

# ECE 341 - Homework #7

Uniform and Exponential Distributions. Summer 2023

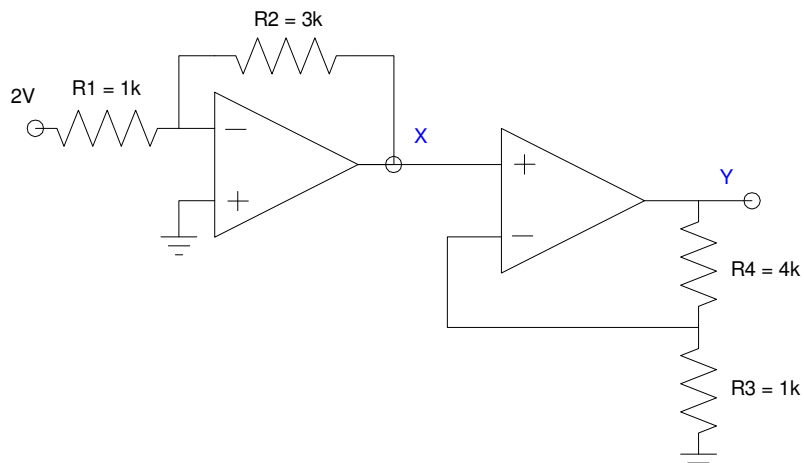
## Uniform Distributions

Let

- $\mathbf{a}$  be a sample from A, a uniform distribution over the range of (0, 3)
- $\mathbf{b}$  be a sample from B, a uniform distribution over the range of (0, 5)

- 1) Determine the pdf for  $\mathbf{a} + \mathbf{b}$  using moment generating functions (i.e. LaPlace transforms)
- 2) Determine the pdf for  $\mathbf{a} + \mathbf{b}$  using convolution (by hand or Matlab)

3) Assume each resistor has a tolerance of 5% (i.e. a uniform distribution over the range of (0.95, 1.05) of the nominal value). Determine the mean and standard deviation for the voltage at Y for the following circuit using a Monte Carlo simulation.



## Exponential Distributions

Let

- $\mathbf{d}$  be a sample from D, an exponential distribution with a mean of 10
- $\mathbf{e}$  be a sample from E, an exponential distribution with a mean of 15
- $\mathbf{f}$  be a sample from F, an exponential distribution with a mean of 20

4) Let  $X = d + e$

- a) Use convolution to find the pdf of X
- b) Use moment generating functions to find the pdf of X
- c) Check that the two answers match at  $t = 10$  seconds.

5) Let  $Y = d + e + f$

- a) Use convolution to find the pdf of Y
- b) Use moment generating functions to find the pdf of Y
- c) Check that the two answers match at  $t = 10$  seconds.

Skip 4 & 5  
(Pascal distribution)  
(next lecture)

## 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 50 seconds.
- The time it takes to serve each customer is an exponential distribution with a mean of 40 seconds.

6) 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?