### TABLE 27.9. Example of UPGMA tree construction

<table>
<thead>
<tr>
<th>Step</th>
<th>Cycle 1</th>
<th>Cycle 2</th>
<th>Cycle 3</th>
<th>Cycle 4</th>
<th>Cycle 5</th>
<th>Cycle 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance matrix</td>
<td>OTUs</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>C</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>4</td>
<td>D</td>
<td>6</td>
<td>E</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>6</td>
<td>E</td>
<td>6</td>
<td>4</td>
<td></td>
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<tr>
<td>E</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Identify smallest D
- A↔B = 2
- AB↔C = 4
- AB↔DE = 6
- ABC↔DE = 6
- ABCDE↔F

#### Taxa joined
- A and B
- D and E
- AB and C
- ABC and DE
- ABCDE and F

#### Subtree

**Step 1.** Because the distance from AB to C is also 4, that pair could have been selected as well.

#### Comments on tree drawing
- The distance between A and B is 2 units. A subtree is drawn with the branch point halfway between the two. Thus, each branch is 1 unit in length.
- Branching done as in Step 1. The tree is now complete but unrooted.
- The tree can then be rooted using midpoint rooting which tries to balance all the tips to reach the same end point. Note this is the tree that we started with to build the distance matrix.