

# ECE 341 - Homework #8

Gamma, Poisson, & Normal Distributions. Summer 2023

## Gamma Distributions

Let A be an exponential distribution with a mean of 10 seconds

The time until the next customer arrives

Let B be the time until three customers arrive (B has a gamma distribution)

1) Determine the pdf for B using LaPlace transforms.

- From your results, determine the pdf at  $B=20$

2) Determine the pdf of B using convolution

- From your results, determine the pdf at  $B = 20$

## Poisson Distributions

3) Determine the probability that 3 customers will arrive within 20 seconds ( $0 < t < 20$ )

- Using moment generating functions
- Using convolution

4) In D&D, you automatically make your saving throw if you roll a 20 on a 20-sided die ( $p = 5\%$ ).

- Using a binomial pdf, determine the probability of making your saving throw four times in 20 rolls
- Using a Poisson approximation, determine the probability of making four saving throws in 20 rolls

## Normal Distribution

- Let  $x$  be a random number from a normal distribution with a mean of 10 and a standard deviation of 6
- Let  $y$  be a random number from a normal distribution with a mean of 15 and a standard deviation of 8
- Let  $z$  be a random number from a normal distribution with a mean of 20 and a standard deviation of 10

5) Let  $F = x + y$ . Determine the probability that  $F > 40$

- a) Using a z-score
- b) Using a Monte-Carlo simulation with 100,000 samples of F

6) Let  $G = x + y + z$ . Determine the probability that  $G > 60$

- a) Using a z-score
- b) Using a Monte-Carlo simulation with 100,000 samples of G

In Matlab: use `randn` (standard normal). multiply by the standard deviation, add the mean

```
x = randn*6 + 10;  
y = randn*8 + 15;  
z = randn*10 + 20;  
F = x + y;  
G = x + y + z;
```