Show All Solutions

Rosen, Discrete Mathematics and Its Applications, 8th edition
Extra Examples
Section 10.1—Graphs and Graph Models

Extra Examples — *Page references correspond to locations of Extra Examples icons in the textbook.*

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p.680, icon at Example 11

#1. The relative strengths of the teams that compete against each other can be measured using a graph model.

For example, we can set up a graph G that models the National Football League season. The vertices of G are the NFL teams. We draw an edge from vertex x to vertex y if x played a game against y and x beat y. (If these two teams played a second game, we would add a second edge from x to y if x beat y a second time, and from y to x if y beat x.) If a game between x and y ended in a tie, we add an edge from x to y and an edge from y to x. The resulting digraph will have 32 vertices (one for each of the 32 NFL teams) and 256 edges (because each team plays 16 games). (The number of edges would be larger than 256 if tie games occurred during the season.)

We can use this digraph to measure the strength of the teams. For example, suppose teams A and B each have a final win-loss record of 10–6. (In graph theory terms, this means that the outdegree of each of the two vertices is 10 and the indegree is 6.) If team A played team B during the season and A beat B in their game, it might be reasonable to say that A is stronger than B. But suppose that A and B did not play each other. To decide which of the two teams might be considered the stronger team, we might look at the strength of the teams that each of these two teams beat. For example, A might have beaten "strong" teams (i.e., teams with many wins) and B might have beaten "weak" teams (i.e., teams with few wins). In this case we might conclude that team A is stronger than team B because A's ten wins are against stronger teams than those that B beat. In graph theory terms, we are examining paths of the form A–x–y ("A beat x who beat y"); these are "two-step wins"—paths of length 2.

Later in this chapter we will see that this large graph G can be described as a 32×32 matrix (called the adjacency matrix) and the two-step wins can be easily counted by examining terms of the square of this matrix.

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Extra Examples
Section 10.3—Representing Graphs and Graph Isomorphism

Extra Examples — *Page references correspond to locations of Extra Examples icons in the textbook.*

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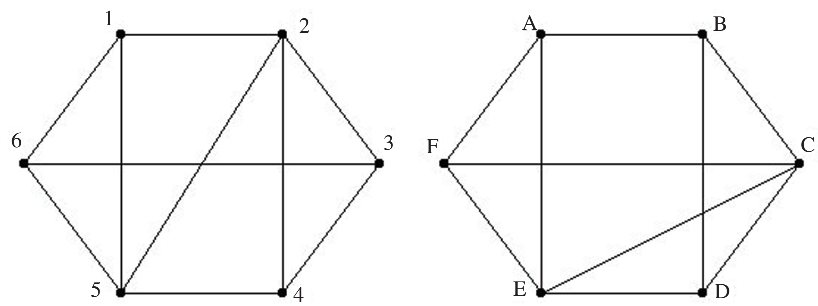
p.707, icon at Example 9
#1. Determine whether the following graphs are isomorphic.



See Solution

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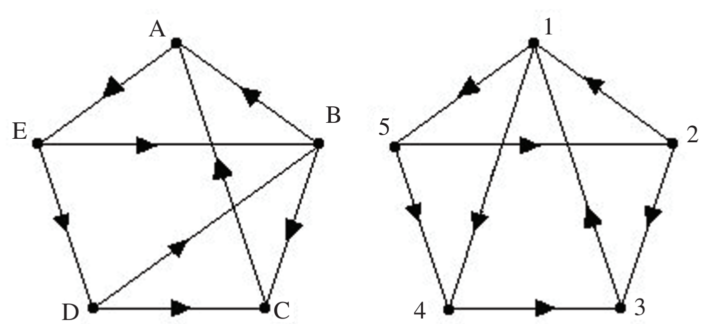
p.707, icon at Example 9
#2. Determine whether the following digraphs are isomorphic.



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Extra Examples
Section 10.5—Euler and Hamilton Paths

Extra Examples — *Page references correspond to locations of Extra Examples icons in the textbook.*

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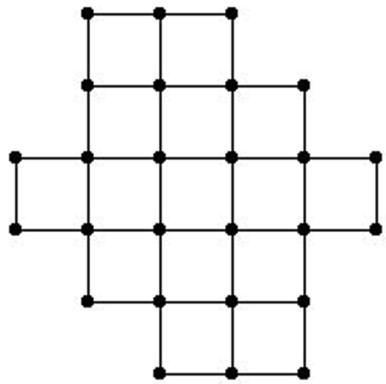
p.694, icon at Example 2
#1. Determine whether the following graph has an Euler circuit or Euler path.



See Solution

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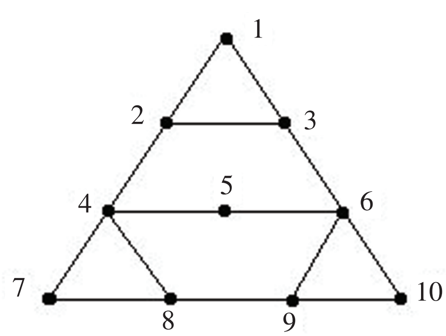
p.694, icon at Example 2
#2. Determine whether the following graph has an Euler circuit or Euler path.



