BRAINWARE UNIVERSITY

Term End Examination 2019 – 20

Programme – Master of Science in Mathematics

Course Name – Mathematical Statistics

Course Code – MSCMC103

(Semester – 1)

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

[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) 20 x 1 = 20

1. Answer any *twenty* from the following

(i) Which of the following is not based on all the observations?

a. Mean b. Median

c. Mode d. None of these

(ii) Find the number of all possible samples from a population containing 8 items from which 2 items are selected at random without replacement.

a. 56 b. 28

c. 38 d. 66

(iii) The estimated value of the unknown parameter p of B(n, p):

a. $\frac{\bar{x}}{n}$ b. $n\bar{x}$

c. $\bar{x}$ d. None of these

(iv) Any population regarding measurement is called

a. Statistic b. Parameter

c. Estimator d. none of these

(v) Probability distribution of a statistic called

a. sampling b. parameter

c. sampling distribution d. none of these

(vi) A statement about a population developed for the purpose of testing is called:

a. hypothesis
b. hypothesis testing
c. level of significance
d. test-statistic

vii) The number of independent values in a set of values is called

a. test statistic
b. degrees of freedom
c. level of significance
d. level of confidence

(viii) Statistical inference has two branches namely:

a. Level of confidence and degrees of freedom
b. Biased estimator and unbiased estimator
c. Point estimator and unbiased estimator
d. Estimation of parameter and testing of hypothesis

(ix) If $\hat{\theta}$ be an unbiased estimator of the parameter θ, then

a. $E(\hat{\theta}) > \theta$
b. $E(\hat{\theta}) < \theta$
c. $E(\hat{\theta}) = \theta$
d. None of these

(x) A hypothesis can be classified as:

a. Null
b. simple
c. composite
d. all the above

(xi) The chance of rejecting of a true hypothesis decreases when sample size is

a. increases
b. decreases
c. constant
d. both (a) and (b)

(xii) In t-distribution for two independent samples $n_1 = n_2 = n$, then the degrees of freedom is equal to:

a. 2n – 1
b. 2n – 2
c. 2n + 1
d. n – 1

(xiii) If for any two variables cov(x,y)=0, then it implies

a. there is no correlation between x and y
b. the two variables are independent
c. both(a) and (c)
d. None of these

(xiv) A square matrix in which the diagonal elements are equal to 1 and the off-diagonal elements are equal to 0 is known as:

a. A variance–covariance matrix
b. A column vector
c. An identity matrix
d. The error sum of squares and cross-products matrix (or error SSCP)

(xv) If n number of samples are drawn without replacement at random from a population of size N, then the possible number of ways samples can be chosen:

a. N^n b. N^n-N

c. N d. N

(xvi) The unbiased estimator of population variance σ^2 is

a. Sample variance b. $\frac{n-1}{n}\sigma^2$

c. $\frac{n}{n-1}\sigma^2$ d. None of these

(xvii) The first order raw moment is equal to

a. Zero b. 1

c. Negative d. None of these

(xviii) The value of the multiple correlation coefficient is always (lies)

a. greater than 1 b. between 0 to 1

c. between -1 to +1 d. less than -1

(xix) If E(T)=5m+6 then the unbiased estimator of m is

a. 5T+6 b. 6T+5

c. T d. none of these

(xx) The m.l.e. of the unknown parameter m in poisson distribution is

a. $n\overline{x}$ b. $\overline{x}$

c. $\frac{\overline{x}}{n}$ d. None of these

(xxi) In which of the following types of sampling the information is carried out under the opinion of an expert?

a. quota sampling b. convenience sampling

c. purposive sampling d. judgment sampling

(xxii) The distribution for which mean and variance are equal is

a. Poisson b. Normal

c. Binomial d. Exponential

(xxiii) Interval estimate is associated with:

a. Probability b. Non-Probability

c. Range of values d. Number of parameters

(xxiv) A tentative assumption about a population parameter is called

a. hypothesis b. null hypothesis

c. significance level d. type-I error

(xxv) The mean of the binomial distribution is

a. less than the variance b. equal to its variance

c. greater than its variance d. greater than or equal to its variance

Group – B

(Short Answer Type Questions) 4 x 5 = 20

Answer any *four* from the following

2. A random sample of 16 values from a normal population is found to have a mean of 41.5 and a standard deviation of 2.795. On this information is there any reason to reject the hypothesis that the population mean is μ =43? Also find the confidence limit for μ. 5

3. A box contains 'a' white balls and 'b' black balls; 'c' balls are drawn. Show that the expectation of the number of white balls drawn is $\frac{ca}{(a+b)}$. 5

4. Define cumulative distribution function. For a random variable X, the distribution function is given by: 5

$$F_X(x) = \begin{cases} 0 & x < 0 \\ \frac{1}{4} & 0 \le x < 1 \\ \frac{1}{2} & 1 \le x < 2 \\ 1 & x \ge 2 \end{cases}$$

Categorize the random variable and plot the graph for this distribution.

5. Prove that moment generating function of the sum of a number of independent random variables is equal to the product of their respective moment generating functions. 5

6. (i) Define mixed random variables. 1+2+2

(ii) If a random variable X takes the values as

$$x_k = \frac{(-1)^k 2^k}{k}, k = 1,2,3 \dots \dots \dots$$

with probabilities $p_k = 2^{-k}$ find E(X).

(iii) Distinguish between population mean and sample mean.

7. Let X be a continuous random variable with the following pdf $f(x) = \frac{x}{2}, 0 \le x \le 2$. Find mean variance and standard deviation of X. 5

Group – C

(Long Answer Type Questions) 2 x 10 = 20

Answer any *two* from the following

8. Define Gamma distribution. Show that mean and variance of Gamma distribution are $\alpha\beta$ and $\alpha\beta^2$ respectively. 10

9. Derive the formula for mean and variance of Normal distribution. 10

10. A random variable X has a density function given by: 10

$$f(x) = \begin{cases} 2e^{-2x}, for x \geq 0 \\ 0, for x < 0 \end{cases}$$

Find m.g.f. and hence the first four moments of X about origin as well as standard deviation.

11. Following marks have been obtained by a class: 10

PaperI: 45	55	56	58	60	65	68	70	75	80	85
Paper II: 56	50	48	60	62	64	65	70	74	82	90

Compute coefficient of correlation and also lines of regression.
