2023

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, 2, 3** and **4** choose the correct answer and rewrite.*

1. The probability of appearing more than 4 in throwing a die once is – 1

(A) $\frac{1}{3}$ (B) $\frac{2}{3}$

(C) $\frac{1}{2}$ (D) $\frac{1}{6}$

2. The probability of containing 52 Sundays in a non-leap year is – 1

(A) $\frac{5}{7}$ (B) $\frac{2}{7}$

(C) $\frac{6}{7}$ (D) $\frac{1}{7}$

3. The (n –1)th difference of rational integral function p(x) of degree n (when the values of the independent variable x are at equal intervals) is – 1

(A) Zero (B) Linear in x

(C) Constant (D) none of the above

4. For dichotomy classification with three attributes A, B, C, the number of 2nd order class frequencies is – 1

(A) 3 (B) 6

(C) 9 (D) 12

5. Define a random experiment. 1

6. Given the probability function : 1

x :	0	1	2	3
p(x) :	0.1	2K	0.4	3K

Find the value of K.

7. Evaluate $\Delta (x^2 + 1)$, the interval of differencing is 2. 1

8. Evaluate $\left(\frac{\Delta}{E}\right)e^x$, the interval of differencing being h. 1

9. A and B play a game in which their chances of winning are in the ratio 3:2. Find the probability of A's not winning the game. 1

10. If X~N(30,25), sketch the area of the portion $P(x \geq 36)$ from the probability curve. (use standard normal curve) 1

11. Define contrary class frequencies in the theory of attributes. 1

12. What is meant by order of a class ? 1

13. Draw the diagram of critical and non-critical regions from the sample space which lies in the 1st quadrant on the sample of size 2. 1

14. What inference can be drawn about the new born girls when Net Reproduction Rate is unity ? 1

15. Two balls are drawn from a bag containing 3 white and 2 black balls. What is the probability of drawing 2 white balls ? 2

16. Find the expectation of the number of heads in tossing a coin twice. 2

17. If A and B are any two events which are subsets of the sample space S and are not disjoint, draw the Venn diagrams using different shades of the events $A \cap \bar{B}$, $\bar{A} \cap B$ and $A \cap B$ in the sample space S. 2

18. Define interval of differencing and leading difference for the calculus of finite difference. 2

19. State the conditions for consistency of two attributes A and B in dichotomy classification. 2

20. Given that $(AB) = 250, (A\beta) = 340, (\alpha B) = 360, (\alpha\beta) = 1246$, find (A) and (B). 2

21. State the independence of the attributes A and B, given N=1216, $(A\beta) = 48$, $(\alpha B) = 768$, $(AB) = 256$ the symbols having their usual meaning. 2

22. Define crude death rates for males and females. 2

23. Given the following table for lx, the number of rabbits living at the age x :

x	:	0	1	2	3	4	5
lx	:	100	80	70	65	30	0

Let X and Y are the two rabbits of age 2 and 3 respectively. Find the probability that X and Y will be alive for two years time. 2

24. If 4:3 is in favour of A to survive 5 years more and 5:3 in favour of B to survive 5 years more, find the probability that at least one of them will survive for 5 years more. 4

25. Prove the following identity by using Δ and E operators (the interval of differencing is unity). 4

$$u_x = u_{x-1} + \Delta u_{x-2} + \Delta^2 u_{x-3} + \ldots\ldots\ldots + \Delta^{n-1} u_{x-n} + \Delta^n u_{x-n}$$

26. Deduce Simpson's one-third rule of numerical integration from general quadranture formula. 4

27. For a binomial distribution the mean is 6 and standard deviation is $\sqrt{2}$. Find the probability function P(x) of the binomial distribution and deduce P(x=2). 4

Or

If the independent random variables X,Y are binomially distributed respectively with $n_1=3$, $p = \frac{2}{3}$ and $n_2 = 4$, $p = \frac{2}{3}$, write down the probability fuction of X+Y and obtain $P(X+Y \geq 1)$. 4

28. A manufacturer of cutter pins knows that 3% of his product is defective. If he sells cotter pin in boxes of 100 and guarantees that not more than 6 pins will be defective, what is the probability that a box will fail to meet the guaranteed quality ?

4

29. In an experiment on pea-breading, Mendel obtained the following frequencies of seeds : 311 round and yellow, 98 wrinkled and yellow, 104 round and green, 31 wrinkled and green. Theory predicts that the frequencies should be in the proportion 9:3:3:1 respectively. Obtain x^2 test statistics for testing significance of theory and experiment.

4

30. A random sample of 16 values from a normal population showed the sum of values is 720 inches and the sum of the squares of deviations from the mean equal to 135 square inches. Test whether the assumption of the mean 47 inches for the population is reasonable at 5% level of significance. 4

[Given $t_{5\%}$ for 15 d.f. = 2.13]

31. Find the standardized death rate for the population A by direct method for the data given below :

4

Age	Standard Population		Population A	
	Population ('000)	Specific Death rate	Population ('000)	Specific Death rate
0 – 5	6	50	10	45
5 – 15	8	14	11	13
15 – 50	25	10	14	8
50 and above	4	60	9	55

32. A box contains 4 white and 5 black balls. 5 balls are drawn. Find the expected value of number of white balls drawn. 6

Or

A box contains 3 red, 4 white and 3 black balls. A person draws 4 balls from the box at random. Find the probability that among the balls drawn there is at least one ball of each colour. 6

33. Derive Newton's forward interpolation formula. 6

34. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Simpson's three-eight rule of numerical integration.

Hence obtain the approximate value of π. 6

Or

Obtain the approximate value of $\log_e 7$ by using Simpson's one-third rule of numerical integration from $\int_0^6 \frac{1}{1+x}\,dx$. 6

35. A student reported the results of a survey in the following manner, in terms of the usual notations

$N=1000, (A)=525, (B)=312, (C)=470, (AB)=42, (BC)=96, (AC)=137,$

$(ABC)=25, (AB\gamma)=17, (A\beta C)=112.$ 6

36. Two independent samples of 8 and 7 items respectively had the following values of variables.

Sample I (x_i)	:	9 11 13 11 15 9 12 14
Sample II(y_i)	:	10 12 10 14 9 8 10

Do the estimates of population variences differ significantly ?

(Table value of the test statistic is 4.26) 6

37. The values of lx. the number of persons living at the age x, are as given below :

x	:	96	97	98	99	100	101	102
lx	:	106	69	44	32	24	14	0

Complete the life table for the above data. 6