Dear Student,

Please read the information on assignments in the Programme Guide that we have sent youafter your enrolment. A weightage of 30%, as you are aware, has been earmarked for continuousevaluation, **which would consist of one tutor-marked assignment** for this course. The assignmentsfor the theory courses MST-001 to MSTE-004 have been given inthis booklet.

**Instructions for Formatting Your Assignments**

Before attempting the assignment, please read the following instructions carefully:

1) On top of the first page of your answer sheet, please write the details exactly in the following format:

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ENROLLMENT NO :……

NAME :……

ADDRESS :……

……

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PROGRAMME CODE: ……..

COURSE CODE: …….

COURSE TITLE: ……

STUDY CENTRE: ……..……. DATE: …….……...

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**PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION ANDTO AVOID DELAY.**

2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.

3) Leave 4 cm margin on the left, top and bottom of your answer sheet.

4) Your answers should be precise.

5) This assignment is to be submitted at the Study Centre.

   **We strongly suggest that you should retain a copy of your answer sheets.**

6) This assignment is valid from January 1st, 2025up toDecember 31, 2025.

7) The latest assignments should be submitted by the candidate.

8) **You cannot fill the Exam Form for this course** till you have submitted this assignment. So solve itand **submit it to your study centre at the earliest.**If you wish to appear in the **TEE, June 2025,** you should submit your TMAs by**March 31, 2025.** Similarly, If you wish to appear in the **TEE, December 2025,** you should submit your TMAs by**September 30, 2025.**

We wish you good luck.

**TUTOR MARKED ASSIGNMENT**

**MST-004: Statistical Inference**

**Course Code: MST-004** **Assignment Code: MST-004/TMA/2025**

**Maximum Marks: 100**

**Note: All questions are compulsory. Answer in your own words.**

**1.** State whether the following statements are **True** or **False**. Give reason in support of your answer: **(5×2=10)**

**(a)** If the probability of non rejection of $H_0$ when $H_1$ is true is 0.4 then power of the test will be 0.6.

**(b)** If $T_1$ and $T_2$ are two estimators of the parameter $\theta$ such that $Var(T_1) = 1/n$ and $Var(T_2) = n$ then $T_1$ is more efficient than $T_2$.

**(c)** A 95% confidence interval is smaller than 99% confidence interval.

**(d)** If the level of significance is the same, the area of the rejection region in a two-tailed test is less than that in a one-tailed test.

**(e)** Non parametric tests are more powerful than the parametric tests.

**2.** If a finite population has four elements: 6, 1, 3, 2.

**(a)** How many different samples of size n = 2 can be selected from this population if you sample without replacement?

**(b)** List all possible samples of size n = 2.

**(c)** Compute the sample mean for each of the samples given in part *b*.

**(d)** Find the sampling distribution of $\bar{x}$ and draw the histogram.

**(e)** Compute standard error.

**(f)** If all four population values are equally likely, calculate the value of the population mean $\mu$. Do any of the samples listed in part (b) produce a value of $\bar{x}$ exactly equal to $\mu$? **(13)**

**3.** A study was conducted to compare the mean numbers of police emergency calls per 8-hour shift in two districts of a large city. Samples of 100 8-hour shifts were randomly selected from the police records for each of the two regions and the number of emergency calls was recorded for each shift. The sample statistics are listed here:

| | **Region** | |
|---|---|---|
| | **1** | **2** |
| Sample size | 100 | 100 |
| Sample mean | 2.4 | 3.1 |
| Sample variance | 1.44 | 2.64 |

Find a 90% confidence interval for the difference in the mean numbers of police emergency calls per shift between the two districts of the city. Interpret the interval. **(7)**

**4.** A bond proposal for school construction will be submitted to the voters at the next municipal election. A major portion of the money derived form this bond issue will be used to build schools in a rapidly developing selection of the city, and the remainder will be used to renovate and update school buildings in the rest of the city. To assess the viability of the bond proposal, a random sample of $n_1 = 50$ residents in the developing section and $n_2 = 100$ residents from the other parts of the city were asked whether they plan to vote for the proposal. The results are tabulated below

**Sample Values for Opinion on Bond Proposal**

| | **Developing Section** | **Rest of the City** |
|---|---|---|
| Sample size | 50 | 100 |
| Number favoring proposal | 38 | 65 |

**(a)** Estimate the difference in the true proportions favoring the bond proposal with a 99% confidence interval.

**(b)** If both samples were pooled into one sample of size n = 150, with 103 in favor of the proposal, provide a point estimate of the proportion of city residents who will vote for the bond proposal. **(10)**

**5.** The following data relate to the number of items produced per shift by two workers for a number of days:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Worker A** | 19 | 22 | 24 | 27 | 24 | 18 | 20 | 19 | 25 | |
| **Worker B** | 26 | 37 | 40 | 35 | 30 | 40 | 26 | 30 | 35 | 45 |

Can it be inferred that Worker A is more stable worker compared to B by testing the variation in the item produced by them at 5% level of significance. **(10)**

**6.** If magnitude of earthquakes recorded in a region of a country follows a distribution with parameter μ whose pdf is given below:

$$f(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(x-\mu)^2}, -\infty < x, \mu < \infty$$

then show that the estimators of the parameter μ using maximum likelihood and method of moments are same. **(15)**

**7.** A company plans to promote a new product by using one of three advertising campaigns. To investigate the extent of product recognition from these three campaigns, 15 market areas were selected and five were randomly assigned to each advertising plan. At the end of the ad campaigns, random samples of 400 adults were selected in each area and the proportions who were familiar with new product were recorded. The responses were not approximately normal. Is there a significant difference among the three population distributions from which these samples came? Use an appropriate nonparametric method to answer this question at 5% level of significance.

| **Campaign** | | |
|---|---|---|
| **1** | **2** | **3** |
| 0.33 | 0.28 | 0.21 |
| 0.29 | 0.41 | 0.30 |

| | | |
|---|---|---|
| 0.21 | 0.34 | 0.26 |
| 0.32 | 0.39 | 0.33 |
| 0.25 | 0.27 | 0.31 |

**(15)**

**8.** A psychology class performed an experiment to determine whether a recall score in which instructions to form images of 25 words were given differs from an initial recall score for which no imagery instructions were given. Twenty students participated in the experiment with the results listed in the table:

| **Student** | **With Imagery** | **Without Imagery** | **Student** | **With Imagery** | **Without Imagery** |
|---|---|---|---|---|---|
| 1 | 20 | 5 | 11 | 17 | 8 |
| 2 | 24 | 9 | 12 | 20 | 16 |
| 3 | 20 | 5 | 13 | 20 | 10 |
| 4 | 18 | 9 | 14 | 16 | 12 |
| 5 | 22 | 6 | 15 | 24 | 7 |
| 6 | 19 | 11 | 16 | 22 | 9 |
| 7 | 20 | 8 | 17 | 25 | 21 |
| 8 | 19 | 11 | 18 | 21 | 14 |
| 9 | 17 | 7 | 19 | 19 | 12 |
| 10 | 21 | 9 | 20 | 23 | 13 |

**(a)** What two testing procedures can be used to test for differences in the distribution of recall scores with and without imagery? What assumptions are required for the parametric procedure? Do these data satisfy these assumptions?

**(b)** Use both the parametric and non-parametric tests for differences in the distributions of recall scores under these two conditions.

**(c)** Compare the results of the tests in part b. Are the conclusions for same? If not, why not?

**(20)**