

ECE 341 - Homework #7

Uniform and Exponential Distributions. Summer 2023

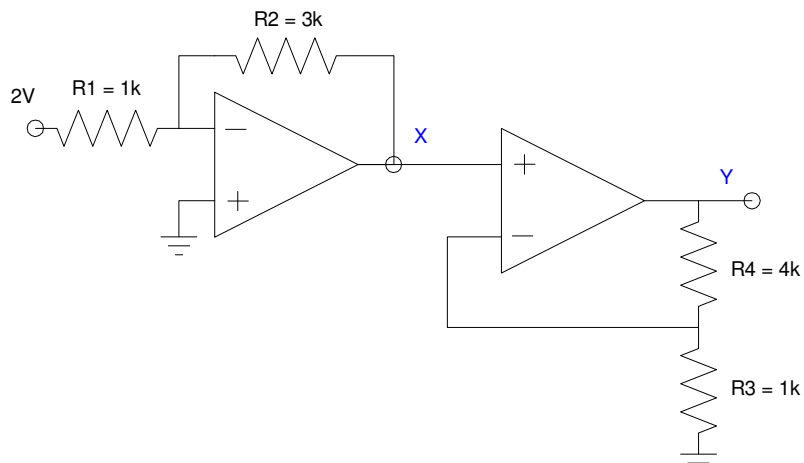
Uniform Distributions

Let

- **a** be a sample from A, a uniform distribution over the range of (0, 3)
- **b** be a sample from B, a uniform distribution over the range of (0, 5)

- 1) Determine the pdf for **a + b** using moment generating functions (i.e. LaPlace transforms)
- 2) Determine the pdf for **a + 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

- **d** be a sample from D, an exponential distribution with a mean of 10
- **e** be a sample from E, an exponential distribution with a mean of 15
- **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.

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?