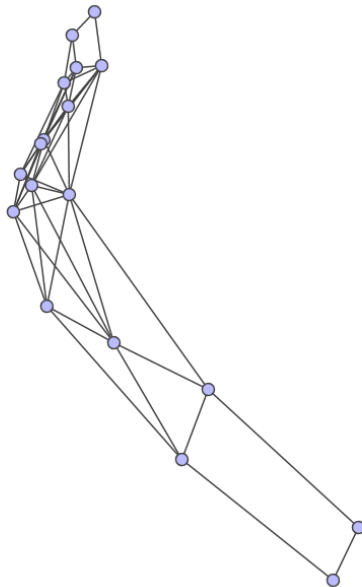
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- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



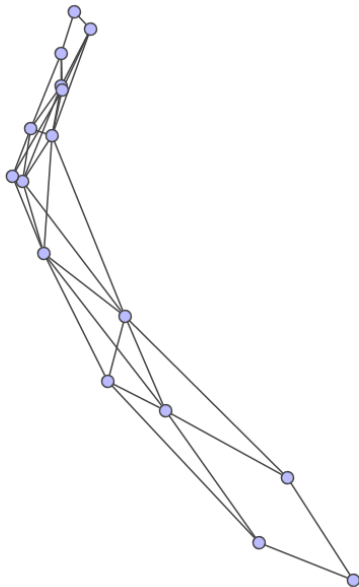
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- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



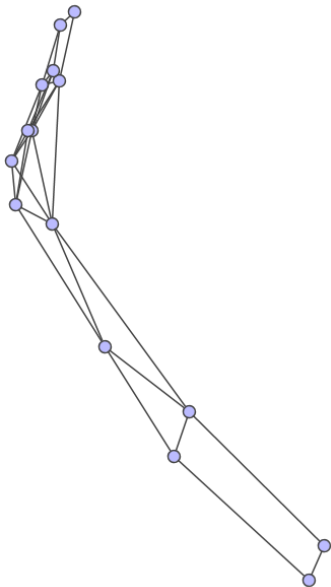
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- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



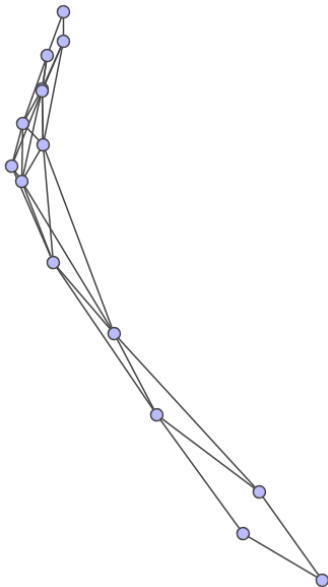
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



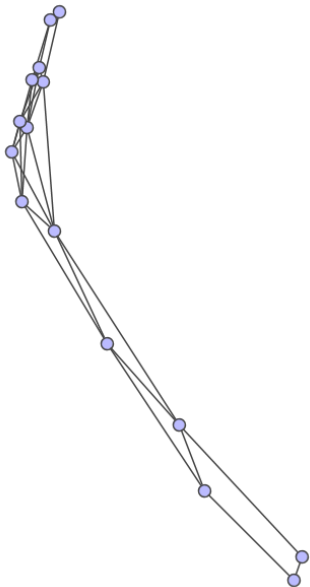
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



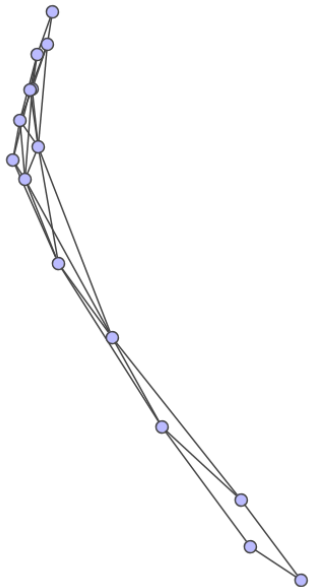
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



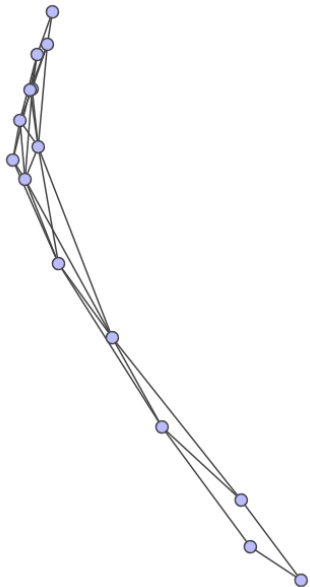
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



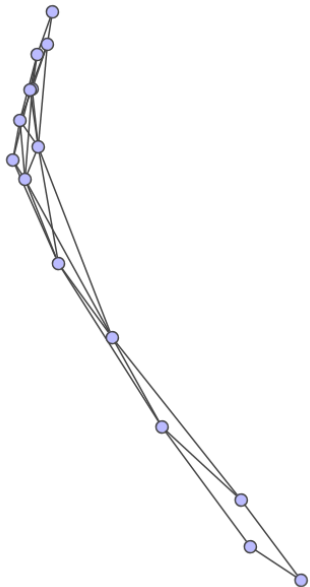
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings

Clique Behavior



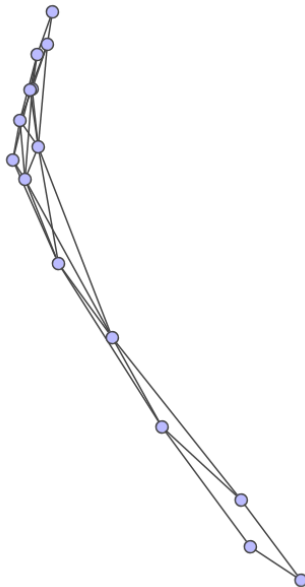
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings
- ▶ Retractions

