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**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, 1<sup>ST</sup> Semester Examination - 2013**
**IT 1002: Mathematics for Computing (New)**
**Instructions for Candidates:**

Answer five (05) questions only.

**Time : Three (03) hours**

No of pages : 05

No of questions : 08

(1)

 List the elements of the following sets where  $P = \{1, 2, 3, \dots\}$ 

- (I) (a)  $A = \{x : x \in P, 5 < x \leq 13\}$   
 (b)  $B = \{x : x \in P, x+4 = 1\}$   
 (c)  $C = \{x : x \in P, x \text{ is a multiple of } 4\}$   
 (d)  $D = \{x : x \in P, 50 \leq x < 63, x \text{ is an even integer}\}$  (04 Marks)

(II) Explain the following terms with venn diagram

- (a) Universal Set  
 (b) Compliment (04 Marks)

 (III)  $U = \{b, c, d, e, f, g, h, i, j, k\}$   $A = \{b, c, d, h, i, k\}$   $B = \{b, d, e, f, h\}$ 
 $C = \{b, d, e, f, g, i\}$ 

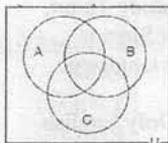
 Find (p)  $A^c \cup B$ 

 (q)  $A^c \cap B$ 

 (r)  $C^c \cup B$ 

 (s)  $C^c \cap B$  (08 Marks)

(IV) On a standard three-circle Venn diagram like the one shown below, shade the regions corresponding to the given sets expressions.



- (a)  $(A \cap C^c) \cup B^c$  (b)  $(A^c \cup B)^c \cap C$  (04 Marks)

(Total Marks 20)

(2)

(i) Briefly explain with example

- (a) Sub set
- (d) Symmetric Difference
- (e) Power set

(06 Marks)

(ii) Let  $U = \{1, 2, \dots, 9\}$  be the universal set and let  $A = \{1, 2, 5, 6\}$   
 $B = \{2, 5, 7\}$   $C = \{1, 3, 5, 7, 9\}$

~~Find~~ which of the above sets can equal a set X under each of the  
 Find the elements

- (a)  $(A \cup B) \setminus C$
- (b)  $A \oplus B$
- (c)  $(A \setminus B) \oplus C$
- (d) Power set of B

(08 Marks)

(iii) Prove the following identity with giving reasons.

$$(A \cap B) \cup (A \cap B^c) \cup (A^c \cap B) \cup (A^c \cap B^c) = U$$

(06 Marks)

(Total Marks 20)

(3)

(i) Explain inclusion – Exclusion principle

(03 Marks)

(ii)  $n(U) = 80$ ,  $n(A) = 40$ ,  $n(B) = 55$ ,  $n(A \cap B) = 20$ Find (a)  $n(A \cup B)$ , (b)  $n(A^c)$ , (c)  $n(B^c)$ , (d)  $n(A^c \cap B^c)$ , (e)  $n(A \oplus B)$  (05 Marks)

(iii) Each student at some college has a mathematics requirement M (to take at least one mathematics course) and a science requirement S (to take at least one science course). Selections of 130 students show that:

50 completed M, 55 completed S, 10 completed both M and S

Find (a) At least one of the two requirements

(b) Exactly one of the two requirements

(c) Neither requirement

(06 Marks)

(Only using equation)

(iv) In a survey of 70 people, it was found that 20 study Sinhala, 22 study Tamil, 28 study English, Also 8 study both Sinhala and English, 6 study Sinhala and Tamil, 5 study both Tamil and English, and 4 study all three language.

