137
(b) The relative error expressed as a percent is \( \varepsilon = \frac{\text{Fin} - \text{Opt}}{\text{Opt}} = \frac{15 - 12}{12} = 25\% \).

56. (a) The optimal finishing time is Opt = 10.

(c) The relative error expressed as a percent is \( \varepsilon = \frac{\text{Fin} - \text{Opt}}{\text{Opt}} = \frac{11 - 10}{10} = 10\% \).

57. (a) Since all tasks are independent, the critical-time priority list is identical to a decreasing-time list. Notice that the finishing is optimal.
(b) Once again, since all tasks are independent, the critical-time priority list is identical to a decreasing-time list. The finishing is optimal.

\[
\begin{array}{c|c|c|c|c|c|c|c|c}
\text{Time: } & 0 & 1/8 & 1/4 & 3/8 & 1/2 & 5/8 & 3/4 & 7/8 & 1 \\
\hline
P_1 & & & & & & & & 1/2 & 1/4 \\
\hline
P_2 & & & & & & & & 1/4 & 1/8 \\
\hline
\end{array}
\]

\[\text{Fin} = 1\]

58. (a) Time: 0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60

\[
\begin{array}{c|c|c|c}
\hline
P_1 & 34 & 8 & 2 \\
\hline
P_2 & 21 & 13 & 5 & 3 & 1 \\
\hline
\end{array}
\]

\[\text{Fin} = 44\]

(b) Time: 0 3 6 9 12 15 18 21 24 27 30 33 36 39 42 45 48 51 54 57 60 63 66 69 72 75 78

\[
\begin{array}{c|c|c|c|c|c}
\hline
P_1 & & & 55 & 13 & 3 & 1 \\
\hline
P_2 & 34 & 21 & 8 & 5 & 2 & 1 \\
\hline
\end{array}
\]

\[\text{Fin} = 72\]

G. Miscellaneous

59. Every arc of the graph contributes 1 to the indegree sum and 1 to the outdegree sum.

60. (a) asymmetric

(b) symmetric

(c) neither

(d) symmetric

(e) asymmetric

61. Assuming that all of the tasks are independent, then A, B, C, E, G, H, D, F, I is one possible priority list.

62. A, B, G, I, C, D, H, E, F

63. Refer to the project digraph given in the text.

<table>
<thead>
<tr>
<th>Time</th>
<th>Status of Processors</th>
<th>Priority List</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(P_1) (P_2)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Start: (IW)</td>
<td>(AD\ (BW\ (AC\ (HP\ (AP\ (AW\ (ID\ (IP\ (PE\ (PU\ (HI\ (IC\ (PD\ (EU\ (FW\</td>
</tr>
<tr>
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<td>(AD\ (BW\ (AC\ (HP\ (AP\ (AW\ (ID\ (IP\ (PE\ (PU\ (HI\ (IC\ (PD\ (EU\ (FW\</td>
</tr>
<tr>
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<td>Start: (ID)</td>
<td>(AD\ (BW\ (AC\ (HP\ (AP\ (AW\ (ID\ (IP\ (PE\ (PU\ (HI\ (IC\ (PD\ (EU\ (FW\</td>
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<tr>
<td>35</td>
<td>Start: (IC)</td>
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</tr>
<tr>
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<td>Start: (EU)</td>
<td>(AD\ (BW\ (AC\ (HP\ (AP\ (AW\ (ID\ (IP\ (PE\ (PU\ (HI\ (IC\ (PD\ (EU\ (FW\</td>
</tr>
<tr>
<td>38</td>
<td>Start: (FW)</td>
<td>(AD\ (BW\ (AC\ (HP\ (AP\ (AW\ (ID\ (IP\ (PE\ (PU\ (HI\ (IC\ (PD\ (EU\ (FW\</td>
</tr>
<tr>
<td>44</td>
<td>Idle</td>
<td>(AD\ (BW\ (AC\ (HP\ (AP\ (AW\ (ID\ (IP\ (PE\ (PU\ (HI\ (IC\ (PD\ (EU\ (FW\</td>
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<tr>
<td></td>
<td>Idle</td>
<td>(AD\ (BW\ (AC\ (HP\ (AP\ (AW\ (ID\ (IP\ (PE\ (PU\ (HI\ (IC\ (PD\ (EU\ (FW\</td>
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