Clique Behavior



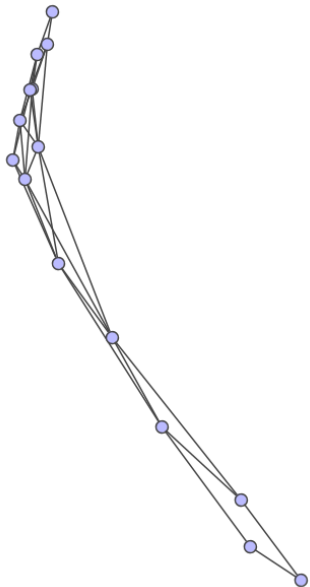
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings
- ▶ Retractions
- ▶ Covering Maps

Clique Behavior



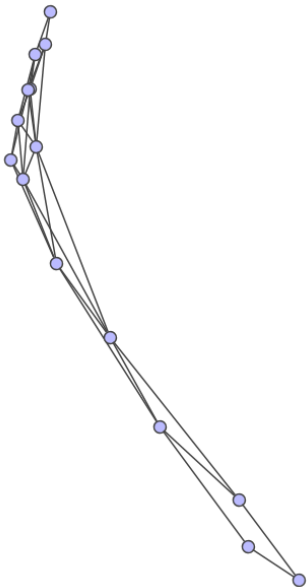
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings
- ▶ Retractions
- ▶ Covering Maps
- ▶ Expansivity

Clique Behavior



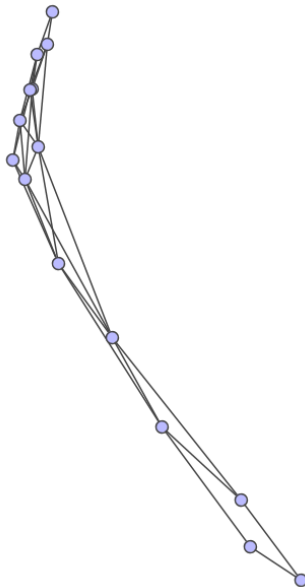
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings
- ▶ Retractions
- ▶ Covering Maps
- ▶ Expansivity
- ▶ Graph Fiber Bundles

Clique Behavior



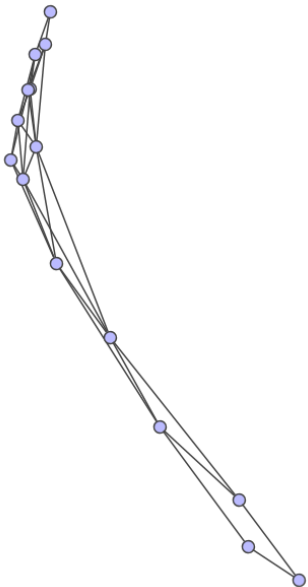
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings
- ▶ Retractions
- ▶ Covering Maps
- ▶ Expansivity
- ▶ Graph Fiber Bundles
- ▶ Equivariant Morphisms

Clique Behavior



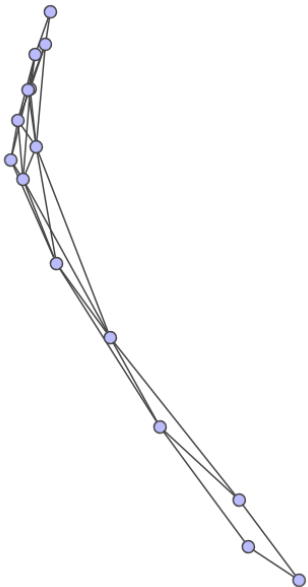
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings
- ▶ Retractions
- ▶ Covering Maps
- ▶ Expansivity
- ▶ Graph Fiber Bundles
- ▶ Equivariant Morphisms
- ▶ Categorical Products

Clique Behavior



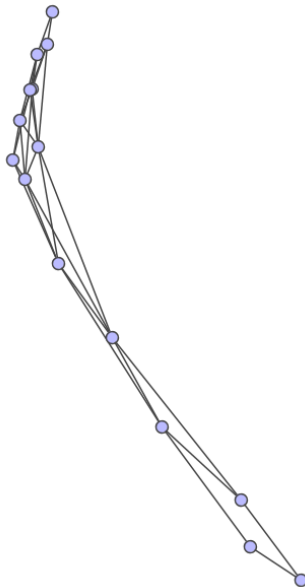
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- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings
- ▶ Retractions
- ▶ Covering Maps
- ▶ Expansivity
- ▶ Graph Fiber Bundles
- ▶ Equivariant Morphisms
- ▶ Categorical Products
- ▶ Discrete Homotpy

Clique Behavior



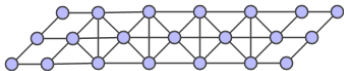
- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings
- ▶ Retractions
- ▶ Covering Maps
- ▶ Expansivity
- ▶ Graph Fiber Bundles
- ▶ Equivariant Morphisms
- ▶ Categorical Products
- ▶ Discrete Homotpy
- ▶ Unbounded Morphisms

Clique Behavior

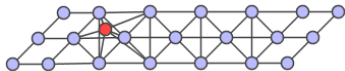


- ▶ Hellyness
- ▶ Fundamental Group
- ▶ Clockwork Graphs
- ▶ Local Cutpoints
- ▶ ????
- ▶ Dismantlings
- ▶ Retractions
- ▶ Covering Maps
- ▶ Expansivity
- ▶ Graph Fiber Bundles
- ▶ Equivariant Morphisms
- ▶ Categorical Products
- ▶ Discrete Homotpy
- ▶ Unbounded Morphisms
- ▶ Much, much more...

