



SLIATE

SRI LANKA INSTITUTE OF ADVANCED TECHNOLOGICAL EDUCATION

(Established in the Ministry of Higher Education, vide in Act No. 29 of 1995)

Higher National Diploma in Information Technology

First Year, First Semester Examination – 2019

HNDIT 1107 – Mathematics for IT

Instructions for Candidates:

Answer four (04) questions only

All questions carry equal marks

No. of questions: 05

No. of pages : 04

Time : 02 hours

1.

(i) Define the following terms with a suitable example.

- a. Disjoint set
- b. The intersection of set A and B
- c. The union of set A and B
- d. Power set

[08 Marks]

(ii) If A, B and C are non-disjoint sets. Draw the shaded Venn diagram for the following.

- a. $A - B$
- b. A'
- c. $(A \cap B) \cup (A \cap C)$
- d. $(A - B) \cap C$
- e. $A' \cap B'$
- f. $(A \cup B) \cap C$

[06 Marks]

(iii) Given $U = \{2, 4, 6, 8, 10, 12, 14, 16, 18, 20\}$

Let $P = \{x \mid x \text{ is an integer } x < 18\}$

$Q = \{x \mid x \text{ is a multiplication of } 2, 10 \leq x < 40\}$

$R = \{x \mid x \text{ is divisible by } 3\}$

Find

- a. $P \cap Q$
- b. $Q - R$
- c. $P(R)$
- d. $Q' \cap (P \cap R)$
- e. $n[(P \cap Q) \cup (P \cap R)]$

[02 Marks]

[02 Marks]

[03 Marks]

[02 Marks]

[02 Marks]

(Total 25 Marks)

$$\begin{aligned} 10 &\geq 5x - 40 \\ 10 &\geq 5(2) - 40 \\ &\quad -40 \\ &\quad -5(4) - 40 \end{aligned}$$

2.

- (i) To recruit personnel to the teacher's service, health service and administrative service, an examination is held under three sections A, B. and C. The candidates should pass A for the teachers' service, B for the health service and C for the administrative service.

The number of personnel who sat the examination was 460.

100 passed A and C.

90 passed B and C.

50 passed only A and B.

230 personnel passed the health service

30 passed all three examination

20 personnel not passed any examination

200 personnel passed the teacher's services

Handwritten calculations:

$$\begin{array}{r} 50 \\ 30 \\ 30 \\ 20 \\ \hline 130 \end{array}$$

$$\begin{array}{r} 230 \\ 100 \\ 90 \\ \hline 420 \end{array}$$

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- Draw a Venn Diagram to illustrate the above information
- How many personnel passed only B
- How many Personnel passed A and C only
- How many personnel passed only A

[05 Marks]

[02 Marks]

[02 Marks]

[02 Marks]

(ii)

- Let $n(U) = 30$, $n(A) = 10$, $n(A \cap B) = 7$ and $n(A \cup B)' = 5$

Find the followings using equation.

- $n(A' \cap B')$
- $n(A - B)$
- $n(A \oplus B)$

Handwritten:
 $U = 30$
 $n(A) = 10$

Handwritten calculations:

$$\begin{array}{r} 70 \\ 30 \\ 30 \\ \hline 130 \end{array}$$

$$\begin{array}{r} 30 \\ 10 \\ 10 \\ \hline 50 \end{array}$$

$$\begin{array}{r} 30 \\ 10 \\ 10 \\ \hline 50 \end{array}$$

[07 Marks]

- Prove the De Morgan's Law using algebraic method.

$$(A \cap B)' = A' \cup B'$$

[07 Marks]

(Total 25 Marks)

3.

- (i) Define the following types of relations with a suitable example.

- Reflexive relation
- Symmetric relation
- Transitive relation

[06 Marks]

- (ii) Given $A = \{10, 20, 30, 40\}$, $B = \{p, q, r\}$ and $C = \{3, 7, 9\}$. Let S be a relation from A to B. Let T be a relation from B to C.

$$S = \{(10, q), (20, q), (30, p), (40, r)\}$$

$$T = \{(p, 7), (q, 3), (r, 3), (r, 9)\}$$

- Find the domain and range for Relation T

[02 Marks]

- Draw an arrow diagram for relation S

[02 Marks]

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- c. Find S^{-1} [02 Marks]
 d. Find $S \circ T$ [03 Marks]
 (iii)
 a. Define the injective and surjective function using arrow diagrams with a suitable example. [04 Marks]
 b. Let the function from $\mathcal{R} \rightarrow \mathcal{R}$ be defined as $f(x) = 2x - 5$
 i. Find $f \circ f$ [03 Marks]
 ii. Find f^{-1} [03 Marks]

(Total 25 Marks)

4.

- (i) Define the following matrices
 a. Transpose of a Matrix
 b. Lower Triangular Matrix [04 Marks]
 (ii) Let $A = \begin{bmatrix} 1 & 2 \\ -2 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 1 \\ 3 & -1 \end{bmatrix}$ verify
 a. $(AB)^T = B^T A^T$ [04 Marks]
 b. Using the part (a) prove the following.

$$(ABC)^T = C^T B^T A^T$$
 [02 Marks]

(iii) Let $P = \begin{bmatrix} 3 & 4 & 0 \\ -2 & 5 & 1 \\ 0 & 2 & 3 \end{bmatrix}$ and $Q = \begin{bmatrix} 2 & 5 \\ 0 & 1 \\ -1 & 2 \end{bmatrix}$

Find

- a. PQ [02 Marks]
 b. $P^2 + 3P + 2I$ where I is a 3×3 unit matrix [05 Marks]

(iv) Find the inverse of matrix $A = \begin{bmatrix} 1 & 1 & 0 \\ 2 & -1 & 1 \\ 3 & 1 & 2 \end{bmatrix}$ [08 Marks]

(Total 25 Marks)

5.

- (i) Let $A = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 1 & 3 \\ 5 & 1 & 4 \end{bmatrix}$ verify
 a. $|A| = |A^T|$
 b. $|2A| = 2|A|$ [06 Marks]

(ii) Prove that $\begin{vmatrix} 1 & 1 & 1 \\ \alpha & \beta & \gamma \\ \beta\gamma & \gamma\alpha & \alpha\beta \end{vmatrix} = (\alpha - \beta)(\beta - \gamma)(\gamma - \alpha)$ [06 Marks]
 Using determinant.

(iii) Use Cramer's rule to find values for x, y and z in the following system of linear equations:

$$-3x + 2y - 6z = 6$$

$$5x + 7y - 5z = 6$$

$$x + 4y - 2z = 8$$

[13 Marks]

(Total 25 Marks)