



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 – 2017

HNDIT 1107/HNDIT 11072 – Mathematics for IT

Instructions:

Answer four (04) questions only.

All questions carry equal marks.

No. of questions: 05

No. of pages: 03

Time: Two (02) hours

1.

i. Define the following terms with an example.

- a. Power Set
- b. Disjoint Set
- c. Complement of a set
- d. Sub Set

[08 Marks]

ii. If A and B are disjoint sets, state whether following statements are true or false.

- a. $A \subseteq B$
- b. $A \cap B = \phi$
- c. $A - B = A$
- d. $B \subseteq A$
- e. $n(A \cup B) = n(A) + n(B)$
- f. $A^c \cap B^c = \phi$

[06 Marks]

iii. Consider the following sets and ...

$$U = \{1, 2, \dots, 12\}$$

$$A = \{x: x \text{ is an odd integer}\}$$

$$B = \{x: x \text{ is an odd integer, } 3x - 5 \geq 10\}$$

$$C = \{x: x \text{ is divisible by } 3\}$$

Find the elements for the followings.

a. $A \cup B \cup C$

[02 Marks]

b. $A^c \cap (B \cup C)$

[02 Marks]

c. $A \cap (B \setminus C)$

[02 Marks]

d. $(A \oplus B) \oplus C$

[02 Marks]

e. $P(C)$

[03 Marks]

(Total Marks 25)

2.

i. In a city of 100 people, 60 people owned cats, dogs, or rabbits. 30 people owned cats, 40 owned dogs, 21 owned rabbits. 4 owned a cat and a dog. 2 owned a cat and a rabbit. 4 owned a dog and a rabbit.

- a. Draw a Venn diagram to illustrate the above information. [05 Marks]
- b. How many people own all three? [02 Marks]
- c. Owned cats but neither dogs nor rabbits [02 Marks]
- d. Only dogs [02 Marks]
- e. Exactly two pets [02 Marks]
- f. How many did not own any pet? [02 Marks]

ii. Prove the following, using set theory laws.

$$(A \cap B^c) \cup (A^c \cap B) \cup (A \cap B) = A \cup B \quad [06 \text{ Marks}]$$

iii. Write the dual of the followings.

- a. $A = (A \cup B) \cap (A \cup \phi)$
- b. $(B^c \cup \phi) \cup (A^c \cap U) = (A \cap B)^c$ [04 Marks]

(Total Marks 25)

3.

i. Let R be the following relations on $B = \{a, b, c, d\}$

$$R = \{(a, a), (a, c), (c, b), (c, d), (d, b)\}$$

- a. Draw a directed graph for relation R. [02 Marks]
- b. Determine the matrix of the relation R. [02 Marks]
- c. Using the above matrix, find the composition relation RoR . [03 Marks]

ii. What are the type of relations? Give an example for each. [06 Marks]

iii. Let $X = \{1, 2, 3, 4\}$. Determine whether the following relations is a function from X into X or not. Give reasons.

- a. $f = \{(2, 3), (1, 4), (2, 1), (3, 2), (4, 4)\}$
- b. $g = \{(3, 1), (4, 2), (1, 1)\}$
- c. $h = \{(2, 1), (3, 4), (1, 4), (2, 1), (4, 4)\}$ [06 Marks]

iv. Let the function $f:R \rightarrow R$ be defined as follows

$$f(x) = \begin{cases} 2x + 1 & \text{if } x \leq -5 \\ 3x^2 + 2 & \text{if } -5 < x < 6 \\ 5x - 2 & \text{if } x \geq 6 \end{cases}$$

Find,

- a. $f(2)$
- b. $f(0)$
- c. $f(6)$

[06 Marks]
(Total Marks 25)

4.

i. Define the following terms:

- a. Vector
- b. Singular matrix
- c. Lower triangular matrix

[06 Marks]

ii. State two applications of matrices .

[02 Marks]

iii. Find the value of x that satisfy the matrix equation.

$$\begin{bmatrix} 0 & -2+x \\ 4 & 3x-2 \end{bmatrix} = \begin{bmatrix} 0 & 4 \\ 2+2x & 7x+14 \end{bmatrix}$$

[04 Marks]

iv. Let $A = \begin{bmatrix} 1 & 2 \\ 5 & -2 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 3 \\ 1 & 4 \end{bmatrix}$ and $C = \begin{bmatrix} -9 & 3 \\ 1 & -1 \end{bmatrix}$

Verify,

- a. $A(B+C) = AB+AC$
- b. $(AB)^T = B^T A^T$

[08 Marks]

v. Find the inverse of the matrix $A = \begin{bmatrix} 5 & 8 & 4 \\ 0 & -3 & -5 \\ 1 & 1 & 3 \end{bmatrix}$

[05 Marks]

(Total Marks 25)

5.

i. State three properties of determinants.

[06 Marks]

ii. Find the determinant of $A = \begin{bmatrix} 3 & 2 & 1 \\ 4 & 1 & 3 \\ 1 & 1 & 1 \end{bmatrix}$

[06 Marks]

iii. Souvenir pens, caps and mugs are sold by SLIATE for 25th anniversary .Three pens, two caps and one mug cost Rs.140. two pens, two caps and two mugs cost Rs.170. One pen, three caps and two mugs cost Rs.180.

- a. Write a system of linear equations for the above problem. [03 Marks]
- b. Find the prices of individual items by solving the system of linear equations using Cramer's rule.

[10 Marks]

(Total Marks 25)