Use a Venn diagram find (a) Only Sinhala, (b) Only Tamil (c) Only English  
 (d) Sinhala and Tamil, but not English (e) Only one of the language (f) None of the language

(06 Marks)

(Total Marks 20)

(4)

(i) Let  $A = \{a, b, c\}$ ,  $B = \{x, y\}$ ,  $C = \{p, q\}$ 

- Find
- (a)  $A \times A$
  - (b)  $A \times B \times C$
  - (c)  $n(B \times C)$
  - (d)  $A \times B \neq B \times A$

(04 Marks)

(ii)  $A = \{p, q, r\}$  and  $B = \{5, 6, 7, 8\}$   $R$  be the following relation from  $B$  to  $A$ .

$$R = \{(5, q), (5, r), (7, q), (8, p), (8, r)\}$$

- (a) Determine the matrix of the relation
- (b) Draw the arrow diagram of  $R$
- (c) Find the inverse relation  $R^{-1}$  of  $R$
- (d) Determine the domain and range of  $R$

(08 Marks)

(iii) Consider the following four relations on the set  $A = \{1, 2, 3, 4\}$ 

$$R_1 = \{(1,1), (1,2), (2,3), (1,3), (4,4)\}$$

$$R_2 = \{(1,1), (1,2), (2,1), (2,2), (3,3), (4,4)\}$$

$$R_3 = \{(1,3), (2,1)\}$$

$$R_4 = A \times A \text{ the universal relation}$$

Determine which of the relations are

- (a) Reflexive
- (b) Symmetric
- (c) Antisymmetric
- (d) Transitive

(08 Marks)

(Total Marks 20)

(5) (i) Briefly explain the followings with example

- (a) Domain
- (b) Co-domain (target set)
- (d) Composition Function

(06 Marks)

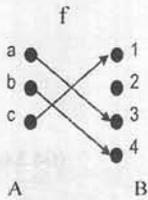
(ii) Let the function  $f$  and  $g$  be defined  $f(x) = 2x + 1$  and  $g(x) = x^2 - 2$ .

Find the formula defining the composition function

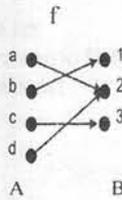
- (a)  $g \circ f$
- (b)  $f \circ g$

(06 Marks)

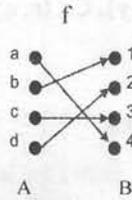
(iii) Let  $f:A \rightarrow B$  be defined by the following diagrams Determine if each function is one-to one, onto and invertible.



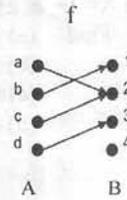
(a)



(b)



(c)



(d)

(08 Marks)

(Total Marks 20)

(6) (i) Briefly explain with example

(a) Symmetric Matrix

(b) Skew Symmetric Matrix

(04 Marks)

(ii) Find inverse of A (Using Gauss elimination method)

$$A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 2 & 7 & 7 \end{bmatrix}$$

(12 Marks)

(iii) Show that  $AA^{-1} = A^{-1}A = I$

(04 Marks)

(Total Marks 20)

(7). (i) Show that three properties of Determinants

(03 Marks)

(ii) Find the determinants of A

$$A = \begin{bmatrix} 1 & 3 & 1 \\ 2 & 4 & 2 \\ 3 & 5 & 3 \end{bmatrix}$$

(03 Marks)

(iii)

$$\begin{bmatrix} 11 & -1 & -1 \\ -1 & 6 & -2 \\ -1 & -2 & 7 \end{bmatrix} \begin{bmatrix} p_1 \\ p_2 \\ p_3 \end{bmatrix} = \begin{bmatrix} 31 \\ 26 \\ 24 \end{bmatrix}$$

Find  $p_1, p_2, p_3$  (using cramer's rule)

(14 Marks)

(Total Marks 20)

- (8). (i) Briefly explain with example (a) Transpose of Matrix (06 Marks)  
(c) Square Matrix

(ii)

$$\text{If } A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & 1 & 2 \\ -1 & 0 & -1 \end{bmatrix} \text{ Find cofactor matrix of } A$$

(08 Marks)

- (iii) (a) Find adjoint of A (01 Marks)  
(b) Find determinant of A (03 Marks)  
(c) Find inverse of A (02 Marks)

(Hint:  $C_{ij} = (-1)^{i+j} m_{ij}$  Where  $m_{ij}$  is the determinant of the matrix of order  $n-1$  obtained by deleting the row and column containing  $a_{ij}$ )

(Total Marks 20)