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**SLATE**

SRI LANKA INSTITUTE OF ADVANCED TECHNOLOGICAL EDUCATION

(Established by the Ministry of Higher Education, vide its Act No. 29 of 1988)

Higher National Diploma in Information Technology

First Year, First Semester Examination - 2018

HNDIT 1107 / HNDIT 1107-2: Mathematics for IT / Mathematics for Computing

Instructions:

Answer four questions only.

All questions carry equal marks

No. of questions: 05  
No. of pages: 03

Time: Two(02) hours

Question 01

(i) Define the following terms with examples

- a) Set
- b) Finite Set
- c) Proper Subset
- d) Null Set

[Total Marks 25]

(08 marks)

(ii) Write the elements of the following sets.

- a)  $A = \{x : x^2 \leq 5 \text{ and } x \in \mathbb{Z}\}$
- b)  $B = \{x : 3x - 2 \leq 11 \text{ and } x \in \mathbb{N}\}$
- c)  $C = \{a : a \in \mathbb{Z} \text{ and } a \in \mathbb{N}\}$

(06 marks)

(iii) Given  $U = \mathbb{Z}^+$

$A = \{x : x \text{ is an even integer and } x \leq 20\}$

$B = \{x : x \text{ is divisible by 3 and } x \leq 15\}$

$C = \{x : 2x - 8 = 2\}$

Find

- a)  $A \cap C$
- b)  $A \cap (C \cup B)$
- c)  $B - A$
- d)  $A \oplus B$
- e)  $P(A \cup B)$

(02 marks)

(02 marks)

(02 marks)

(02 marks)

(05 marks)

Question 02

(i) Among positive integers less than or equal to 50, let A be the set of even integers and B be the set of integers divisible by 5. How many integers are,

[Total Marks 25]

- a) Even or divisible by 5
- b) Even and divisible by 5

(02 marks)

(02 marks)

(ii) Suppose that A and B are two disjoint sets. Find

- a)  $A \cup B$
- b)  $A \cap B$

(02 marks)  
(02 marks)

(iii) Each student in a class of 60 plays at least one outdoor game: cricket, football or volleyball. 38 play cricket, 40 play volleyball and 47 play football. 27 play cricket and volleyball, 32 play volleyball and football, 24 play cricket, football and volleyball.

Find the number of students who play

- a) Cricket and volleyball
- b) Cricket, football but not volleyball

(04 marks)  
(04 marks)

(iv) Show that  $A \setminus (A \cap B) = (A \setminus B)$  using set theory laws

(06 marks)  
(03 marks)

(v) Write the dual of  $(B^c \cup \phi) \cup (A^c \cap U) = (A \cap B)^c$

**Question 03**

[Total Marks 25]

(i). "Every function is a relation but every relation is not a function". State whether the above statement is true or false by providing an example. (03 marks)

(ii). Given  $A = \{1, 2, 3\}$ ,  $B = \{x, y, z\}$ ,  $C = \{a, b\}$ . Let R be a relation from A to B. Let S be a relations from B to C

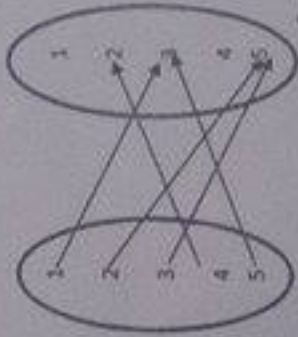
$$R = \{(1, x), (1, y), (2, y), (2, z), (3, x)\}$$

$$S = \{(x, a), (y, a), (y, b)\}$$

- a) Draw an arrow Diagram for relation R
- b) Find the Domain and Range of relation S
- c) Find RoS
- d) Find  $A \times B$
- e) Find inverse relation of S

(03 marks)  
(02 marks)  
(03 marks)  
(02 marks)  
(02 marks)

(iii) Let  $A = \{1, 2, 3, 4, 5\}$  and  $f: A \rightarrow A$  be defined by the following.



Find,

- a) Graph of f
- b)  $f(S)$  where  $S = \{3, 4, 5\}$

(02 Marks)  
(02 Marks)

c)  $f^{-1}(T)$  where  $T = \{4, 5\}$

(02 Marks)

(iv) Find a formula for the inverse of  $g(x) = 2x - 3 / 5x - 7$

(04 Marks)

**Question 04**

(i) Define the following matrices with examples:

- a) Identity matrix
- b) Skew symmetric matrix
- c) Upper triangular matrix

[Total Marks 25]

(ii) Let  $A = \begin{bmatrix} 1 & 3 \\ -4 & 2 \end{bmatrix}$  and  $B = \begin{bmatrix} 3 & 0 \\ 1 & -2 \end{bmatrix}$  verify the  $AB \neq BA$

(06 marks)

(iii) Let  $A = \begin{bmatrix} 4 & x \\ 0 & 10 \end{bmatrix}$ ,  $B = \begin{bmatrix} -5/2 & -1 \\ 0 & y \end{bmatrix}$  and  $C = \begin{bmatrix} 2 & 4 \\ 4 & 6 \end{bmatrix}$

(04 marks)

If  $A + B = C^{-1}$ , find  $x$  and  $y$       $x = 2$       $y = -1$

(10 marks)

(iv) Find the inverse of the matrix  $A = \begin{bmatrix} 1 & -2 & 0 \\ 3 & 1 & 5 \\ -1 & 2 & 3 \end{bmatrix}$

(05 marks)

**Question 05**

(i) If  $A = \begin{bmatrix} 3 & 1 \\ 0 & 2 \end{bmatrix}$  and  $B = \begin{bmatrix} 1 & 5 \\ 1 & 2 \end{bmatrix}$  then, find the following

[Total Marks 25]

(10 marks)

- a)  $|A|$      6
- b)  $|B|$      -5
- c)  $|A \times B|^{-14}$
- d)  $|AB|^{-15}$

(ii) Prove that  $\begin{vmatrix} 1 & 1 & 1 \\ \alpha & \beta & \gamma \\ \beta\gamma & \gamma\alpha & \alpha\beta \end{vmatrix} = (\alpha - \beta)(\beta - \gamma)(\gamma - \alpha)$

(05 marks)

(iii) Solve the following system of linear equations using Cramer's rule.

(10 marks)

$$\begin{array}{rcl} x + 2y + 3z & = & 4 \\ x + 4y + 9z & = & 6 \\ x + y + z & = & 3 \end{array}$$