

# ECE 341 - Homework #8

Queueing Theory & Normal Distributions.

## Queueing Theory

Assume you are running a fast-food restaurant.

- The time between customers arriving at a restaurant is an exponential distribution with a mean of 90 seconds.
- The time it takes to serve each customer is an exponential distribution with a mean of 60 seconds.

1) Run a single Monte-Carlo simulation for this restaurant over the span of one hour.

- Give the formula for each column in your simulation
- What is the longest waiting time for a customer in your simulation?
- What is the largest queue over the span of one hour?

## Normal Distribution

The mean and standard deviation for a 6 and 8-sided die are

$$\mu_{d6} = 3.50$$

$$\mu_{d8} = 4.50$$

$$\sigma_{d6} = 1.7078$$

$$\sigma_{d8} = 2.291$$

$$\sigma_{d6}^2 = 2.9166$$

$$\sigma_{d8}^2 = 5.2487$$

2) Let Y be the sum of rolling five 6-sided dice (5d6) plus five 8-sided dice (5d8).

$$Y = 5d6 + 5d8$$

- a) What is the mean and standard deviation of Y?
- b) Using a normal approximation, what is the 90% confidence interval for Y?
- c) Using a normal approximation, what is the probability that the sum of the dice will be more than 49.5?

3) Check your answer using a Monte-Carlo simulation in Matlab with 100,000 rolls:

```
N = 0;
for i=1:1e5
    Y = sum( ceil( 6*rand(5,1) ) ) + sum( ceil( 8*rand(5,1) ) );
    if(Y > 49.5)
        N = N + 1;
    end
end
N / 1e5
```

4) Fargo's high temperature in the month of June has been measured by Hector Airport since 1942.

- Determine the mean and standard deviation for the high in June
- Assuming a normal distribution, determine the probability that the high in June will exceed 100F this year

(note: data set is linked on Bison Academy)