ECE 3710

Final Exam

Manage your time.

Students are allowed to use any material that has been uploaded on Canvas or TEMAS for the course.

The textbook is permitted for the exam.

Calculator is permitted.

For the programming questions, students are allowed to use MATLAB or PYTHON. You must include your codes, as well.

No other internet resources are allowed for the exam.

Students are required to upload their solutions on Canvas no later than Friday, June 23, 11:59 pm. This is a strict deadline, and no excuse will be accepted for late submissions. Make sure you submit the correct file and double-check your submission.

There are 3 questions to be answered.

Name:

UVU id:

1. (**40 points**) A batch of n resistors have an **average of 101.5** Ohms. Assuming a population **sample variance** of **25**. We are interested to see whether the population mean is 100 Ohms at a level of significant **0.05** (meaning that our criterion for drawing the conclusion from the **p-value** is based on **0.05**). The hypothesis testing is as follows.

   a) $H_0: \mu = 100 \quad versus \;\; H_1: \mu \neq 100.$

   For $n = \mathbf{100}$, compute the **p-value** and **draw a conclusion** for our test.

   b) $H_0: \mu \geq 100 \quad versus \; H_1: \mu < 100.$

   For $n = \mathbf{100}$, compute the **p-value** and **draw a conclusion** for our test.

   c) $H_0: \mu \geq 100 \quad versus \; H_1: \mu < 100.$

   For $n = \mathbf{10}$, compute the **p-value** and **draw a conclusion** for our test.

<u>You need to show your work with an explanation for each part.</u>

2. (**30 points**) A clinical trial (**N # 50 patients**) has been performed in which the volume of distribution of a new anti-diabetes drug has been calculated as **9.5 $\pm$ 5.0 L**. Calculate the **65%** and **95%** confidence limits of the mean value (assuming that the data originated from a normal distribution).

3. (**30 points**) We are given the following set of input-output (x,y) data.

x: *Late Payments*	y: *Credit Score*
0.43	772
0.67	735
0.40	774
0.45	769
0.80	723

Suppose that we want to model the above set of data with a linear model $y = ax + b$. Since our model may be perfect and there might be some noise in the measurements y , we assume

$y = ax + b + e$, where e is the error in our modeling.

a) Write down the matrix structure for this problem using the given model and the input-out data.
b) Write down the structure of the solution for the coefficients a and b. Then, use MATLAB or Python to solve for the coefficients of the model, i.e., a and b using least-squares error method. Include your code and the obtained results.

c) Fill out the last column of the following table using the model and obtained coefficients.

x: *Late Payments*	y: *Credit Score*	Estimated Credit Score using $\hat{y} = ax + b$
x_1 = 0.43	y_1 = 772	$\hat{y}_1$ =?
x_2 = 0.67	y_2 = 735	$\hat{y}_2$ =?
x_3 = 0.40	y_3 = 774	$\hat{y}_3$ =?
x_4 = 0.45	y_4 = 769	$\hat{y}_4$ =?
x_5 = 0.80	y_5 = 723	$\hat{y}_5$ =?

d) Find the **normalized squared-error** defined as follows

$e = \sqrt{\frac{1}{5}\sum_{n=1}^{5}(y_n - \hat{y}_n)^2}$, where y_n is the nth measurement and $\hat{y}_n$ is the output of the model evaluated at the nth input data.

Good luck.