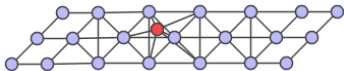
Gates and Circuits



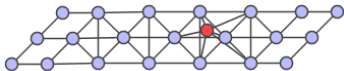
Gates and Circuits



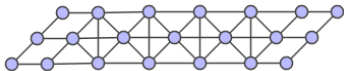
Gates and Circuits



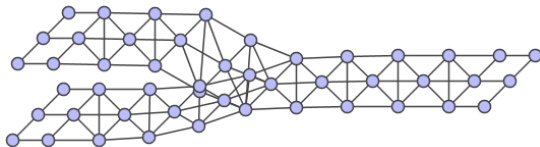
Gates and Circuits



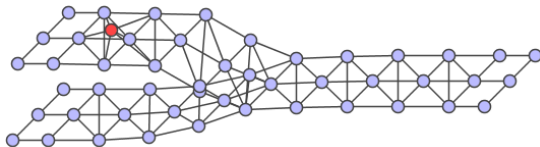
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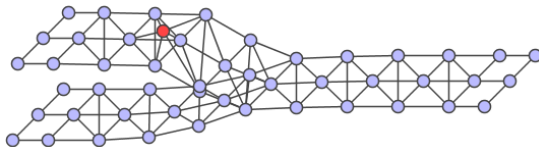
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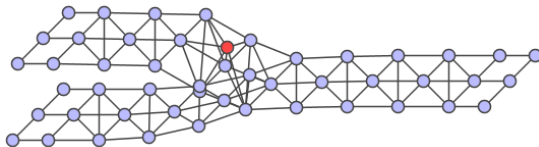
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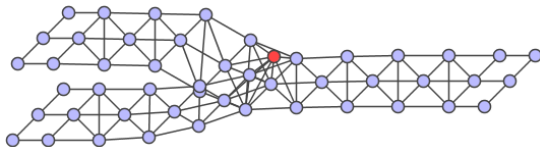
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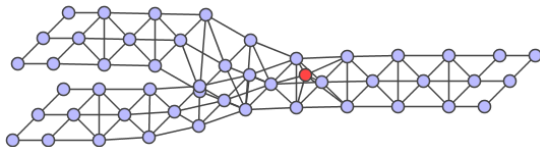
Gates and Circuits