See Solution

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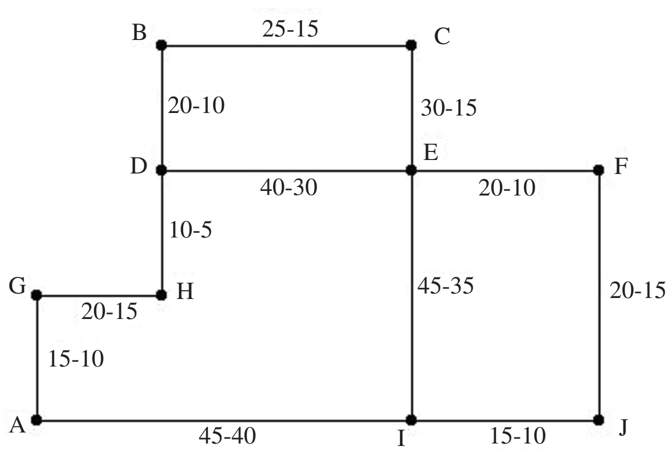
p.694, icon at Example 2

#3. *The Chinese Postman Problem*: The following graph shows the streets along which a mail carrier must deliver mail. Each street segment has a label consisting of two numbers: the first number gives the time (in minutes) that it takes for the mail carrier to deliver mail along that street; the second number gives the time (in minutes) that it takes the mail carrier to walk along that street without delivering mail. What is the minimum total length of time required to start from point *A*, complete mail delivery along all the streets in the map, and return to *A*?

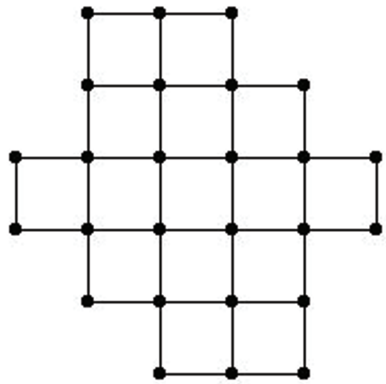
Note: A further discussion of this problem and similar ones can be found on this website in Chapter 20 of *Applications of Discrete Mathematics*.



See Solution

p.699, icon at Example 5

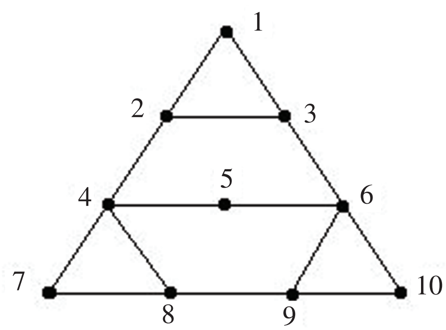
#1. Determine whether the following graph has a Hamilton circuit or Hamilton path.



See Solution

p.699, icon at Example 5

#2. Determine whether the following graph has a Hamilton circuit or Hamilton path.



See Solution

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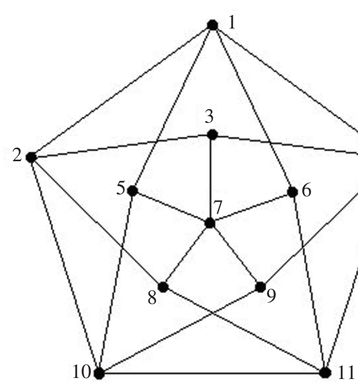
p.699, icon at Example 5

#3. Find a Hamilton circuit in the graph at the right, called the Grötzsch graph.



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Extra Examples
Section 10.7—Planar Graphs

— *Page references correspond to locations of Extra Examples icons in the textbook.*

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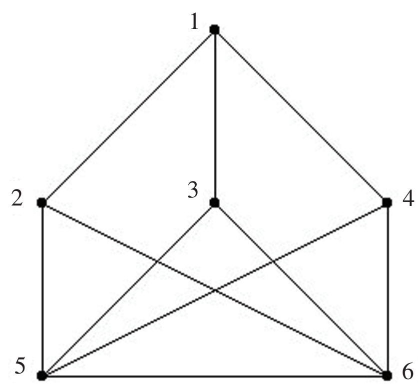
p.724, icon at Example 8
#1. Determine whether the following graph is planar.



See Solution

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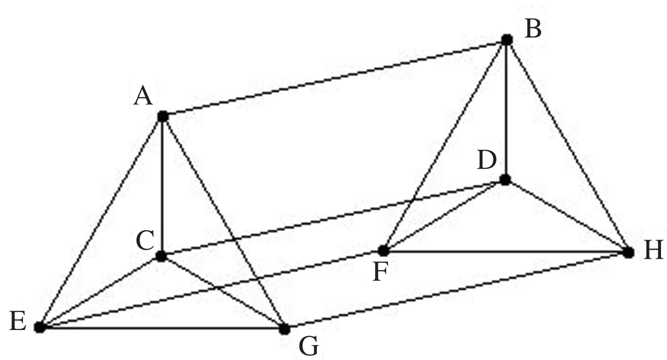
p.724, icon at Example 8
#2. Determine whether the following graph is planar.



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Extra Examples
Section 10.8—Graph Coloring

Extra Examples — *Page references correspond to locations of Extra Examples icons in the textbook.*

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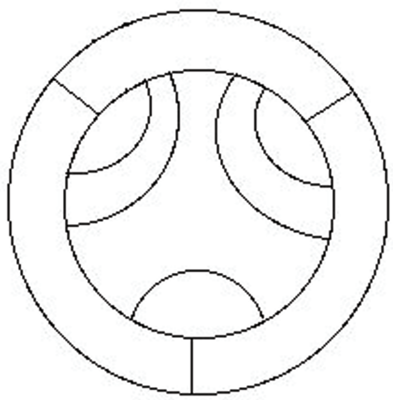
p.729, icon at Example 1

#1. Find the minimum number of colors needed to color the regions, including the infinite region, of the following map, so no adjacent regions have the same color.



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