

2024

## STATISTICS

Full Marks: 100

Pass Marks: 33

Time: Three hours

*Attempt all Questions**The figures in the right margin indicate full marks for the questions.**For Question Nos. 1 to 10 choose the correct answer and rewrite.*

1. When A and B are events which are not mutually exclusive, the  $(A \cup B)$  is equal to – 1
  - A.  $P(A) + P(B)$
  - B.  $P(A) + P(B) - P(A \cup B)$
  - C.  $P(A) \times P(B)$
  - D. None of the above
2. In tossing a coin three times in succession, the number of sample points in the sample space is – 1
  - A. 6
  - B. 8
  - C. 3
  - D. 9
3. An urn contains 2 red balls, 3 blue balls and 4 black balls. Three balls are drawn at random. The probability that they are of same colour is – 1
  - A.  $\frac{5}{84}$
  - B.  $\frac{3}{9}$
  - C.  $\frac{2}{7}$
  - D.  $\frac{3}{7}$

P.T.O.

4. The first order difference  $\Delta x^2$  is equal to – 1  
A.  $x^3$  B.  $2x$   
C.  $x$  D.  $2x + 1$
5. For using Simpson's three-eighth Rule of numerical integration, the integrand is assumed to be a polynomial of degree – 1  
A. 1 B. 2  
C. 3 D. 4
6. The mean of binomial distribution with parameters 5 and 0.3 is – 1  
A. 1.05 B. 5.03  
C. 3.5 D. 1.5
7. The condition for consistency of a set of independent class frequencies is that no ultimate class frequency is – 1  
A. Zero B. Positive  
C. Negative D. Prime
8. In testing the equality of the means of two populations based on samples of sizes 8 and 9 separately drawn from two normal populations, the degree of freedom of the test statistic,  $t$  is – 1  
A. 15 B. 16  
C. 17 D. None of the above
9. The Total Fertility Rate is an index of – 1  
A. the total child production  
B. the overall fertility of the community  
C. the total female child population  
D. the total male child population

10. The crude death rate for a population is 30 and its adjustment factor is 0.3. The standardised death rate of the population is – 1
- A. 30.3 B. 29.7  
C. 9 D. 100
11. Write the sample space in throwing a nun biased die and a coin together at a time. 1
12. Define the operator  $\Delta$  . 1
13. Evaluate  $E^2x^2$  when the interval of differencing is unity. 1
14. For deriving general quadrature formula, the function  $f(n)$  can be approximated by Newton's backward interpolation formula. Rewrite the correct statement. 1
15. What is meant by a Bernoulli Trial ? 1
16. If  $(A) = 95$  and  $(A\beta) = 70$ , find  $(AB)$ . 1
17. The male population of a state is 250 lakhs. The number of literate males is 20 lakhs and total number of male criminals is 26 thousand. The number of literate male criminals is 2 thousand. Do you find any association between criminality and literacy? 1
18. Define a null hypothesis. 1
19. Based on two random samples of sizes 10 and 12 with sample mean Squares,  $S_1^2 = 3.35$  and  $S_2^2 = 3.05$  respectively, it is to test whether the two samples come from two normal populations having the same variance. What will be the degree of freedom of the F-statistic used for the test ? 1
20. Define Crude Birth Rate(C.B.R.). 1
21. Give the statistical definition of probability. 2

22. The probability that a student pass a Physics Test is  $\frac{2}{3}$  and that the pass both Physics and English test is  $\frac{14}{45}$ . The probability that the passes at least one of the tests is  $\frac{4}{5}$ . Find the probability that he passes the English Test. 2
23. Letters are drawn one at a time from a box containing the letters A,H,M,O,S,T. Find the probability that the letters in the order of draw spell the word "THOMAS". 2
24. Show that  $\Delta E \equiv E\Delta$ . 2
25.  $X \sim (50,4)$ , draw the curve of  $X$  and shade the area depicting  $P(X \geq 45)$ . 2
26. Test the consistency of the data :  
 $N = 1000$  ,  $(A) = 600$ ,  $(B) = 500$ ,  $(AB) = 50$ . 2
27. Draw the curve of Chi-square probability curve for 6 degrees of freedom and identify the type of skewness. 2
28. Compute the Crude Death Rate of population A; given the following data : 2

Age Group (in years)	Population A	
	Population	Deaths
Under 20	30,000	650
20 - 40	50,000	340
40 - 60	25,000	1,210
Above 60	15,000	500

29. A family has 2 children. What is the probability that both the children are boys given that at least one of them is a boy? 4
30. Show that for a third degree polynomial in  $x$ , the third order difference is a constant.

**OR**

2 Sts 12/24

4

Contd.

