Queueing Theory summary – Creative Technology Nights – 9 February 2015

People have to wait in line all the time - at the grocery store, in the doctor's office, at the airport, and so on. But nobody likes waiting in line, so we'd all like to know strategies to minimize the time we have to wait. Queueing theory is the study of waiting in line: how to predict how long we'll have to wait, and how to make smart decisions to wait for shorter lengths of time.

In tonight's session, we'll learn about two important concepts in queueing theory. Task assignment is the customer's choice of which line to choose when you have multiple options (the line with fewest people? the express line in the grocery store?). Scheduling is the server's choice of which customer to serve next (the one who has been waiting the longest? the one with the smallest amount of work?). We'll investigate different task assignment and scheduling strategies and learn which strategies are most effective - maybe next time you're in the grocery store, you won't have to wait as long!
What is Queueing Theory?

Queueing Theory

The study of waiting in line
Why Study Queueing?

- Grocery store
- Doctor’s office
- Airport
- Cafeteria
- Traffic
Example: Queueing in the Grocery Store

GOAL: Wait for as short a time as possible!

What are some strategies for choosing a line?
How Can We Choose a Queue?

Task Assignment

Random

Join-the-Shortest-Queue

Round Robin

Least-Work-Left

“Express Lane”
Your Turn!

1. Come up with a strategy for how to choose a line. Everyone in your group should follow the same strategy!
   **GOAL:** Wait for as short a time as possible!

2. At every time:
   1. Does anyone leave the register?
   2. Does anyone arrive? Where do they go?

3. What was the **average** time from arriving to departing for your group?

Arrive: time 6
Size: 3 sec

Get to Cashier: ___
Depart: ________

Total Time: ______
(Depart – Arrive)
What Happened?
How Can The Cashier Help?

GOAL: Wait for as short a time as possible!
How Can The Cashier Help?

GOAL: Wait for as short a time as possible!

What are some strategies for choosing the next job?
How Can We Choose the Next Job?

Scheduling

First-Come First-Served

Random

Last-Come First-Served

Shortest Job First
Your Turn!

1. Come up with a strategy for how to choose the next job. **GOAL:** Wait for as short a time as possible!

2. At every time:
   1. Does anyone leave the register?
   2. Does anyone arrive?
   3. Who does the cashier choose next?

3. What was the **average** time from arriving to departing for your group?
What Happened?

The cashier can help by always choosing the smallest job!

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\text{SLOWDOWN} = \frac{\text{How long I waited}}{\text{How big is my job}}
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Queueing and Computer Science