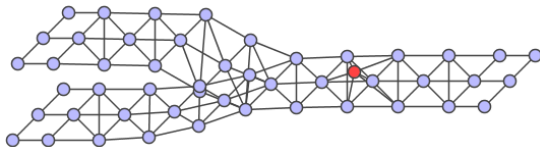
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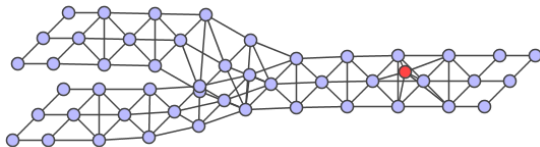
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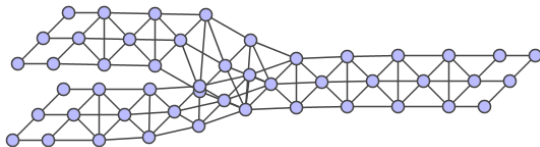
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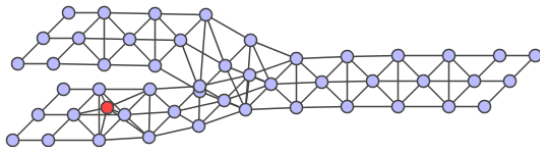
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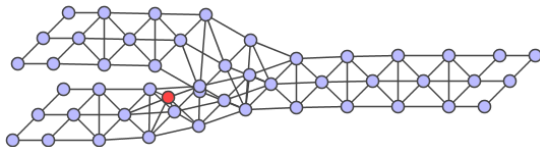
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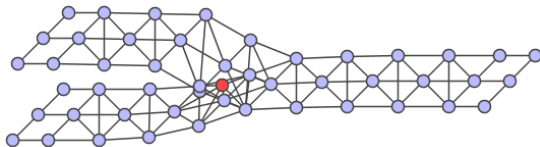
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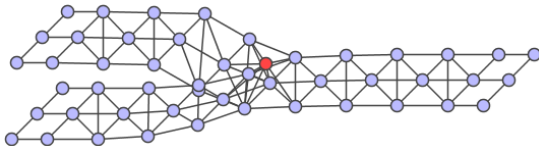
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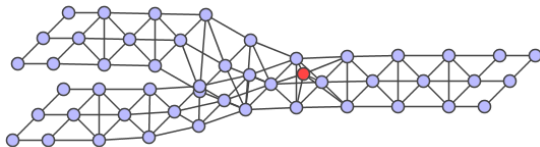
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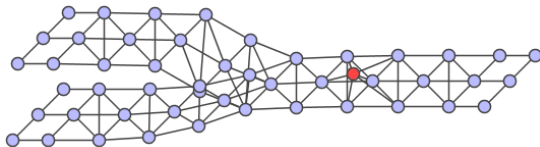
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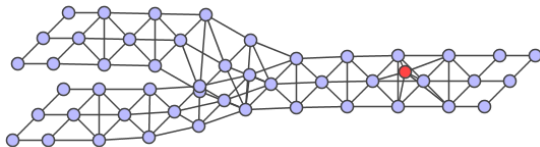
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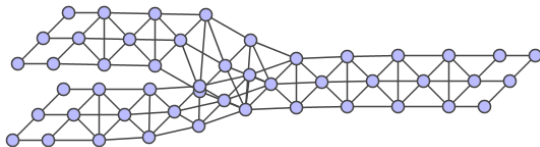
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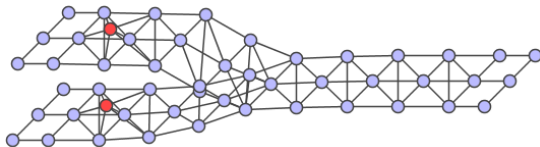
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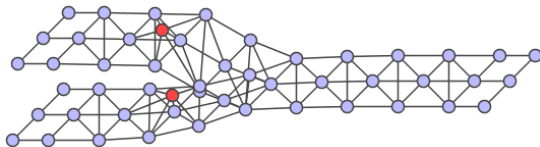
