National University of Sciences & Technology
School of Electrical Engineering and Computer Science
Department of Humanities and Sciences
MATH-361: Probability and Statistics (3+0): 2k20 BEE-12ABCD Fall 2022

Assignment 2	
CLO2: Analyze random variables, probability distributions and sampling distributions CLO3: Apply different probability and statistics techniques in engineering problems	
Maximum Marks: 10	Instructor: Ansar Shahzadi
Announcement Date: 15th December 2022	Due Date: 23th December 2022(Class of Probability and Statistics)

Instructions:

- Understanding the question is part of the assignment and copying is not allowed.
- Express your answer in the most simplified form. Direct calculations using calculator are not allowed, you need to show the detail of your work to get the maximum marks.
- This is a group assignment. Each group has only 6 members.
- Assignment must be handwritten on A4 papers and properly bound.
- There are two pages in this assignment, including this cover page. The first page should be part of every assignment.
- Assignment is not acceptable after deadline.

Sr. No.	Students Name	CMS Id.
1		
2		
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Total Marks	**Marks Obtained**
10	

Questions

1) If a random sample of size 2 are drawn without replacement from population consisting of the five numbers: 4, 6, 7, 8, and 10; Show by finding all possible samples, that

- **a)** $E(S^2) \neq \sigma^2$
- **b)** $E(s^2) = \sigma^2$
- **c)** $E(\bar{X}) = \mu$

2) Draw all possible samples of size n_1=2 with replacement from a finite population consisting of 1,3, and 5. Similarly draw all possible random samples of size n_2=2 with replacement from another population consisting of 2, 4 and 6.

- **a)** Find the possible differences between the sample means of two populations.
- **b)** Construct the sampling distribution of $\bar{X}_1 - \bar{X}_2$.
- **c)** Verify that

$$E(\bar{X}_1 - \bar{X}_2) = \mu_1 - \mu_2$$

$$and\ Var(\bar{X}_1 - \bar{X}_2) = \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}$$

3) The thicknesses of glass sheets produced by a certain process are normally distributed with a mean of 3mm and standard deviation of 0.12mm.

- **a)** What is the probability that a glass sheet is thicker than 3.2mm?
- **b)** What is the probability that a glass sheet is thinner than 2.7mm?
- **c)** What is the value of *c* for which there is a 99% probability that a glass sheet has a thickness within the interval [3 -c, 3+c]?
- **d)** What is the probability that three glass sheets placed one on top of another have a total thickness greater than 9.50mm?

4) An article in the journal of material engineering describes the loads of specimens as following 19.8, 15.4, 11.4, 19.5, 10.1, 18.5, 14.1, 8.8, 14.9, 7.9, 17.6, 13.6, 7.5, 12.7, 16.7, 11.9, 15.4, 11.9, 15.8, 11.4, 15.4, and 11.4

- **a)** Find the 99% confidence interval for the mean?
- **b)** Does this suggest that the mean load at failure exceeds 13 at 1% level of significance?
- **c)** If population standard deviation is 3, then discuss the results of part (b).

5) Discuss the details of Probability and Non-probability Sampling Methods.

6) Discuss following topic with help of examples:

- **a)** Point Estimation
- **b)** Properties of point estimator
- **c)** Maximum likelihood method.