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MST-001

**POST GRADUATE DIPLOMA IN
APPLIED STATISTICS
(PGDAST/MSCRWEE) MASTER OF
SCIENCE (RENEWABLE ENERGY AND
ENVIRONMENT)**

Term-End Examination

December, 2023

**MST-001 : FOUNDATION IN MATHEMATICS
AND STATISTICS**

Time : 3 Hours

Maximum Marks : 50

Note : (i) *Question No. 1 is compulsory.*

(ii) *Attempt any **four** questions from the remaining Question Nos. 2 to 7.*

(iii) *Use of scientific calculator (non-programmable) is allowed.*

(iv) *Use of Formulae and Statistical Tables Booklet for PGDAST is allowed.*

(v) *Symbols have their usual meanings.*

P. T. O.

1. State whether the following statements are True or False. Give reasons in support of your answer :

$$5 \times 2 = 10$$

(a) If $A = \{2, 4, 5\}$ and $B = \{4, 5, 7\}$, then

$$A \Delta B = \{2, 4, 5, 7\}.$$

(b) The function $f(x) = 3 + |x - 3|$ is differentiable at $x = 3$, but is not continuous at $x = 3$.

(c) If :

$$\begin{bmatrix} x+2 & 5 \\ 3 & y-2 \end{bmatrix} = \begin{bmatrix} 10+y & 5 \\ 3 & x-10 \end{bmatrix},$$

then $x = 5$ and $y = 3$.

- (d) The box in a box plot shows middle 50% of the data.
- (e) In a box plot the y -axis may be started with any suitable number other than zero.
2. (a) For a project, 75 skilled workers were hired by a software company. Out of 75 workers, 48 were software engineers, 35 were hardware engineers; 42 were network

engineers; 18 had skills in all three jobs and all of them had skill in at least one of these jobs. Find the number of hired workers, who were skilled in exactly 2 jobs. 4

(b) A man has 10 friends, 4 boys and 6 girls. In how many ways can he invite them, if there have to be exactly 3 girls among the invitees ? 4

(c) How many words of five letters (with or without meaning) can be formed from the letters of word MATHEMATICS such that the letters appearing in the odd and even positions are un-repeated and repeated letters respectively ? 2

3. (a) If :

$$x = 2^{99} + 2^{98} + 2^{97} + \dots + 2^0 \text{ and } y = 2^{100},$$

then find the relation between x and y . 2

(b) Find the range of the function $f(x) = -x^2 - 10, x \in \mathbb{R}$. 2

- (c) Is the set $\{7, 9, 11, 13, 15, \dots\}$ enumerable? Justify your answer. 2
- (d) If $A = \{10, 20, 30, 40, \dots\}$ and $B = \{4, 8, 12, 16, 20, \dots\}$, then can we say that $A \sim B$? Give stepwise explanation in support of your answer. 4
4. (a) Check continuity and differentiability of the function $f(x) = 7 + |x - 5|$ at $x = 5$. 4
- (b) Evaluate the following : 4
- (i)
$$\int_2^7 \frac{\sqrt[5]{x+1}}{\sqrt[5]{x+1} + \sqrt[5]{10-x}} dx$$
- (ii)
$$\int_{-3}^3 2^{|2x|} dx$$
- (c) Find derivative of the function : 2

$$f(x) = \left(x + \frac{1}{x}\right) \left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)$$

5. (a) Without expanding, evaluate the following determinants : 3

(i)
$$\begin{vmatrix} 2 & 3 & 30 \\ 5 & 4 & 54 \\ 6 & 1 & 42 \end{vmatrix}$$

$$(ii) \begin{vmatrix} a-b & b-c & c-a \\ b-c & c-a & a-b \\ c-a & a-b & b-c \end{vmatrix}$$

$$(iii) \begin{vmatrix} ab & 1 & c(a+b) \\ bc & 1 & a(b+c) \\ ca & 1 & b(c+a) \end{vmatrix}$$

- (b) Solve the following system of equations using matrix method : 5

$$3x + 6y - 4z = 3$$

$$3x - z = 0$$

$$12x - 6y - z = -3$$

- (c) Differentiate between discrete and continuous data with an example of each. 2
6. (a) Which mathematical operations $=, \neq, <, >, +, -, \times, \div$ can be performed (make sense) in the four scales of measurement ? Explain with reason. 4
- (b) Explain classification of data in detail. 6

7. (a) Differentiate between diagrammatic and graphical presentation of data. 2

(b) A random sample of 20 concentrations of calcium carbonate (CaCO_3) in milligrams per litre is given as follows :

130.8, 129.9, 131.5, 129.5, 132.7, 131.5,
127, 133.7, 132.2, 134.8, 131.7, 133.9,
129.8, 131.4, 127.8, 132.7, 132.8, 131.4,
131.3, 129.9

Create a stem-and-leaf plot of the data. 2

(c) In a study of memory recall times, a series of stimulus words was shown to a candidate on a computer screen. For each word, the candidate was instructed to recall either a pleasant or an unpleasant memory associated with that word. The recall times (in seconds) for 20 pleasant

and 20 unpleasant memories are given as follows :

Pleasant memory	Unpleasant memory
1.07	1.45
1.17	1.67
1.22	1.90
1.42	2.02
1.63	2.32
1.98	2.35
2.12	2.43
2.32	2.47
2.56	2.57
2.70	3.33
2.93	3.87
2.97	4.33
3.03	5.33
3.15	5.72
3.22	6.48
3.42	6.90
4.63	8.68
4.70	9.47
5.55	10.00
6.17	10.93

Make comparative analysis with the help of boxplots to check whether pleasant memories could be recalled more quickly than unpleasant ones or not ? Also, write your conclusions.

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