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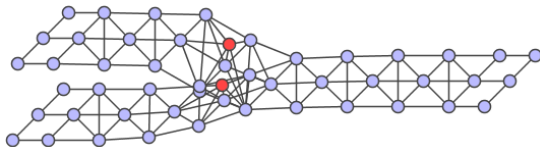
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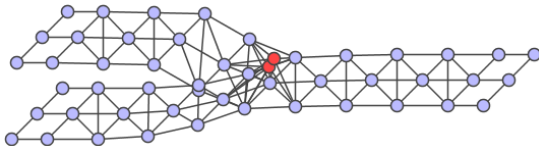
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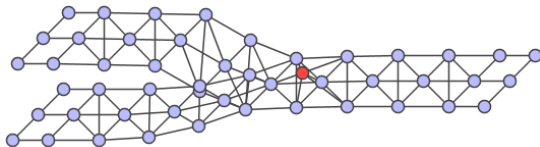
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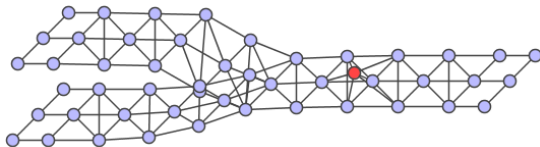
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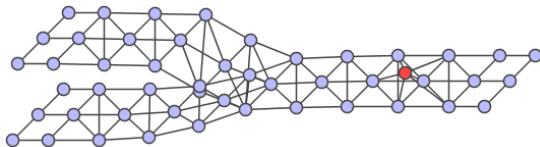
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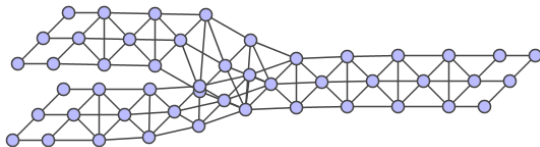
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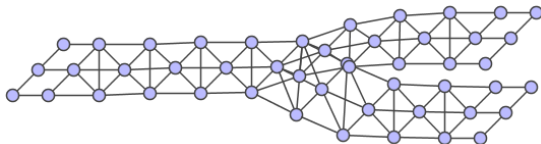
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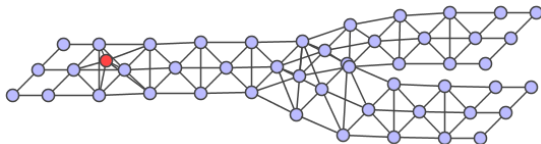
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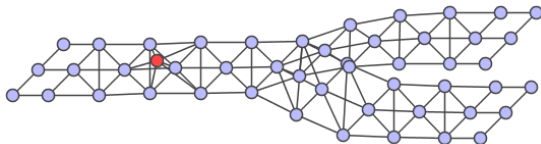
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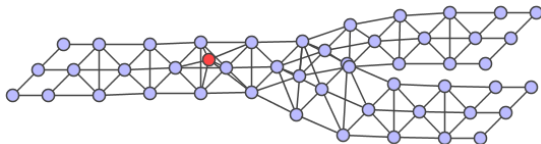
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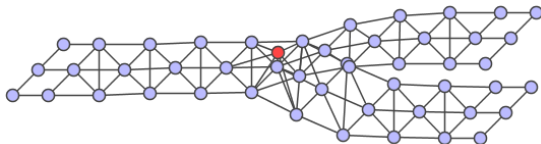
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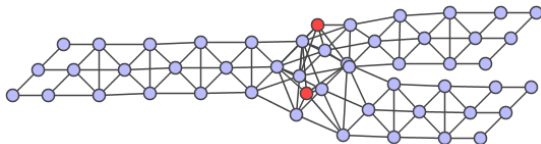
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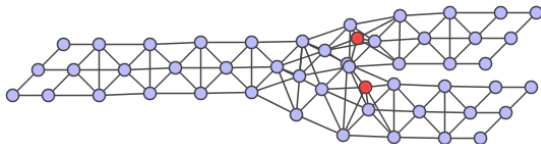
