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Paper Code : BBA-203

STATISTICS-II

Time Allotted : 3 Hours | *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) For a Binomial distribution, if $n = 9$ and $q = \frac{1}{4}$, then the mean is

   a) $\sqrt{\frac{27}{16}}$ b) $\frac{27}{4}$

   c) $\frac{27}{16}$ d) none of these.

   ii) When two perfect coins are tossed simultaneously, the probability of getting at least one head is

   a) $\frac{1}{4}$ b) 0

   c) 1 d) $\frac{3}{4}$.

iii) If $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$ and $P(A \cap B) = \frac{1}{4}$, then $P(A + B)$ is

a) $\frac{7}{12}$ b) $\frac{3}{4}$

c) $\frac{1}{8}$ d) $\frac{5}{6}$.

iv) If a false null hypothesis is accepted then

a) Type I error is committed

b) Type II error is committed

c) No error is committed

d) none of these.

v) If a random variable X follows Poisson distribution, with parameter m, then mean and variance are respectevely

a) m and $\frac{1}{m}$ b) $\frac{1}{m}$ and m

c) $\frac{1}{m}$ and $\frac{1}{m}$ d) m and m.

vi) Events are mutually exclusive when

a) they can appear simultaneously

b) they cannot appear simultaneously

c) they are non-existing

d) none of these.

vii) If X follows normal distribution with mean m and standard deviation σ, then the mean of $\left(\frac{X-m}{\sigma}\right)$ is

a) 0 b) 1

c) m d) none of these.

viii) A sample of size 81 has been drawn with replacement from a population with standard deviation 4·5. The standard error of sample mean is

a) 4·5 b) 0·055

c) 0·5 d) 5.

ix) A random sample of 64 observations has mean and variance 160 and 100 respectively. Then 95% confidence limits of population mean are

a) (157·55, 162·45) b) (155·57, 164·43)

c) (135·5, 184·5) d) none of these.

x) A function $f(x)$ will be a probability mean function, if it satisfies

a) $f(x) \geq 0$ b) $\sum f(x) = 1$

c) both (a) and (b) d) neither (a) nor (b).

xi) If X and Y are two independent variables with var $(x) = 5$ and var $(y) = 10$, then var $(2x + y) =$

a) 20 b) 30

c) 15 d) none of these.

xii) The mean of uniform distribution

$f(x) = K \quad a \leq x \leq b$

a) 0 b) $-\left(\frac{b-a}{2}\right)$

c) $\frac{a+b}{2}$ d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. A random variable X has the following probability distribution :

Value of X	0	1	2	3	4	7
$P(X)$	k	$3k$	$5k$	$7k$	11	$13k$

a) Determine k

b) Find $P(X < 3)$

c) Find $P(X \geq 3)$.

3. Box I contains three defective and seven non-defective balls and Box II contains one defective and nine non-defective balls. We select a box at random and then draw one ball at random from that box.

   a) What is the probability of drawing a non-defective ball ?

   b) What is the probability that box I was chosen, given a non-defective ball is drawn ?

4. A discrete random variable X follows a Poisson distribution such that $P(X = 1) = P(X = 2)$. Find the mean and variance of X.

5. For a Binomial distribution, mean is 4 and variance is 2. Find the probability of

   a) two success

   b) at least 2 success.

6. A random sample of 100 students from a large population of students is drawn. The average height of the students in the sample is 5·6 feet while the S.D. is 0·75 ft. Find

   a) 95%

   b) 99%

   confidence limits for the average height of all the students in the population.

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) An office switchboard receives telephone calls at the rate of 3 calls per minute on average. What is the probability of receiving no calls in one minute interval ? Given $\left(e^{-3} = 0 \cdot 4979\right)$.

   b) Two bags contain respectively 3 white and 2 red balls, 2 white and 4 red balls. One ball is drawn at random from the first bag and is put into the second, then a ball is drawn from the second bag. What is the probability that the ball drawn from the second bag is white ?

   c) If X is a random variable, then prove that

   $V(aX + b) = a^2 V(X)$. 4 + 6 + 5

8. a) For a population of six units, the values of a characteristic x are given as 3, 9, 6, 5, 7, 10. Consider all possible samples of size two using SRSWOR and show that the mean of the sample means is exactly equal to the population mean.

   b) Hospital records show that of patients suffering from a certain disease, 75% die of it. What is the probability that out of 6 randomly selected patients, 4 will recover ?

   c) A machine produced 20 defective articles in a batch of 400 articles. After overhauling it produced 10 defective articles in a batch of 300 articles. Has the performance of the machine improved after overhauling ? Test at 5% level of significance.

   6 + 4 + 5

9. a) You are given the following data about the life of two brands of bulbs :

Brand	Mean life	S.D.	Sample Size
Brand *A*	2000 hrs	250 hrs	60
Brand *B*	2230 hrs	300 hrs	100

Do you think there is a significant difference in the quality of the two brands of bulbs ?

b) A company surveyed employees to observe whether they preferred a large increase in retirement benefits or a similar increase in salary. From a group of 1000 male employees 850 supported the retirement benefits and out of 500 female employees 400 supported the retirement benefits. Test the null hypothesis that the proportions of men and women supporting retirement benefits are equal :

(given $\chi^2_{0.05}$ = 3.80 5.99 7.81

d.f = 1 2 3) 7 + 8

10. a) Show that the sample mean is an unbiased estimator of the population mean, but the sample variance is a biased estimator of the population variance.

b) The heights of 10 males of a given locality are found to be 70, 67, 62, 68, 61, 68, 70, 64, 64, 66 inches. Is it reasonable to believe that the average height is greater than 64 inches ? Test at 5% level of significance. Use *t*-distribution (tabulated value of *t* at 9 d.f. 5% level of significance is 1.833). 8 + 7

11. a) There are three brands of car tyre (*A*, *B*, *C*) available in the market. A random sample of 5 tyres is taken from each of these three brands. The lifetime of these tyres as measured by the mileage run in given below. On the basis of the data, test whether the average lifetime of the 3 brands of tyres are equal or not. [Tabulated value of $F_{0.01}$ (2, 12) = 6.93 and $F_{0.05}$ (2, 12) = 3.89]

Sl. No.	***Brand A***	***Brand B***	***Brand C***
1	70	80	89
2	71	88	80
3	73	83	92
4	78	86	94
5	75	87	95

b) If a random variable *X* follows a normal distribution whose mean is 18, s.d is 5, find the value of $P (8.2 < X < 27.8)$ and $P (X < 27.8 \ / \ X > 18)$.

Given that $\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{1.96} e^{\frac{-t^2}{2}} dt = 0.9750021$. 8 + 7