

2022

STATISTICS*Full Marks : 100**Time : 3 hours**The figures in the margin indicate full marks for the questions**General Instructions :*

- (i) Write all the answers in the Answer Script.
- (ii) Attempt Part —A Objective Questions serially.
- (iii) Attempt all parts of a question together at one place.

(PART : A — OBJECTIVE)

(Marks : 50)

SECTION – I

(Marks : 20)

1. Choose and write the correct answer : 1 × 10 = 10

a. The value of ${}^nP_{n-1}$ is

- (i) n
- (ii) 0
- (iii) $n - 1$
- (iv) None of the above

10. (a) Define

(i) Crude Death Rate (CDR)

(ii) Specific Death Rate (SDR)

(iii) Standardised Death Rate (SDR) $2 + 2 + 2 = 6$

(b) Prove that

(i) $AM \geq GM \geq HM$ (ii) $AM \times HM = (GM)^2$ $3 + 3\frac{1}{2} = 6\frac{1}{2}$

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(8)

6. (a) Write down Newton's forward interpolation formula. Find the value of $f(1)$ from the following data

x	:	0	2	4	6	
$f(x)$:	8	11	20	41	$7\frac{1}{2}$

- (b) Prove that

$$\Delta^3(ae^x) = (e-1)^3 ae^x, \text{ a being a constant.} \quad 5$$

GROUP — B

7. (a) Define the following with examples: $2 \times 3 = 6$

- (i) Random experiment
- (ii) Conditional Probability
- (iii) Compound Probability

- (b) What is the chance of throwing not less than 16 in a single throw with three dice? 4

- (c) Let A and B are two events such that

$$P(A) = \frac{1}{2}, P(B) = \frac{1}{2} \text{ and } P(A \cap B) = \frac{2}{3}, \text{ find } P(\bar{A} \cap \bar{B}). \quad 2\frac{1}{2}$$

(3)

- e. Two dice are thrown simultaneously. The Probability of getting even numbers on both the dice is

(i) $\frac{1}{4}$

(ii) $\frac{3}{4}$

(iii) $\frac{2}{35}$

- (iv) none of the above.

- f. If $P(A) = \frac{3}{8}$, $P(B) = \frac{1}{2}$ and $P(A \cap B) = \frac{1}{4}$, then

$P\left(\frac{B}{A}\right)$ is

(i) $\frac{2}{3}$

(ii) $\frac{1}{2}$

(iii) $\frac{3}{4}$

- (iv) None of the above.

- g. The mean of 7 variates is 12, if six of them are 5, 13, 9, 17, 14 and 10. Then seventh variate is

(i) 11

(ii) 20

(iii) 16

- (iv) none of the above.

(5)

(6)

2. Fill in the blanks : $1 \times 5 = 5$

(a) If $\log_4(x+3) = 2$. Then the value of $x =$ _____.

(b) If $f(x) = 5^x$ and $h = 1$, then the value of $\Delta f(x) =$ _____.

(c) The range of the data 7, 13, 6, 25, 18, 20, 16 is _____.

(d) The probability of winning a Twenty-Twenty cricket match by team A is 0.65, then the probability that the team A may not win is _____.

(e) The ratio of births to deaths in a year is called _____.

3. State whether the following statements are *True* or *False*. $1 \times 5 = 5$

(a) $\log 1 \times \log 1000 = 0$

(b) Geometric mean G of any two numbers x and y is $G = (xy)^{\frac{1}{2}}$.

(c) If A and B be any two events such that $A \subseteq B$, then $P(A) \leq P(B)$.

(d) If m and n are positive integers, we can define $\Delta^m[\Delta^n f(x)]$ as $\Delta^{m+n} f(x)$.

(e) For comparing the health conditions of two towns we have to calculate standardised death rate.

SECTION — II

(Marks : 30)

4. Answer the following questions : $3 \times 10 = 30$

(a) If $a^2 + b^2 = 23ab$, show that

$$\log\left(\frac{a+b}{5}\right) = \frac{1}{2} (\log a + \log b).$$

(b) Find the term independent of x in the expansion of $\left(x^2 + \frac{1}{x}\right)^9$.

(c) Show that if $f(E)$ is a polynomial in E then

$$f(E)a^x = a^x f(a), \text{ a being constant.}$$

(d) If $f(x) = (1-x)(1-2x)(1-3x)$, then find the value of $\Delta^3 f(x)$.

(e) In a class, 40% of the students study mathematics and science. 60% of the students study mathematics. What is the Probability of a student studying science given he/she is already studying mathematics?

(f) Define:

(i) Random experiments

(ii) Compound Probability.

(4)

h. The measure which takes into account all the data is

- (i) Mean
- (ii) Median
- (iii) Range
- (iv) Mode.

i. Vital Statistics is mainly concerned with

- (i) births
- (ii) deaths
- (iii) marriages
- (iv) all the above.

j. Crude death rates are particularly useful for

- (i) comparing death rates of two regions.
- (ii) comparing death rates of same regions.
- (iii) both (i) and (ii)
- (iv) neither (i) nor (ii).

(7)

(g) What are the various methods of collecting statistical data?

(h) Calculate mode from the following frequency distribution:

Marks	0-20	20-40	40-60	60-80	80-100
No. of Students	5	15	30	12	8

(i) Calculate the standard deviation of 1, 3, 7, 9, 11, 13, 15, 17, 19, 21.

(j) Write about the different sources of vital statistics.

(PART : B — DESCRIPTIVE)

(Marks : 50)

Answer any **four** questions, taking atleast **one** from each Group.

GROUP — A

5. (a) In how many ways can a cricket team be selected from 17 players in which 5 players can bowl? Each cricket team must include 2 bowlers. 6

(b) Find the co-efficient of x^2 in the expansion of

$$\left(3x - \frac{1}{x} \right)^6 \text{ Where } x \neq 0. \quad 3$$

(c) Show that $1 + \frac{1}{2!} + \frac{1}{4!} + \frac{1}{6!} + \dots = \frac{1}{2} \left(e + \frac{1}{e} \right)$ $3\frac{1}{2}$

- b.** The Binomial expansion of $(a + b)^n$ has
- (i) n terms
 - (ii) $(n + 1)$ terms
 - (iii) $(n - 1)$ terms
 - (iv) None of the above.
- c.** The value of $\Delta^2 e^x$, taking the interval of difference to be h is
- (i) $e^x(e^h - 1)^2$
 - (ii) $e^x(1 - e^h)$
 - (iii) $e^h(e^x - 1)$
 - (iv) none of the above.
- d.** Newton's backward formula is used when the interpolating value lies
- (i) in the middle of the series
 - (ii) in the begining of the series
 - (iii) at the end of the series
 - (iv) none of the above.

- 8.** (a) For any event E, Prove that

$$P(E^c) + P(E) = 1$$
 $3\frac{1}{2}$
- (b) How many words can be formed of the letters of the word "SHILLONG"? 3
- (c) If X and Y are events with $P(X) = \frac{3}{8}$, $P(Y) = \frac{5}{8}$ and $P(X \cup Y) = \frac{3}{4}$ find $P\left(\frac{X}{Y}\right)$ and $P\left(\frac{Y}{X}\right)$. Are X and Y independent? $2 + 2 + 2 = 6$

GROUP — C

- 9.** (a) What do you understand by the term "Vital Statistics"? How are such statistics collected and what are their defects? What suggestion can you give for their improvement? $2 + 2 + 2 = 6$
- (b) Find the mean deviation from mean from the following frequency distribution:

Items	10-20	20-30	30-40	40-50	50-60
Frequency	7	10	20	10	3

 $6\frac{1}{2}$