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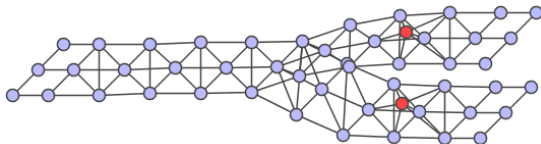
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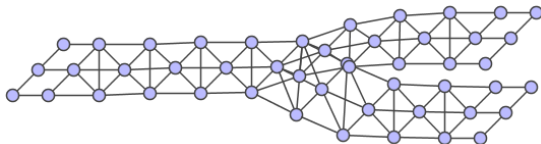
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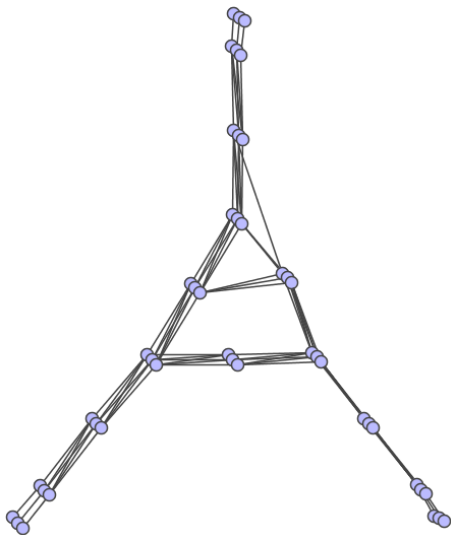
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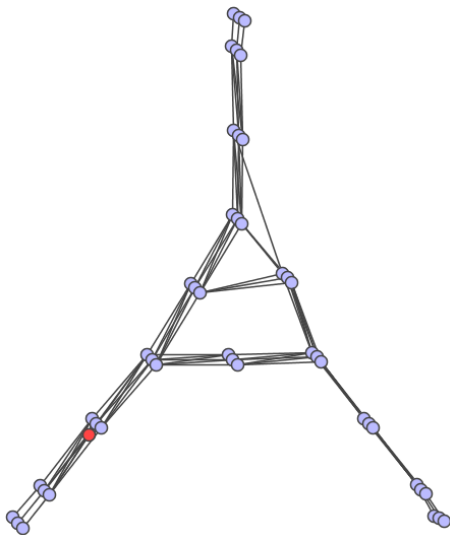
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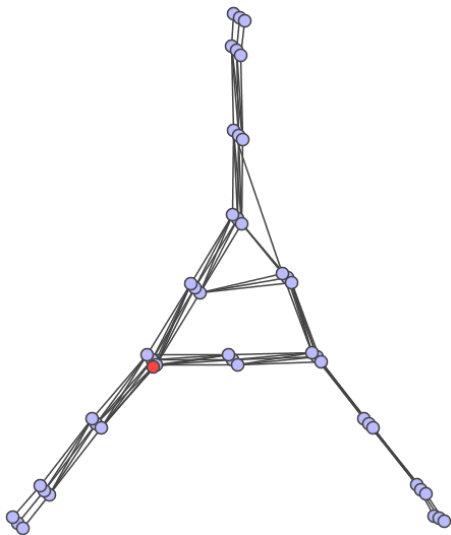
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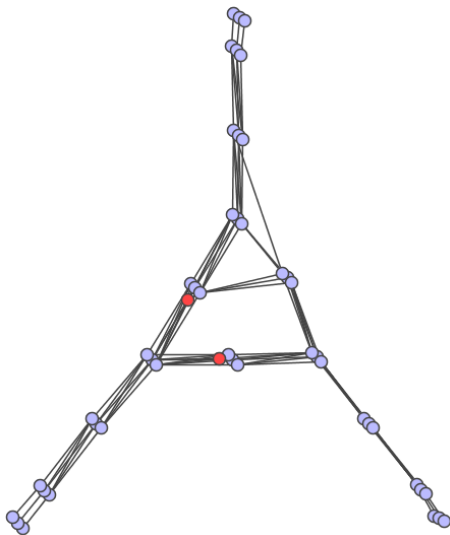
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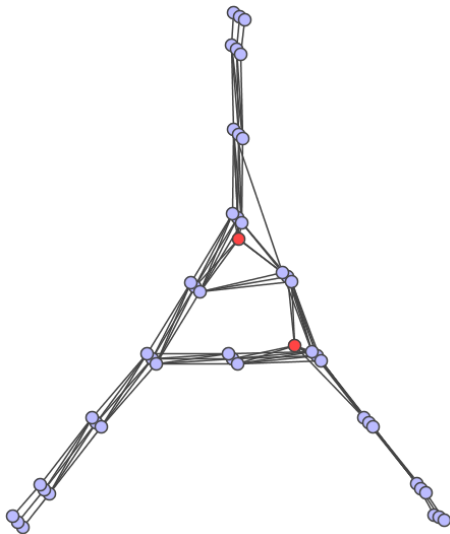
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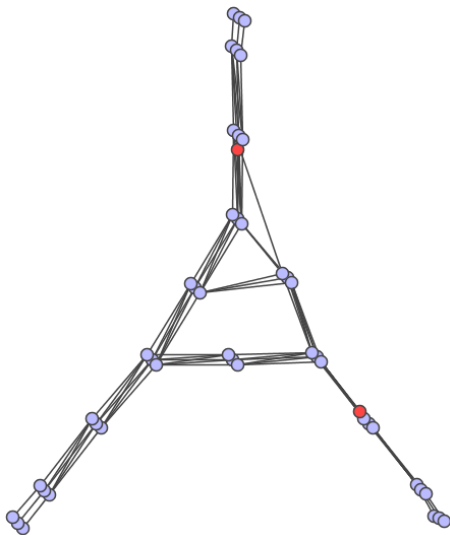
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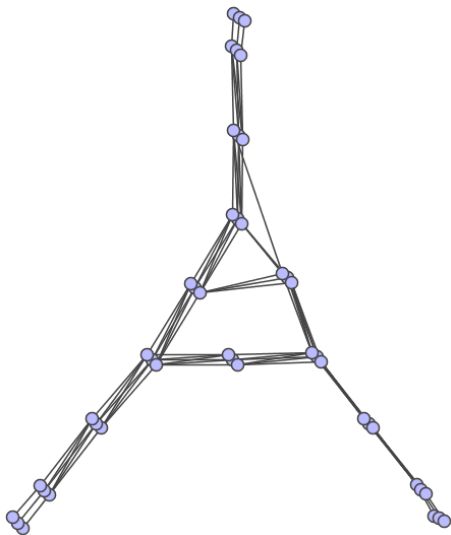
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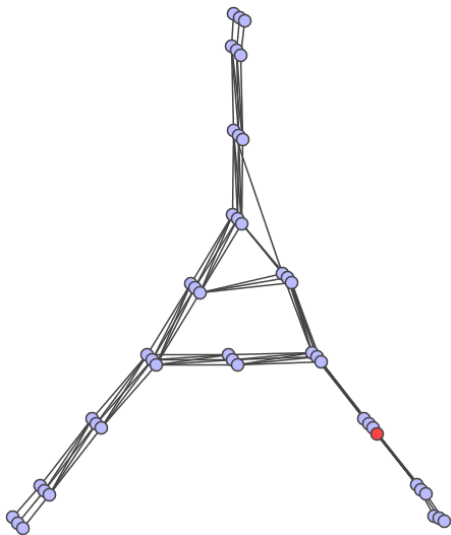
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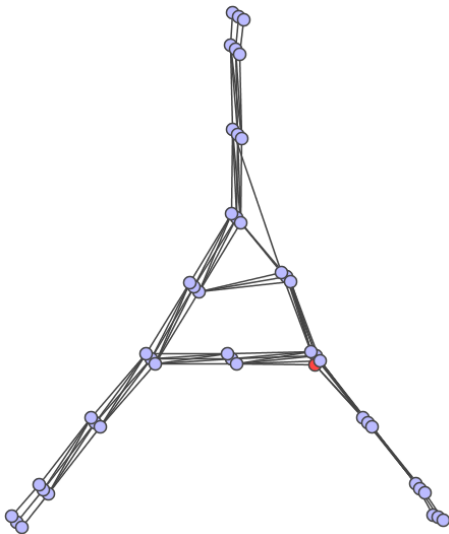
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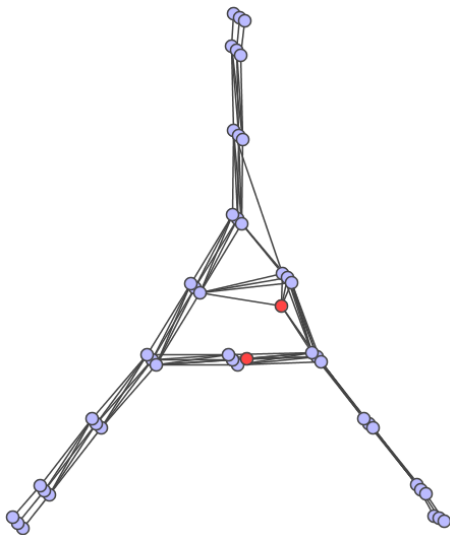
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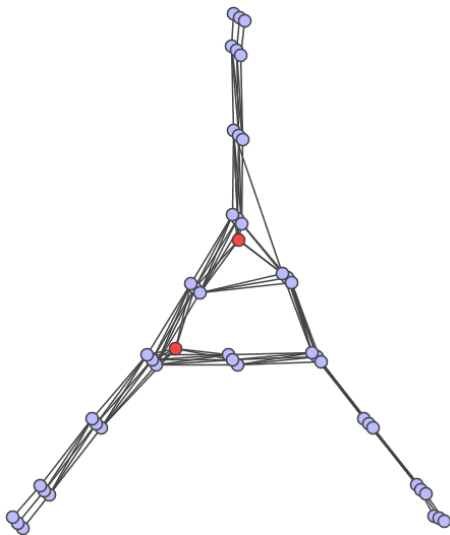
Gates and Circuits



