6.5310: Geometric Folding Algorithms, Spring 2025

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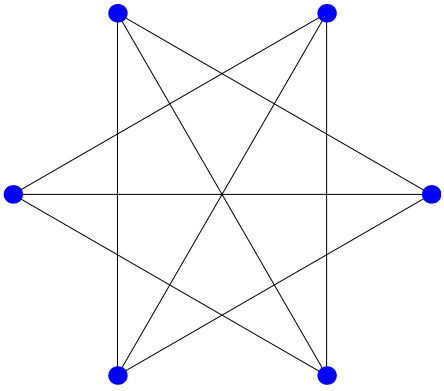
Problem Set 6 Solutions

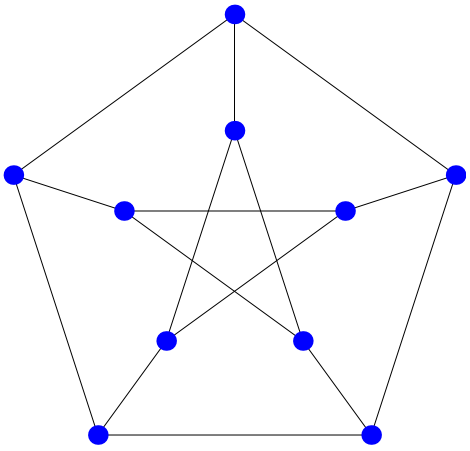
Due: Tuesday, March 18, 2025 at 10am

Problem 6.1 [Generic Rigidity]. For each of the following graphs, characterize as generically flexible, minimally generically rigid, or redundantly generically rigid.



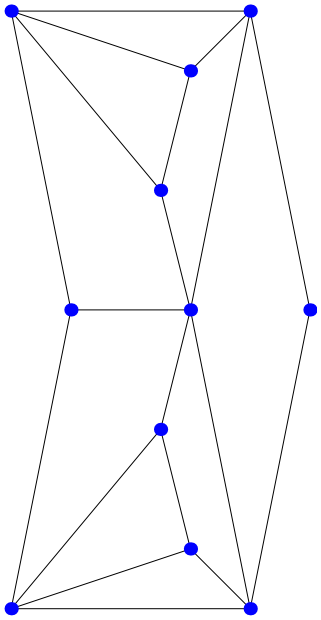
(a)

https://courses.csail.mit.edu/6.5310/spring25/psets/ps6-star.pdf



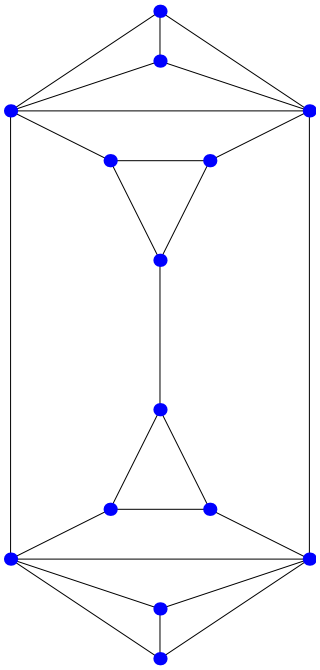
(b)

https://courses.csail.mit.edu/6.5310/spring25/psets/ps6-petersen.pdf



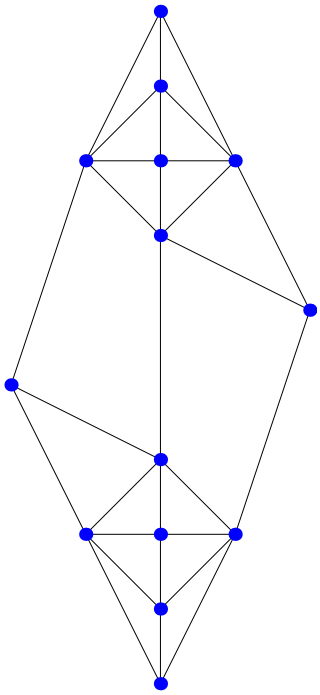
(c)

https://courses.csail.mit.edu/6.5310/spring25/psets/ps6-wings.pdf



(d)

https://courses.csail.mit.edu/6.5310/spring25/psets/ps6-prism.pdf

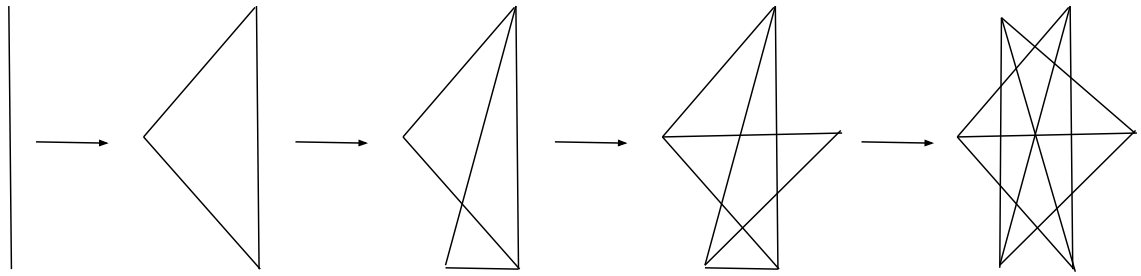


(e)

https://courses.csail.mit.edu/6.5310/spring25/psets/ps6-crystal.pdf

Solution by Anna Ellison:

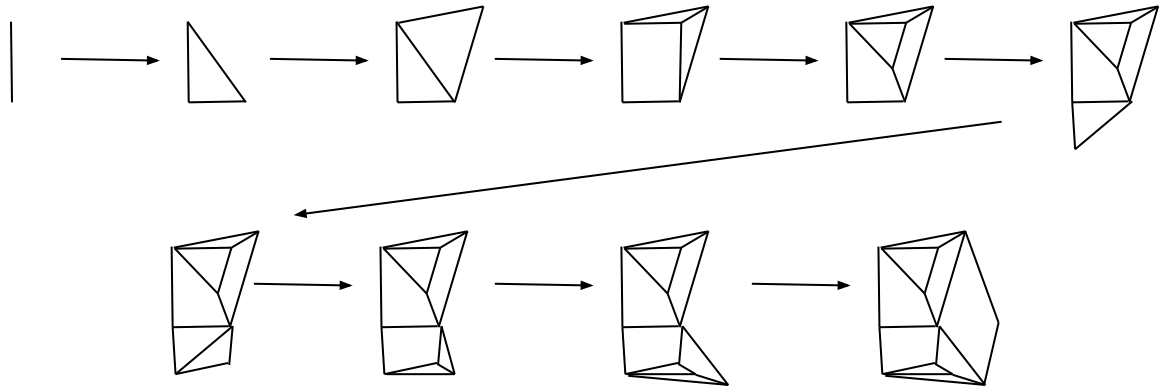
(a) This is minimally generically rigid.



This is a Henneberg construction that shows it is minimally generically rigid.

(b) This has 10 vertices and $15 < 2 \cdot 10 - 3$ edges, so it will be generically flexible.

(c) This is minimally generically rigid. It can be constructed as follows:



(d) This is generically flexible. If it were generically rigid, then the graph would also be rigid if we removed one edge from the top four vertices, since the top 4 vertices would still be rigid. However, the new graph has 24 edges and 14 vertices, and $24 < 2 \cdot 14 - 3 = 25$, so it must be generically flexible. Then, the first graph must have been generically flexible.

(e) This is redundantly generically rigid. The following construction shows that a linkage with a subset of edges is a minimally generically rigid graph.