11. Determine whether each of these graphs is strongly connected and if not, whether it is weakly connected.

\[ G = (V, E) \]
\[ V = \{a, b, c, d, e\} \]
\[ E = \{(b, a), (b, e), (c, d), (d, b), (e, a), (b, c)\} \]
$FW, A, SA, CC$ is a simple path of length 3

$A, H, CC, SA, A$ is a simple circuit of length 4

$A, H, A, H, A, H$ is not simple

$A, SA, A, SA, A, SA, A$
Vertex cut
size 2
{FW, A3, SA, H3}
{SA, A3, A, EP3}

Edge cuts
size 2
{E0, A3}, E0, FW33
{CC, SA3, CC, H3}
In Exercises 3–5 determine whether the given graph is connected.

3.

4.

5.

**Cut vertices**

- a, b, c, d, f, h, i, j

**Cut edges**

- all of them
In Exercises 3–5 determine whether the given graph is connected.

3. not connected. Components are: \{a, c, f\}, \{b, g, d\}, \{e\}

4. connected

5. not connected. Components are: \{a, d, e\}, \{b, c, f\}
SBCs are:
{FW, EP, A, D}
{SA, H, CC}
11. Determine whether each of these graphs is strongly connected and if not, whether it is weakly connected.

a) weak
   \[ \text{SCCs are } \{a, b, c, d\}, \{e\} \]

b) weak
   \[ \text{SCCs: } \{a, b, d, e\}, \{c\} \]

c) not even weakly connected?
   \[ \text{SCCs: } \{b, e, f\}, \{a, f\}, \{e, f\}, \{f\} \]
15. Find the strongly connected components of each of these graphs.

(a) \{a, b, f\}

(b) \{c, d, e\}

(c)
Start vertex

Distance from a

<table>
<thead>
<tr>
<th>Vertex</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>0</td>
</tr>
<tr>
<td>b</td>
<td>∞</td>
</tr>
<tr>
<td>c</td>
<td>2</td>
</tr>
<tr>
<td>d</td>
<td>∞</td>
</tr>
<tr>
<td>e</td>
<td>∞</td>
</tr>
</tbody>
</table>

processing a, b, c
added to process

a b c d e f g h i

0 7 4 11 35

a b c h i c l
25. Solve the traveling salesman problem for this graph by finding the total weight of all Hamilton circuits and determining a circuit with minimum total weight.

\[ \text{abcd}a = \text{ad}c\text{ba} = 18 \]
\[ \text{abd}c\text{a} = \text{ac}d\text{ba} = 19 \]
\[ \text{acb}d\text{a} = \text{ad}b\text{c}\text{a} = 17 \]

4 vertices

\[ (4 - 1)! = 3! = 6 \]
\[ 6/2 = 3 \]
26. Solve the traveling salesperson problem for this graph by finding the total weight of all Hamilton circuits and determining a circuit with minimum total weight.

5 vertices
(5-1)! = 4! = 24
24/2 = 12

\[\text{abcde}a = 27\]
\[\text{adebca} = 25\]
\[\text{abedca} = 20\]
\[\text{abcd}e\text{a} = 20\]
26. Solve the traveling salesperson problem for this graph by finding the total weight of all Hamilton circuits and determining a circuit with minimum total weight.