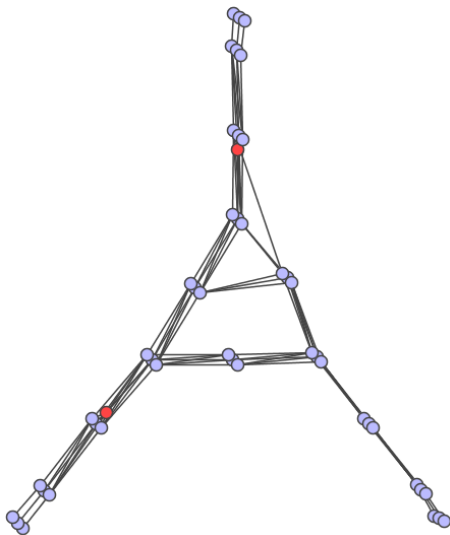
Gates and Circuits



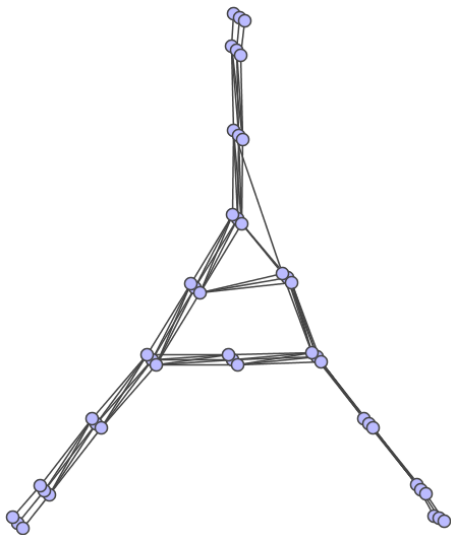
Gates and Circuits



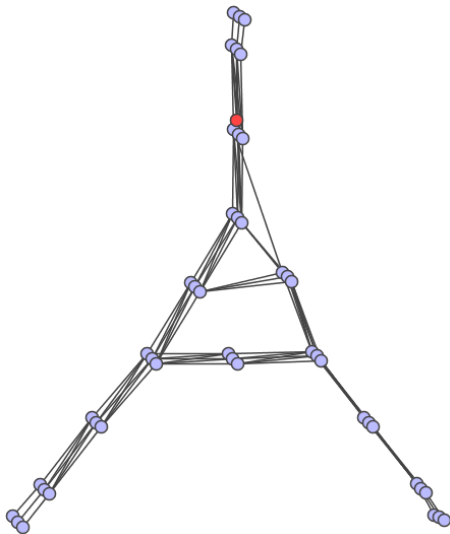
Gates and Circuits



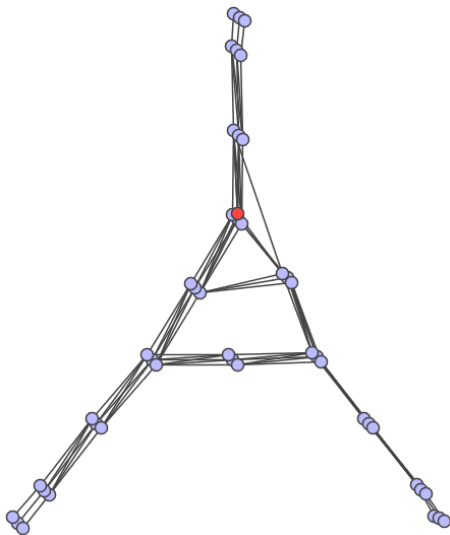
Gates and Circuits



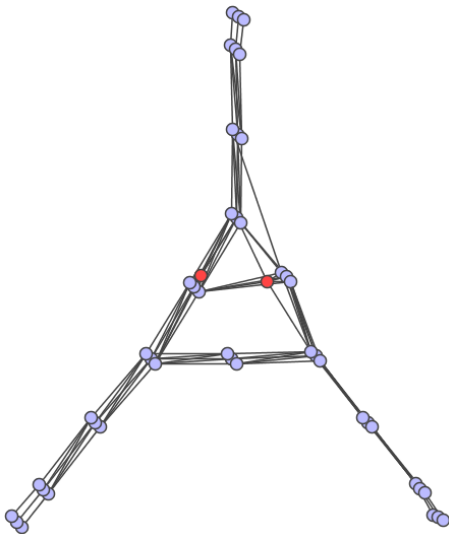
Gates and Circuits



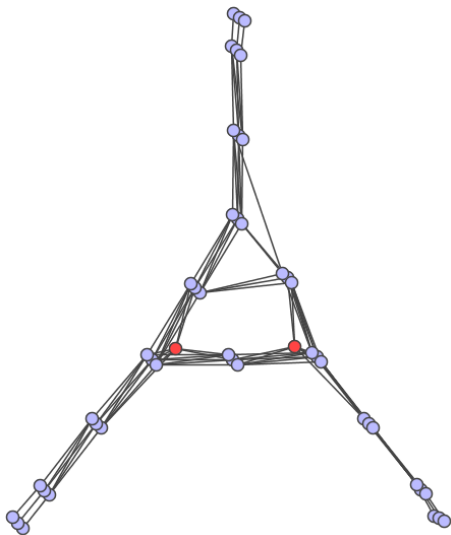
Gates and Circuits



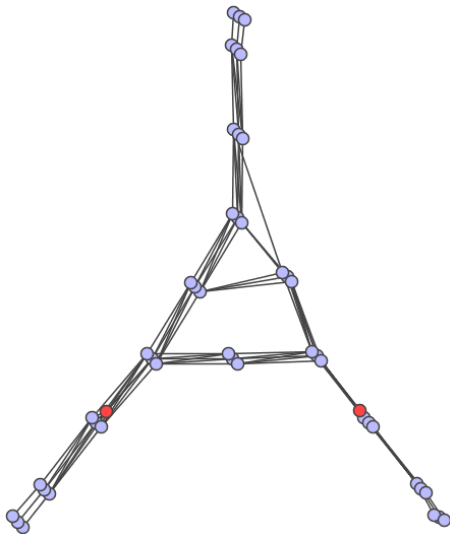
Gates and Circuits



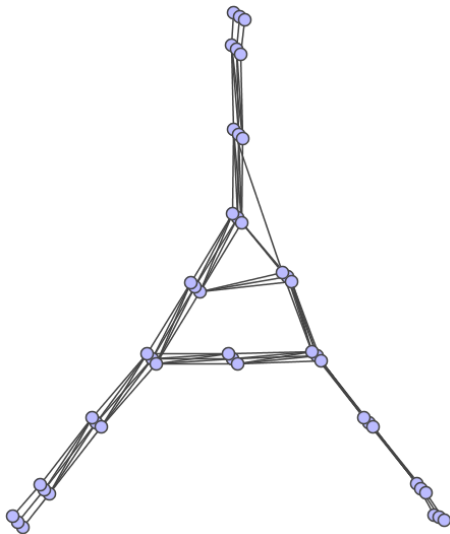
Gates and Circuits



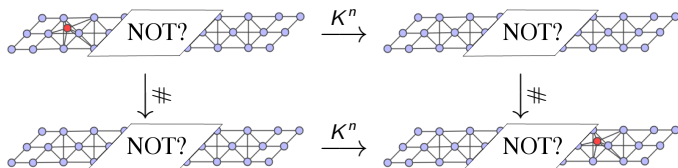
Gates and Circuits



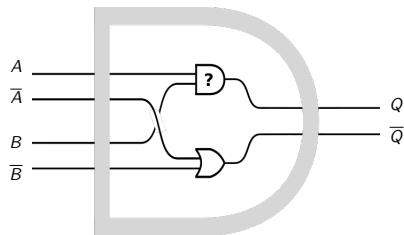
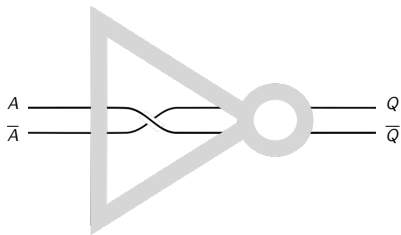
Gates and Circuits



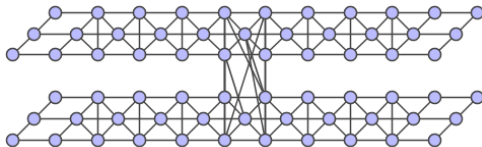
Gates and Circuits



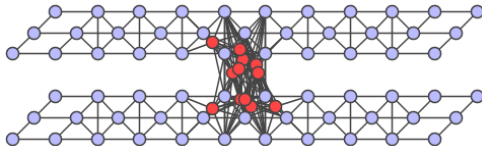
Gates and Circuits



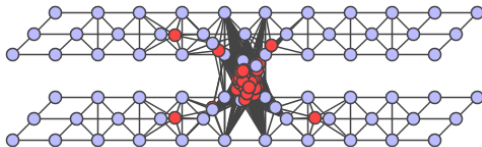
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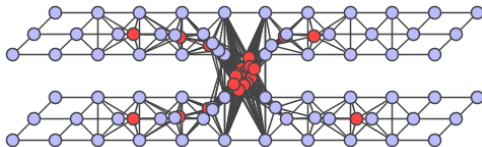
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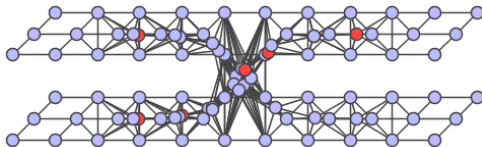
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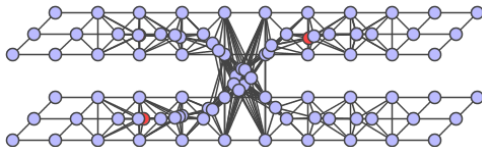
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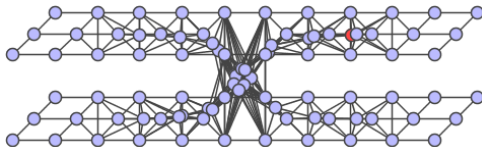
Gates and Circuits