Prove that  $e^x = \left(\frac{\Delta^2}{E}\right)e^x \cdot \frac{Ee^x}{\Delta^2 e^x}$  the interval of differencing being h. 4

31. Evaluate  $\int_1^7 2x dx$  by Simpson's  $\frac{3^{th}}{8}$  rule.

OR

Find an approximate value of  $\int_1^{1.04} y dx$  by using Trapezoidal Rule, given the following values.

x:	1.00	1.01	1.02	1.03	1.04	
y:	3.953	4.066	4.182	4.300	4.421	4

32. Evaluate  $\int_0^4 x^2 dx$ , by a suitable numerical method. 4

33. Given the following frequencies of the positive classes, find the frequencies of the ultimate classes

$$(A) = 40, (B) = 60, (AB) = 30 \text{ and } N = 130$$

OR

In the usual notations,

$N = 1500, (AB) = 500, (\alpha) = 800, (B) = 600$ , test whether the attributes A and B are independent, positively or negatively associated. 4

34. The nine items of a sample had the following values:  
45, 47, 50, 52, 48, 47, 49, 53 and 50

Does the mean of the nine items differ significantly from the assumed normal population mean 47.5 if  $S = 2.54$  ?

(Given:  $t_{0.05}$  for 8 d.f. = 2.31 &  $t_{0.5}$  for 9 d.f. = 2.26)

OR

2 Sts 12/24

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P.T.O.

In sample-I of 8 observations, the sum of squares of deviations of the sample values from the sample mean was 98 and in sample-II of 10 observations it was 99. Test whether the population variances are the same.

(Given  $F_{5\%}$  for (7,9) d.f. = 3.29)

4

35. Define Vital Statistics. Write any three uses of Vital Statistics.

**OR**

Write the meaning of the symbols  $lx$ ,  $Lx$ ,  $px$  and  $Tx$  as used in a life table.

4

36. A box contains 5 tennis balls marked with the digits 1, 2, 3, 4 and 5. At first one ball is drawn at random and then a second ball is drawn at random from the remaining balls. Find the probability that

- (i) an even digit will be drawn at the first time.
- (ii) an even digit will be drawn at the second time.
- (iii) even digits will be drawn in both times.

**OR**

Ten cards numbered 1 to 10 are placed in a box, mixed thoroughly and then one card is drawn at random. It is known that the number on the drawn card is more than 3, what is the probability that it is an even number?

6

37. The following table gives the normal weights of babies during early months of life:

Age in months	0	2	4	6	8
Weights (in lbs.)	7	10	15	16	18

Estimate the weight of the baby at the age of 7 months.

**OR**

From the following data, estimate the number of students obtaining marks below 45 :

<u>Marks</u>	<u>No. of students</u>	
30-40	31	
40-50	42	
50-60	51	
60-70	35	
70-80	31	6

38. Obtain the mean and variance of Poisson Distribution with parameter  $\lambda$ .

**OR**

Obtain the mean and variance of a Binomial Distribution with parameters  $n$  and  $p$ .

6

39. Given the following frequencies of the positive classes, find out the class frequencies :

$(\alpha BC)$ ,  $(A\beta C)$ ,  $(A\beta\gamma)$ ,  $(A\beta\gamma)$ ,  $(\alpha\beta C)$  &  $(\alpha\beta\gamma)$  :

$N = 12000$ ,  $(A) = 977$ ,  $(B) = 1185$ ,  $(C) = 596$ ,  $(AB) = 453$ ,

$(AC) = 284$ ,  $(BC) = 250$ ,  $(ABC) = 127$

**OR**

The following summary data relate to the adult population of a small village :

Adult population	:	900
Number of employees	:	450
Literate adult population employed	;	300
Number of literates	:	500

Give the inference about the degree of association.

6

40. Samples of two independent groups of 10 children were tested to find how many digits they can repeat from memory after hearing them. The results are as follows:

Group I :	8	6	8	7	6	8	7	6	8	6
Group II :	11	7	7	9	7	10	7	6	8	8

Is the difference between the mean scores of the two groups significant?

[ Given  $t_{0.05}$  for 18 d.f.= 2.10]

OR

Two random samples drawn from two normal populations are

Sample (I) :	20	16	26	25	23	22	
Sample (II) :	30	33	42	35	33	34	38

Test whether the populations have the same variance:

[given  $F_{0.05}$  for 6 and 5 d.f. = 4.39 ]

6

41. Fill in the blanks marked with question mark in a portion of life table given below :

Age in months	$l_x$	$d_x$	$p_x$	$L_x$
80	6590	110	?	?
81	?	100	?	?

6