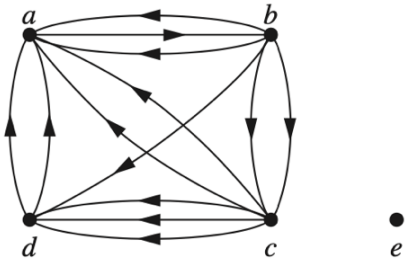
In Exercises 7–9 determine the number of vertices and edges and find the in-degree and out-degree of each vertex for the given directed multigraph.

9.



15. What do the in-degree and the out-degree of a vertex in a telephone call graph, as described in Example 4 of Section 10.1, represent? What does the degree of a vertex in the undirected version of this graph represent?

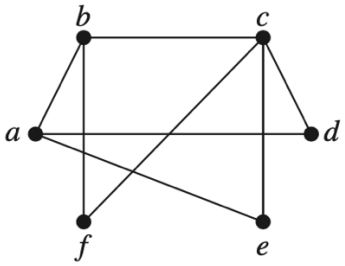
(You don't need to look at Example 4, just imagine a graph of telephone calls.)

19. Use Exercise 18 to show that in a group of people, there must be two people who are friends with the same number of other people in the group.

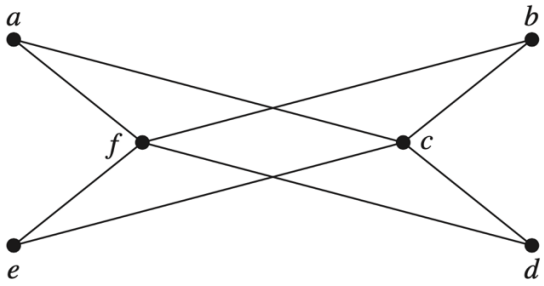
(You don't need to look at Exercise 18.)

In Exercises 21–25 determine whether the graph is bipartite. You may find it useful to apply Theorem 4 and answer the question by determining whether it is possible to assign either red or blue to each vertex so that no two adjacent vertices are assigned the same color.

23.



24.



37. How many vertices and how many edges do these graphs have?

a) K_n **b)** C_n **c)** W_n
d) $K_{m,n}$ **e)** Q_n

Skip d.

39. Find the degree sequence of each of the following graphs.

a) K_4 **b)** C_4 **c)** W_4
d) $K_{2,3}$ **e)** Q_3

Skip d.

41. What is the degree sequence of K_n, where n is a positive integer? Explain your answer.

43. How many edges does a graph have if its degree sequence is 5, 2, 2, 2, 2, 1? Draw such a graph.

A simple graph is called **regular** if every vertex of this graph has the same degree. A regular graph is called n-**regular** if every vertex in this graph has degree n.

55. For which values of n are these graphs regular?

a) K_n **b)** C_n **c)** W_n **d)** Q_n

63. If the simple graph G has v vertices and e edges, how many edges does $\overline{G}$ have?

65. If the degree sequence of the simple graph G is $d_1, d_2, \ldots, d_n$, what is the degree sequence of $\overline{G}$?

67. Show that if G is a simple graph with n vertices, then the union of G and $\overline{G}$ is K_n.