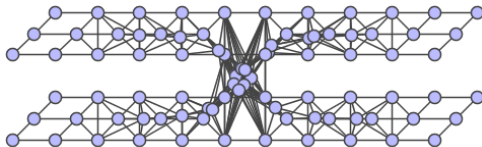
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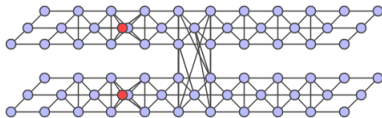
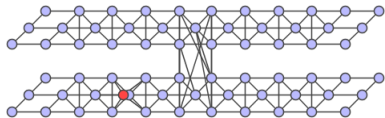
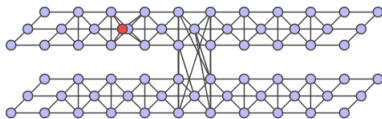
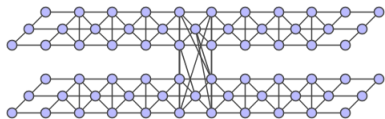
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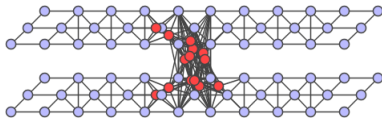
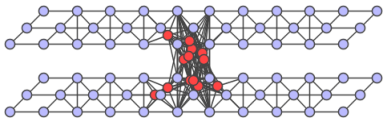
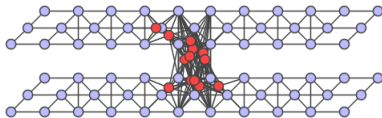
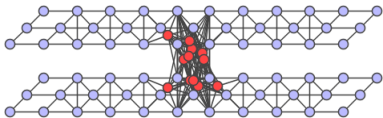
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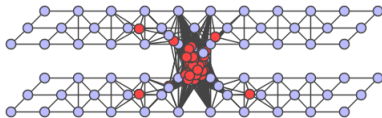
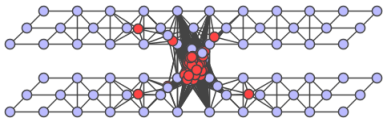
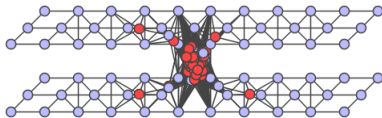
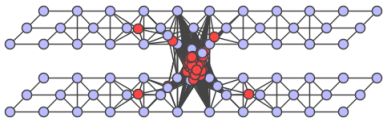
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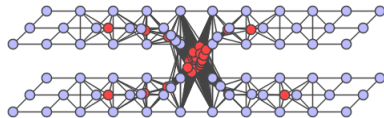
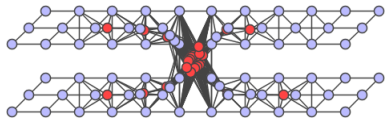
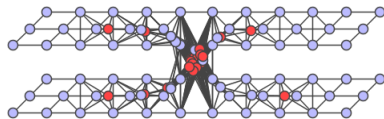
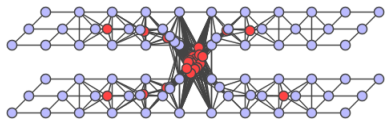
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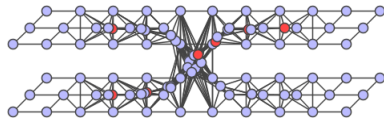
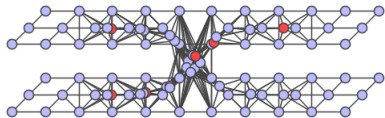
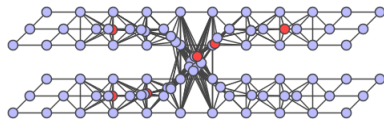
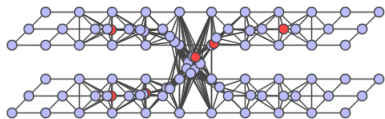
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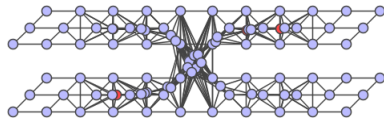
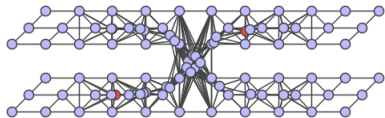
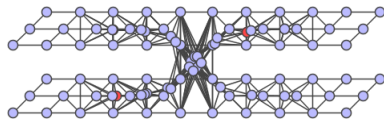
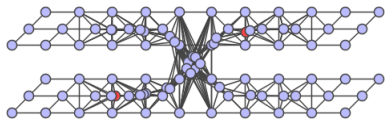
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
Gates and Circuits



Gates and Circuits



YAGS - Yet Another Graph System



YAGS

Yet Another Graph System

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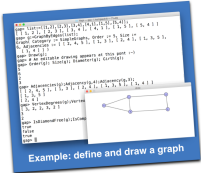
Welcome to YAGS

YAGS - *Yet Another Graph System* is a **GAP** package for dealing with graphs, in the sense of [Graph Theory](#) (not bar graphs, pie charts nor graphs of functions). Hence our graphs are ordered pairs $G = (V, E)$, where V is a finite set of vertices and E is a finite set of edges which are (ordered or unordered) pairs of vertices.

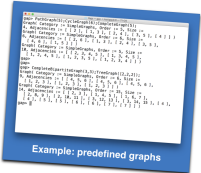
YAGS is a **GAP** package and hence its code is interpreted and not compiled (although some compilation possibilities exist in **GAP**). Therefore, from the very beginning, it was clear that speed was not our main goal. Instead, we wanted a very functional, full-featured system; a system adequate for rapid prototyping of algorithms; and a quick, easy-to-use, way for testing the rapidly changing working conjectures that are typical of the research process.

YAGS was designed to be useful for research in Graph Theory and [clique graphs](#), it offers an ample set of functions ([Appendix B](#)); a graph-drawing subsystem ([Draw \(B.4-15\)](#)); many methods for dealing with graph homomorphism ([Chapter 5](#)); an Object-Oriented approach that simplifies the task of working with several different graph categories ([Chapter 4](#)); and a generic backtracking subsystem useful to solve many combinatorial problems easily ([Chapter 6](#)).

Some quick examples (click on the images for details):



Example: define and draw a graph



Example: predefined graphs

Thanks!