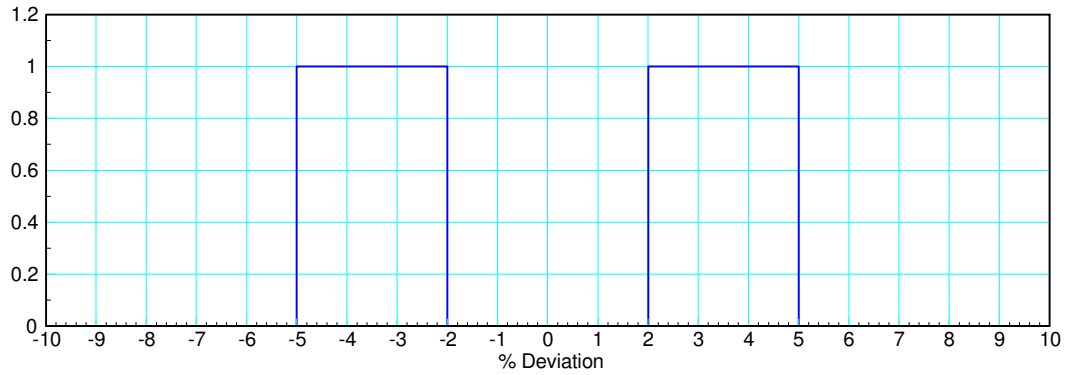# ECE 341 - Test #2

Continuous Probability - Summer 2024

1) Continuous PDF

A 5% tolerance rersistor often has a pdf as shown below (resistors which are within 2% of rated value are removed and sold as 2% or 1% resistors).

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

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

2) Uniform Distribuitions

Let A, B, and C be continuous uniform distributions
- A = uniform over the interval of (3, 7)
- B = uniform over the interval of (1, 2),
- X = A + B

Use moment generating functions to determine the pdf for X (i.e. LaPlace Transforms)

3) Gamma CDF

Let A, B be continuous exponential distributions:

- A has a mean of 2 seconds $a(t) = \frac{1}{2}e^{-t/2}u(t)$ $A(s) = \left(\frac{1/2}{s+1/2}\right)$

- B has a mean of 5 seconds $b(t) = \frac{1}{5}e^{-t/5}u(t)$ $B(s) = \left(\frac{1/5}{s+1/5}\right)$

The moment generating function for the cdf of Y = two A's and one B happens is

$$Y = \left(\frac{1}{s}\right)\left(\frac{1/2}{s+1/2}\right)^2\left(\frac{1/5}{s+1/5}\right)$$

Determine the equation for the cdf (i.e. take the inverse LaPlace transform)

4) Central Limit Theorem

The Dungeons and Dragons spell *Meteor Swarm* does 20-120 damage (the sum of twenty 6-sided dice)

$$y = 20d6$$

Use a normal approximation to determine the probability that the total damage is more than 99.5

die	d4	d6	d8	d10	d12
mean	2.5000	3.5000	4.5000	5.5000	6.5000
variance	1.2500	2.9167	5.2500	8.2500	11.9167

mean of y	standard deviation of y	z-score for sum = 99.5	p(sum > 99.5)

5) Testing with Normal pdf

Two wizards in Dungeons and Dragons cast spells. Let
- A be the damage done by a *Flame Strike* spell (the sum of eight 6-sided dice: 8d6)
- B be the damage done by a *Firestorm* spell (sum of seven 10-sided dice: 7d10)

die	d4	d6	d8	d10	d12
mean	2.5000	3.5000	4.5000	5.5000	6.5000
variance	1.2500	2.9167	5.2500	8.2500	11.9167

Use a normal approximation to determine the probability that A > B

	A = 8d6	B = 7d10	W = A - B
mean			
variance			
z-Score			
p(A > B)			