Meal Picking - Elementary School
Student Worksheet

Part I: Introduction

1. What is a distribution center? A warehouse or storage facility that holds products until they’re ready to be shipped (to consumers or retailers)

2. Give an example of a distribution center. Amazon, Walmart, etc.

3. Give two examples of where distribution centers for meal picking might be used? Cafeterias, In-Flight Caterers, etc.

4. What is the benefit of having a distribution center for meal picking? Better efficiency and faster service

Part II: Simulation-“Tables”

1. What is a systems design? A method or process created by engineers to perform a specific task to its maximum potential.

2. Why do engineers use simulations to study systems design? It’s less expensive and faster than physically testing the design.
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The information in the table below represents the data collected in the “Tables” simulation.

Scenario 1: Tables

<table>
<thead>
<tr>
<th>Meal Order #</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>Overall Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picking Time (sec)</td>
<td>26.0</td>
<td>25.2</td>
<td>24.4</td>
<td>20.4</td>
<td>21.1</td>
<td>18.7</td>
<td>18.0</td>
<td>26.6</td>
<td>22.3</td>
<td>18.9</td>
<td>24.1</td>
<td>22.4</td>
<td>268.1</td>
</tr>
<tr>
<td>Walking Time (sec)</td>
<td>60.2</td>
<td>60.3</td>
<td>55.3</td>
<td>45.9</td>
<td>53.8</td>
<td>56.9</td>
<td>51.0</td>
<td>67.3</td>
<td>48.2</td>
<td>61.2</td>
<td>58.7</td>
<td>53.2</td>
<td>672.0</td>
</tr>
<tr>
<td>Total Time (sec)</td>
<td>86.2</td>
<td>85.5</td>
<td>79.7</td>
<td>66.3</td>
<td>74.9</td>
<td>75.6</td>
<td>69.0</td>
<td>93.9</td>
<td>70.5</td>
<td>80.1</td>
<td>82.8</td>
<td>75.6</td>
<td>940.1</td>
</tr>
</tbody>
</table>

3. What do you notice when comparing the Total Times of each Meal Order? They are about the same (small range)

4. Calculate the Average Total Time needed to pick a Meal Order. Round to the nearest whole number.

\[
\text{Average Picking Time} = \frac{\text{Overall Total Time}}{\text{Number of Meal Orders}}
\]

\[
\text{Average Picking Time} = \frac{940.1}{12}
\]

\[
\text{Average Picking Time} = 78 \text{ seconds}
\]

5. Is it better to have a faster or slower Average Total Time? Faster Why? It would cost the company less money.

6. What is the dependent variable? Overall picking time Independent variable? Design of layout

7. What are possible changes that can be made to this meal picking design to decrease the time it takes to pick meals? Change layout of items, arrange items on list in order they appear (or change order of items to match the order they appear on the list), etc
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Part III: Simulation-“Random Pick-to-Light”

1. What changes in the systems design are shown in this simulation? Layout of items

The information in the table below represents the data collected in the “Random Pick-to-Light” simulation.

### Scenario 2: Random Pick-to-Light

<table>
<thead>
<tr>
<th>Meal Order #</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>Overall Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picking Time (sec)</td>
<td>26.0</td>
<td>25.2</td>
<td>24.4</td>
<td>20.4</td>
<td>21.1</td>
<td>18.7</td>
<td>18.0</td>
<td>26.6</td>
<td>22.3</td>
<td>18.9</td>
<td>24.1</td>
<td>22.4</td>
<td>268.1</td>
</tr>
<tr>
<td>Walking Time (sec)</td>
<td>30.8</td>
<td>27.8</td>
<td>33.0</td>
<td>29.6</td>
<td>34.9</td>
<td>23.1</td>
<td>33.4</td>
<td>32.3</td>
<td>37.4</td>
<td>38.2</td>
<td>40.9</td>
<td>30.3</td>
<td>391.7</td>
</tr>
<tr>
<td>Total Time (sec)</td>
<td>56.8</td>
<td>53.0</td>
<td>57.4</td>
<td>50.0</td>
<td>56.0</td>
<td>41.8</td>
<td>51.4</td>
<td>58.9</td>
<td>59.7</td>
<td>57.1</td>
<td>65.0</td>
<td>52.7</td>
<td>659.8</td>
</tr>
</tbody>
</table>

2. Which Time (Picking or Walking) shows the bigger change compared to the first simulation?

Walking Why? Less distance needs to be travelled between items. (Picking time is just about constant)

3. Calculate the Average Total Time needed to pick a Meal Order using this systems design. Round to the nearest whole number.

\[
Average \ Picking \ Time = \frac{Overall \ Total \ Time}{Number \ of \ Meal \ Orders}
\]

\[
Average \ Picking \ Time = \frac{659.8}{12} \approx 55 \text{ seconds}
\]

4. How does this Average Total Time compare to the Average Total Time from the “Tables” Simulation in Part II? This one is less than the “Tables”.

5. Brainstorm methods to improve this simulation’s design in order to produce an even faster Average Picking Time. Change layout of items so the match the order they appear on the list, etc
Part IV: Conclusions

1. Watch the “Ordered Pick-to-Light” Simulation. What makes this design the better system of the two which use the Pick-to-Light System? Less walking is needed.

2. The Average Total Time in this simulation is 35.84 seconds. How much faster is it compared to the “Tables” simulation? 42.16 sec (Note: This improved time is for picking only 12 Meal Orders. Although the difference may seem trivial it is significant throughout the course of a day, month, etc.)

3. List factors other than the systems design that can affect the Average Total Time. Speed of walker, etc.

4. When would a faster Average Total Time not be better? When items on the order are not picked properly.

Fun Fact

Emirates Flight Catering, which provides in-flight meals for over 100 airlines, produces and packages up to 175,000 meals per day!