# Bipartite Graph

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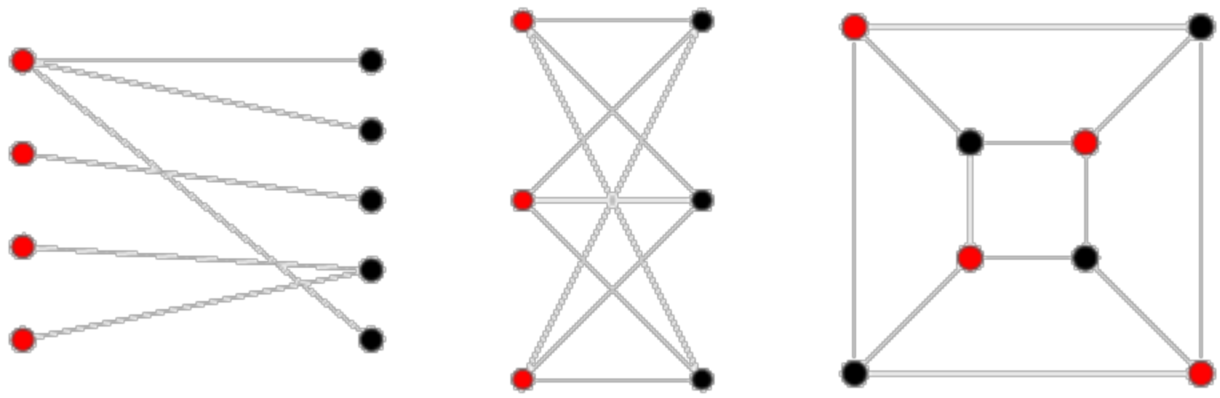
Wolfram Notebook



A bipartite graph, also called a bigraph, is a set of graph vertices decomposed into two disjoint sets such that no two graph vertices within the same set are adjacent. A bipartite graph is a special case of a *k*-partite graph with $k=2$. The illustration above shows some bipartite graphs, with vertices in each graph colored based on to which of the two disjoint sets they belong.

Bipartite graphs are equivalent to two-colorable graphs. All acyclic graphs are bipartite. A cyclic graph is bipartite iff all its cycles are of even length (Skiena 1990, p. 213).

Families of of bipartite graphs include

1. acyclic graphs (i.e., trees and forests),

2. book graphs,

3. crossed prism graphs,

4. crown graphs,

5. cycle graphs $C_n$ of even order,

6. gear graphs,

7. grid graphs,

8. Haar graphs,

9. Hadamard graphs,

10. hypercube graphs,

11. knight graphs,

12. ladder graphs,

13. ladder rung graphs (which are forests).

