BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – M.Sc.(MATH)-2024
Course Name – Mathematical Statistics
Course Code - MSCMC103
(Semester I)

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Brainware University
398, Ramkrishnapur Road, Barasat
Kolkata, West Bengal-700125

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) A problem is given to three students and chances of solving it by them are 1/2, 1/3 and 1/4 respectively. Enumerate the probability that the problem will be solved.

a) 1/4 b) 13/36
c) 3/4 d) 7/12

(ii) If the third moment about mean is zero then the distribution is _____. Identify the correct option.

a) Positively skewed b) Negatively skewed
c) Symmetrical d) None of these

(iii) A man and his wife appear in an interview for two vacancies in the same post. The probability of husband's selection is (1/7) and the probability of wife's selection is (1/5). Enumerate the probability that only one of them is selected.

a) 2/7 b) 1/7
c) 3/4 d) 4/5

(iv) Identify the correct statement from the following.

a) Sampling error increases as we increase the sampling size. b) Sampling error remains constant as we increase the sampling size.
c) Sampling error decreases as we increase the sampling size. d) None of these

(v) If for any two variables cov(x,y)=0, then it implies _____. Identify the correct option.

a) there are no correlation between them b) They are independent
c) No correlation and independent d) None of these

(vi) In a regression line, the predicted value of Y is 25 and the observed value is 28. Estimate the value of regression error in the prediction.

a) 3 b) 25
c) 28 d) None of these.

(vii) The difference between a statistic and the parameter is called _____. Select the correct answer.

a) Random b) Non-random
c) Sampling error d) Probability

(viii) Suppose 5 observations from a Normal population is taken: 18,12,16,14,15. Compute the maximum likelihood estimator of the population mean.

a) 18 b) 12
c) 15 d) None of these

(ix) Suppose 10 coin is tossed and the outcomes are: H, H, T, T, T, T, H, H, T, H. Compute the unbiased estimator of p, probability of success (getting head).

a) 0.4
b) 0.5
c) 0.3
d) None of these

(x) Choose the degrees of freedom for the test statistic in one sample t-test

a) 1
b) n
c) n-1
d) 0

(xi) Select the statement that is not true.

a) The probability of making a Type II error increases as the probability of making a Type I error decreases
b) The probability of making a Type II error and the level of significance are the same
c) The power of the test decreases as the level of significance decreases
d) None of these

(xii) There is a fire, but the smoke detector doesn't go off. Explain the type of error.

a) Type-I error
b) Type-II error
c) No error
d) Power

(xiii) If a hypothesis test were conducted using $\alpha = 0.05$, Select the correct p-value that would result in the rejection of null hypothesis.

a) 0.1
b) 0.041
c) 0.055
d) 0.060

(xiv) Choose the correct option from the following that is true about the p-value.

a) It represents the probability that the null hypothesis is true
b) A smaller p-value indicates stronger evidence against the null hypothesis
c) It ranges from 0 to 1, where 0 represents strong evidence against the null hypothesis
d) It is always equal to the significance level

(xv) Choose which of the following distributions used in ANOVA tests

a) F-test
b) T-test
c) Z-test
d) Chi-square test

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Group-B

(Short Answer Type Questions) 3 x 5=15

2. Write down the assumptions of Cramer-Rao inequality and state Cramer-Rao inequality. (3)

3. Suppose a sample is taken from a normal distribution with mean $\bar{x}$ =0.354 and population S.D= 0.048. If the sample size is taken to be 15 ,estimate a 95% confidence interval for population mean(μ). (3)

4. Describe the concept of Strong Law of Large Number (SLLN). (3)

5. Estimate the expectation and standard error of the sample mean for a random sample of size n drawn from the population of size N in with replacement procedure (3)

6. A government association claims that 44% of adults in the United States do volunteer work. You work for a volunteer organization and are asked to test this claim. You find that in a random sample of 1165 adults, 556 do volunteer work. Conclude, about the rejection of the association's claim at alpha = 0.05. (3)

OR

You represent a chemical company that is being sued for paint damage to automobiles. You want to support the claim that the mean repair cost per automobile is not \$650.Conclude the null and alternative hypotheses. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. A biased coin, which lands heads with probability 1/10 each time it is flipped, is flipped 200 times consecutively. Enumerate an upper bound on the probability that it lands heads at least 120 times. (5)

8. Show that $\bar{x}$ is distributed Normally with mean μ and variance $\frac{\sigma^2}{n}$, while $(n-1)s^2/\sigma^2$ is distributed as chi-square with (n-1) degrees of freedom. (5)

9. State and Illustrate the N-P lemma. (5)

10. Explain the procedure of obtaining a confidence interval for mean also interpret a confidence interval. (5)

11. Suppose that a random sample of size 10 drawn from a Normal population, has mean 40 and s.d 12.Calculate a 99% confidence limits for the population mean.(Given $t_{.005}$=3.25) (5)

12. Escobar performed a study to validate a translated version of the Western Ontario and McMaster University index (WOMAC) questionnaire used with Spanish-speaking patient s with hip or knee osteoarthritis. For the 76 women classified with sever hip pain. The WOMAC mean function score was 70.7 with standard deviation of 14.6, we wish to know if we may conclude that the mean function score for a population of similar women subjects with sever hip pain is less than 75. Let α =0.01. Evaluate the hypothesis. (5)

OR

A dice is thrown 400 times and 'four' resulted 60 times. Do the data justify that the hypothesis of an unbiased dice. (5)

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