Test #2 Review

Problem 3-8c, page 112 in the textbook:
What is the reliability of the following system:

\[
\text{Reliability} = \text{Reliability of 1st component} \times \text{Reliability of 2nd component} \times \text{Reliability of 3rd component}
\]

\[
= [1 - (0.05) \times (0.10)] \times (0.95) \times [1 - (0.05) \times (0.10)] = 0.95 \times 0.95 = 0.9025 = 90.25\%
\]

Problem 3-11, page 112 in the textbook:

Nadia Algar is the overworked IT resource person for her department. In the next round of computer purchases, she is determined to recommend a vendor who does a better job of documenting possible errors in the system and whose customer service line is more responsive to the needs of her colleagues. Nadia compiled the following data over an 8-week observation period. Assuming 40 hours per week, which computer vendor should Nadia pursue?

<table>
<thead>
<tr>
<th>Computer Vendor</th>
<th>Number of problems</th>
<th>Mean time to reach customer service (hours)</th>
<th>Mean time to fix problem (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JCN</td>
<td>50</td>
<td>3</td>
<td>2.0</td>
</tr>
<tr>
<td>Bell</td>
<td>100</td>
<td>2</td>
<td>1.0</td>
</tr>
<tr>
<td>Comtron</td>
<td>250</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Answer:

- 8 week time period
- 40 hours per week
- Total number of hours = 8 * 40 = 320 hours
- MTBF = 320 / # of problems

<table>
<thead>
<tr>
<th>Computer Vendor</th>
<th>MTBF (hours)</th>
<th>MTTR (hours)</th>
<th>System Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>JCN</td>
<td>6.40</td>
<td>5.0</td>
<td>56.14%</td>
</tr>
<tr>
<td>Bell</td>
<td>3.20</td>
<td>3.0</td>
<td>51.61%</td>
</tr>
<tr>
<td>Comtron</td>
<td>1.28</td>
<td>1.5</td>
<td>46.04%</td>
</tr>
</tbody>
</table>

- Choose JCN
**Problem 4-4a, page 153 in the textbook:**

Mikey W. Smitty, an emerging rapper, is getting ready to cut his first CD, called “Western Rap”. The cost of recording the CD is $9,000 with production cost of $2 apiece. If the CDs can be sold for $15 each, how many CDs must be sold to break even?

**Answer:**

- Fixed cost: $9,000
- Variable cost: $2 per CD
- Selling price: $15 per CD
- Find break-even quantity

\[ \text{Revenue} = \text{Total Cost} \]
\[ 15x = 9000 + 2x \]
\[ 13x = 9000 \]
\[ x = 692 \text{ CDs} \]

**Problem 4-10, page 154 in the textbook:**

NanoTech is ready to begin production of its exciting new technology. The company is evaluating three methods of production: (A) a small production facility with older equipment, (B) a larger production facility that is more automated, and (C) subcontracting to an electronic manufacturer in Singapore. The costs of each alternative are shown below. Determine for what level of demand each production process should be chosen.

<table>
<thead>
<tr>
<th></th>
<th>Subcontracting</th>
<th>Small Facility</th>
<th>Larger Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td>$0</td>
<td>$200,000</td>
<td>$600,000</td>
</tr>
<tr>
<td>Variable</td>
<td>$60</td>
<td>$40</td>
<td>$20</td>
</tr>
</tbody>
</table>

**Answer:**

Total Cost of Subcontracting = Total Cost Small Facility
\[ 60x = 200,000 + 40x \]
\[ 20x = 200,000 \]
\[ x = 10,000 \]

Total Cost of Small Facility = Total Cost Larger Facility
\[ 200,000 + 40x = 600,000 + 20x \]
\[ 20x = 400,000 \]
\[ x = 20,000 \]

Subcontract if demand is less than 10,000 items. Use larger facility when over 20,000 items are needed. Otherwise, use small facility.
**Problem 5-3, page190 in the textbook:**

Pratt’s Department Store is opening a new store in The Center’s Mall. Customer movement tracked in its existing stores is shown below. Design a layout for Pratt’s new store on a 3 X 3 grid that will minimize nonadjacent customer movement.

<table>
<thead>
<tr>
<th>NUMBER OF CUSTOMERS TO</th>
<th>Women’s</th>
<th>Men’s</th>
<th>Boys’</th>
<th>Girls’</th>
<th>Infants</th>
<th>Housewares</th>
<th>Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>FROM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women’s</td>
<td>--</td>
<td>20</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>Men’s</td>
<td>--</td>
<td>20</td>
<td>10</td>
<td></td>
<td>20</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Boys’</td>
<td>20</td>
<td>--</td>
<td>20</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Girls’</td>
<td>30</td>
<td>50</td>
<td>--</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infants</td>
<td>30</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Housewares</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Accessories</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20</td>
<td>--</td>
</tr>
</tbody>
</table>

Composite movements, ranked from highest to lowest:

- W ←→ H 110
- W ←→ A 90
- W ←→ G 80
- M ←→ B 40
- M ←→ A 30
- M ←→ H 20
- G ←→ I 30
- B ←→ G 70
- W ←→ M 20
- W ←→ B 50
- M ←→ G 10
- H ←→ A 50
- G ←→ I 30
- M ←→ H 20

Initial layout:

```
  A
 B  G
 W  H
```

Sum of non-adjacent loads: 70+40+20+10 = 140

Optimal layout:

```
  I
 H  G
 A  M
```

Zero sum of the non-adjacent loads.
Problem 5-15, page 193 in the textbook:

The precedence diagram and task times (in minutes) for assembling McCauley’s Mystifier are shown here. Set up an assembly line to produce 125 mystifiers in a 40-hour week. Balance the line and calculate its efficiency.

- Desired cycle time = \(\frac{40 \times 60}{125} = 19.2\) minutes
- Minimum number of workstations = \(\frac{61}{19.2} = 3.17 \approx 4\) workstations

- Actual cycle time = 19 minutes
- Efficiency = \(\frac{61}{4 \times 19} = .8026 = 80\%\)
Problem 5-16, page 193 in the textbook:

The precedence diagram and task times (in minutes) for assembling modular furniture are shown below. Set up an assembly line to assemble 1000 sets of modular furniture in a 40-hour week. Balance the line and calculate its efficiency.

- Desired cycle time = \(\frac{40 \times 60}{1000} = 2.4\) minutes
- Minimum number of workstations = \(\frac{7.2}{2.4} = 3\) workstations

\[
\begin{align*}
\text{WS #1} & \quad \text{WS #2} & \quad \text{WS #3} & \quad \text{WS #4} \\
A, B, E & \quad C, D, F, G, H & \quad I, I & \quad K \\
1.5\text{ min} & \quad 2.4\text{ min} & \quad 1.3\text{ min} & \quad 2\text{ min}
\end{align*}
\]

- Actual cycle time = 2.4 minutes
- Efficiency = \(\frac{7.2}{4 \times 2.4} = .75 = 75\%\)