

# IE 411 - Operations Research II

## HW #2 (Waiting Lines & Queuing Models)



Solve the following problems (from the book) analytically and using a computer software:

### 1- 13-11:

The Rockwell Electronics Corporation retains a service crew to repair machine breakdowns that occur on an average of  $\lambda = 3$  per day (approximately Poisson in nature). The crew can service an average of  $\mu = 8$  machines per day, with a repair time distribution that resembles the exponential distribution.

- (a) What is the utilization rate of this service system?
- (b) What is the average downtime for a machine that is broken?
- (c) How many machines are waiting to be serviced at any given time?
- (d) What is the probability that more than one machine is in the system? Probability that more than two are broken and waiting to be repaired or being serviced? More than three? More than four?

### 2- 13-19:

Juhn and Sons Wholesale Fruit Distributors employ one worker whose job is to load fruit on outgoing company trucks. Trucks arrive at the loading gate at an average of 24 per day, or 3 per hour, according to a Poisson distribution. The worker loads them at a rate of 4 per hour, following approximately the exponential distribution in service times.

Determine the operating characteristics of this loading gate problem. What is the probability that there will be more than three trucks either being loaded or waiting? Discuss the results of your queuing model computation.

### 3- 13-20:

Juhn believes that adding a second fruit loader will substantially improve the firm's efficiency. He estimates that a two-person crew, still acting like a single-server system, at the loading gate will double the loading rate from 4 trucks per hour to 8 truck per hour. Analyze the effect on the queue of such a change and compare the results with those found in Problem 13-19.

### 4- 13-21.

Truck drivers working for Juhn and Sons (see Problems 13-19 and 13-20) are paid a salary of \$10 per hour on average. Fruit loaders receive about \$6 per hour. Truck drivers waiting in the queue or at the loading gate are drawing a salary but are productively idle and unable to generate revenue during that time. What would be the *hourly* cost savings to the firm associated with employing two loaders instead of one?

**Due Date:** Wednesday 6/5/1436 H (25-2-2015)

To be submitted in class (8-9:20 am)

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