ECE 341 - Test #2

Continuous Probability

Open-Book, Open Notes. Calculators, Matlab, Tarot cards, Internet allowed. Just not other people.

Please sign if possible (i.e. you did not get help from someone else).

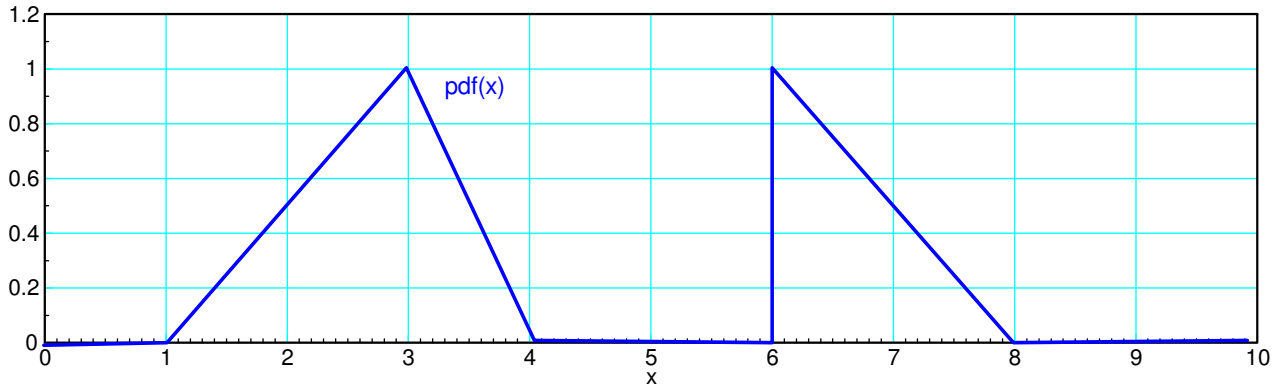
No aid given, received, or observed: _____

Due Sunday, June 7th, 8am

Please make the subject "ECE 341 Test2" if submitting homework electronically to Jacob_Glower@yahoo.com (or on blackboard)

1) Continuous PDF

For the following probability density function



a) Determine the scalar to multiply this curve so that it is a valid pdf (i.e. the total area = 1.0000)

b) Determine the moment generating function (i.e. LaPlace transform)

2) Uniform PDF

Assume each resistor has 5% tolerance with a uniform distribution:

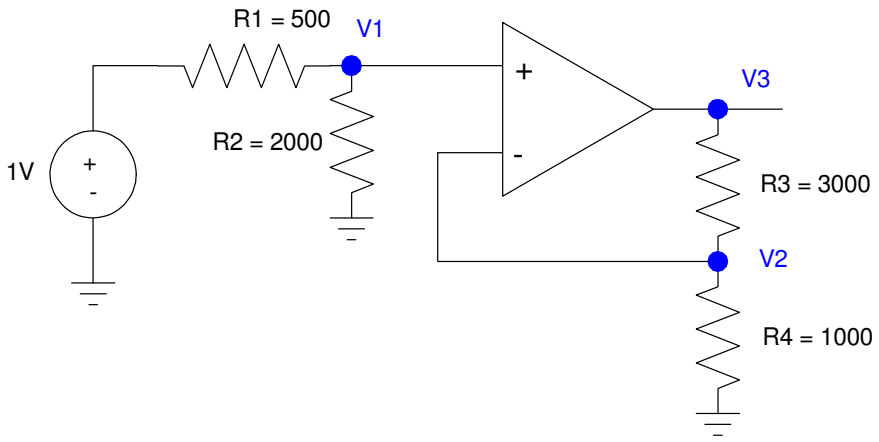
$$R = (1 + 0.05x)R_0$$

where x is uniform(-1, 1).

a) Write the voltage node equations for this circuit in terms of {R1, R2, R3, R4}

b) Run a Monte Carlo simulation to solve for V3 with 1000 sets of R's

c) Determine the mean and standard deviation of V3



3) Geometric & Gamma PDF

Let A, B, and C be continuous exponential distributions:

- A has a mean of 2
- B has a mean of 4, and
- C has a mean of 5

a) Determine the pdf of Y = A + B + C using convolution

- Give your Matlab code and resulting plot of the pdf

b) Determine the pdf of Y = A + B + C using moment generating functions (LaPlace transforms)

4) Central Limit Theorem

Let A, B, and C be continuous uniform distributions

- A = uniform over the interval of (1, 4)
- B = uniform over the interval of (1, 5)
- C = uniform over the interval of (1, 6)
- Y = A + B + C

a) Using convolution, determine the pdf for Y

- Give your Matlab code and resulting plot of the pdf

b) Determine the probability that $Y > 12$

c) Use a normal approximation to Y to determine the z-score corresponding to $Y=12$ and the probability that $Y > 12$

5) Testing with Normal PDF

Let A and B be NPN transistors. The data sheets specify the minimum and maximum current gain

		min hfe (0.5%)	max hfe (99.5%)	mean	standard deviation
A	ZTX857	100	300		
B	ZTX690B	150	500		

Assume both transistors have a normal distribution and the min/max corresponds to the 99% confidence interval (each tail is 0.5% or 0.005).

5a) What is the mean and standard deviation for both transistors with this assumption?

5b) If you pick one transistor at random for each type, what is the probability that transistor B will have a higher gain (hfe) than transistor A?