14. path graphs $P_n$ (which are trees),

15. Mongolian tent graphs,

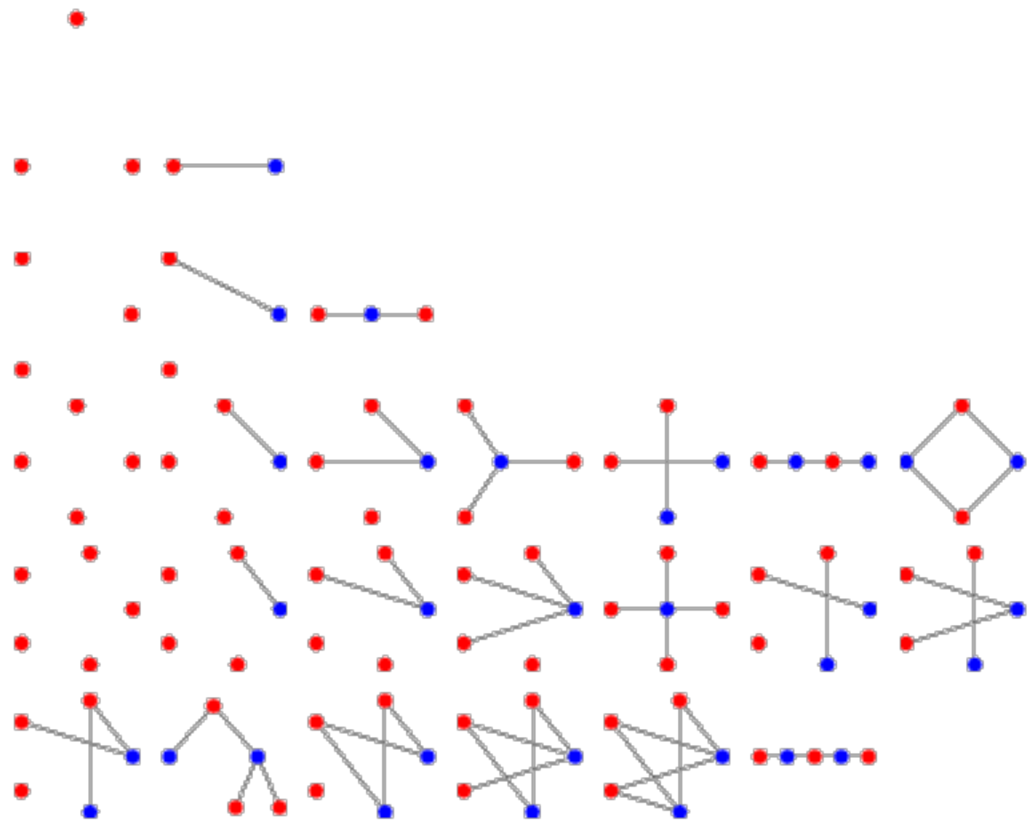
16. Sierpiński carpet graphs,

17. stacked book graphs,

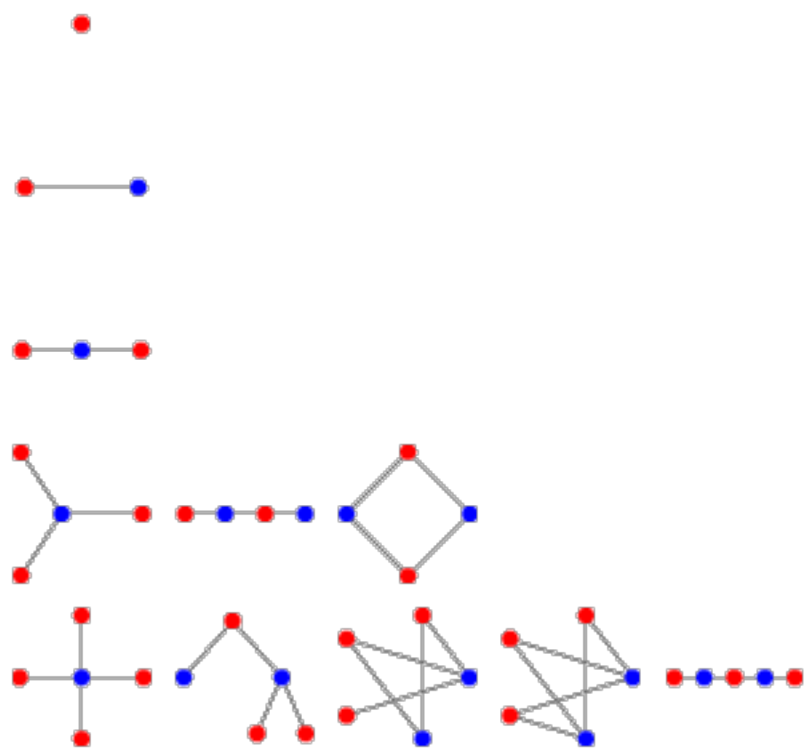
18. star graphs $S_n$ (which are trees).

König's line coloring theorem states that every bipartite graph is a class 1 graph. The König-Egeváry theorem states that the matching number (i.e., size of a maximum independent edge set) equals the vertex cover number (i.e., size of the smallest minimum vertex cover) are equal for a bipartite graph.

A graph may be tested in the Wolfram Language to see if it is a bipartite graph using `BipartiteGraphQ`[$g$], and the indices of one of the components of a bipartite graph can be found using `FindIndependentVertexSet`[$g$][[1]].



The numbers of bipartite graphs on $n=1$, 2, ... nodes are 1, 2, 3, 7, 13, 35, 88, 303, ... (OEIS A033995).



The numbers of connected bipartite graphs on $n=1$, 2 ... nodes are 1, 1, 1, 3, 5, 17, 44, 182, ... (OEIS A005142).

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