



BRAINWARE UNIVERSITY

Term End Examination 2022
Programme – M.Sc.(MATH)-2022
Course Name – Mathematical Statistics
Course Code - MSCMC103
(Semester I)

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) If $(X, Y) \sim BVN(3, 5, 1, 1, 0.5)$, compute $E(X+Y)$.

- a) 10
- b) 8
- c) 18
- d) None of these

(ii) Compute the value of correlation coefficient if $b_{xy} = 0.9$ and $b_{yx} = 0.4$

- a) 0.6
- b) 0.36
- c) -0.6
- d) -0.36

(iii) Find the correlation coefficient between X and Y:

X	-2	-1	0	1	2
Y	4	1	0	1	4

- a) 0
 - b) 1
 - c) -1
 - d) None of these
- (iv) The largest order statistic can be called by _____. Select the correct answer.
- a) Distribution of minimum statistics
 - b) Distribution of maximum statistics
 - c) Both
 - d) None of these
- (v) For a uniform distribution the smallest order statistic will follow _____. Select the correct answer.

- a) Binomial
c) Normal
- b) Poisson
d) Beta
- (vi) Explain asymptotic mean in statistics.
- a) It refers to how an estimator behaves as the sample size gets larger.
c) It refers to how an estimate behaves as the sample size gets larger.
- b) It refers to how an estimator behaves as the sample size gets smaller.
d) It refers to how an estimate behaves as the sample size gets smaller.
- (vii) If two events are independent, then _____. Identify the correct option.
- a) they must be mutually exclusive
c) their intersection must be zero
- b) the sum of their probabilities must be equal to one
d) none of these alternative is correct
- (viii) Identify the measure of location which is the most likely to be influenced by extreme values in the data set.
- a) Range
c) Median
- b) Mean
d) Mode
- (ix) Identify which of the following is not a property of a binomial experiment?
- a) the experiment consists of a sequence of n identical trials
c) the probabilities of the two outcomes can change from one trial to the next
- b) each outcome can be referred to as a success or a failure
d) the trials are independent
- (x) Suppose that vehicle speeds at an interstate location have a normal distribution with a mean equal to 70 mph and standard deviation equal to 8 mph. Estimate the z-score for a speed of 64 mph.
- a) 0.75
c) 0.6
- b) -0.75
d) -0.6
- (xi) Evaluate the number of possible samples of size 2 out of 5 population size in SRSWR.
- a) 10
c) 32
- b) 25
d) 29
- (xii) In SRSWR, the same sampling unit may be included in the sample
- a) only once
c) More than once
- b) two times
d) None
- (xiii) Suppose 10 coin is tossed and the outcomes are: H, H, T, T, T, T, H, T, H. Solve the MLE of p, probability of success (getting head).
- a) 0.4
c) 0.8
- b) 0.6
d) none of these
- (xiv) Suppose 10 coin is tossed and the outcomes are: H, H, T, T, T, T, H, H, T, H. Solve the unbiased estimator of p, probability of success (getting head).
- a) 0.4
c) 0.3
- b) 0.5
d) None of these
- (xv) In t-distribution for two independent samples, the sample size is $n_1 = n_2 = n$, then estimate the degrees of freedom
- a) $2n-2$
c) n
- b) $n-1$
d) $2n+1$

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Describe the assumptions of a multiple linear regression models. (3)

OR

Describe the maximum likelihood method of estimation. What are the properties of a maximum likelihood estimator? (3)

3. The length of time, in hours of a group of people to play one soccer match is normally distributed with a mean of 2 hours and a standard deviation of 0.5 hours. A sample of size $n = 50$ is drawn randomly from the population. Compute the probability that the sample mean is between 1.8 hours and 2.3 hours. (3)

OR

If (X, Y) is $BVN(3, 1, 16, 25, 3/5)$, compute $P(3)$ (3)

4. Sometimes an estimator with larger variance may be preferable - explain. (3)

OR

Unbiased estimator does not always exist - explain. (3)

5. Explain the hypothesis test for the equality of variances. (3)

OR

Estimate the minimal sufficient statistic for Uniform $(0, \theta)$. (3)

6. Construct 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)

OR

Develop the distribution of the maximum order statistic of a uniform random variable. (3)

Group-C

(Long Answer Type Questions)

5 x 6=30

7. Define multiple correlation. Deduce the formula for multiple correlation coefficients in terms of total correlation coefficients (5)

OR

Define partial correlation. Deduce the formula for partial correlation coefficients in terms of total correlation coefficients. (5)

8. Let x_1, x_2 be taken from Normal distribution with mean and variance μ, σ^2 . Construct the maximum likelihood estimators of μ and σ^2 . (5)

OR

Construct the limiting distribution of chi-square distribution using the moment generating function. (5)

9. Compute the mean, variance and standard deviation of a Binomial distribution with parameter n and p . (5)

OR

Compute the mean and variance for a normal distribution. (5)

10. (5)

On the basis of observations made on 35 cotton plants the total correlation of yield of cotton (X_1)

number of bolls, seed-vessels (X_2) and height (X_3) are found to be

$$r_{12} = 0.863, r_{13} = 0.648, r_{23} = 0.709$$

Calculate the multiple correlation coefficient $r_{1.23}$ and the partial correlation coefficients $r_{12.3}$ and $r_{13.2}$.

OR

(5)

If (X, Y) is $BVN(5, 3, 16, 25, 1/2)$, Calculate the followings:

- (i) $E(Y|X=6)$
- (ii) $V(Y|X=6)$
- (iii) $P(2 < X < 9 | X=8)$

11. Illustrate the test for the equality of means of two normal population using likelihood ratio test. (5)

OR

On the basis of observations made on 35 cotton plants the total correlation of yield of cotton ()number of bolls, seed-vessels() and height() are found to be Calculate the multiple correlation coefficient and the partial correlation coefficients and (5)

12. State and prove Rao-Blackwell theorem. (5)

OR

State and prove the necessary and sufficient condition for an Unbiased estimator to be an UMVUE (5)
