Discrete Structures (MA5.101)

Quiz - 2 (Monsoon 2021)
International Institute of Information Technology, Hyderabad
Time: 60 Minutes   Total Marks: 30
Instructions: This is online examination.
Write at the top of your answer book the following:
Discrete Structures (MA5.101)
Quiz - 2 (Monsoon 2021)
Date: 27-Dec-2021
Name:
Roll Number:
Submit your scanned hand-written answer script in the moodle
with the file name: RollNo_Quiz2_SecNo_27Dec2021.pdf

December 27, 2021

1. Choose the correct option for the following questions:

   (a) If A and B are symmetric relations, then the relation $A \cup B$ is _____.
      (A) Reflexive
      (B) Symmetric
      (C) Transitive
      (D) None of these

   (b) Let $S = \{0, 1, 2, 3, 4\}$, a partition be $P = \{\{0, 2\}, \{1\}, \{3, 4\}\}$, and a relation R induced by a partition which is an equivalence relation. Then, the ordered pairs in R is _____.
      (A) $\{(0, 0), (2, 2), (0, 2), (2, 0), (1, 1), (3, 3), (4, 4), (3, 4), (4, 3)\}$
      (B) $\{(0, 0), (2, 4), (4, 2), (0, 2), (2, 0), (1, 1), (3, 3), (4, 4), (3, 4), (4, 3)\}$
      (C) $\{(0, 0), (2, 3), (3, 2), (0, 2), (2, 0), (1, 1), (3, 3), (4, 4), (3, 4), (4, 3)\}$
      (D) $\{(0, 0), (1, 2), (2, 1), (0, 2), (2, 0), (1, 1), (3, 3), (4, 4), (3, 4), (4, 3)\}$

   (c) Let R be a relation on a set S, and R is symmetric as well as transitive relation. Then, R will be an equivalence relation if _____.
      (A) $\forall\, a \in S \nexists b$ such that xRy
      (B) for some $a \in S \exists b$ such that xRy
      (C) $\forall\, a \in S \exists b$ such that xRy
      (D) None of above

   (d) Let $\mathbb{R}$ be a set of real numbers, and define a binary relation R on $\mathbb{R} \times \mathbb{R} : \forall (x, y), (z, w) \in \mathbb{R} \times \mathbb{R}$, $(x, y)R(z, w)$ if and only if either $x < z$ or both $x = z$ and $y \leq w$. The, R is _____.

(A) Reflexive, Symmetric and transitive

(B) Reflexive, antisymmetric and not transitive

(C) Reflexive, antisymmetric and transitive

(D) A partial order relation

(e) Let R be a relation on the set $\mathbb{Z}$ (set of all integers) and define as follows: $\forall x, y \in \mathbb{Z}, xRy$ if and only if $(x + y)$ is divisible by 2. Then, R is _____.

(A) A partial order relation

(B) A symmetric relation

(C) An antisymmetric relation

(D) An antisymmetric but not partial order relation

(f) Let a set S contains 23 elements, and then the cardinality of symmetric relations can be _____.

(A) 2^{529}

(B) 2^{506}

(C) 2^{276}

(C) 2^{253}

(g) Let $A = \{0, 1, 2, 3\}$ and define the relations R, S, and T on A as follows:
i. $R = \{(0, 0), (0, 1), (0, 3), (1, 0), (1, 1), (2, 2), (3, 0), (3, 3)\}$,
ii. $S = \{(0, 0), (0, 2), (0, 3), (2, 3)\}$,
iii. $T = \{(0, 1), (2, 3)\}$
Then, which of the following statement is/are correct(s):

(A) R reflexive, symmetric, and transitive

(B) R reflexive and not transitive.

(C) S is not reflexive

(D) T is transitive

(h) Let a relation R on $\mathbb{Z}$ and define as $(a, b) \in R | a \geq b^2$. Then R is _____.

(A) Not transitive

(B) Antisymmetric

(C) Symmetric

(D) Not reflexive

(i) Let m and n be integers and let d be a positive integer. m is congruent to n modulo d is define by $m \equiv n \pmod{d}$ iff $d|(m - n)$. Then, which of the following statement(s) is/are true:

(A) $12 \equiv 7 \pmod 5$

(B) $6 \equiv -8 \pmod 4$

(C) $3 \equiv 3 \pmod 7$

(D) None of the above

(j) Let $S = \{0, 1, 2, 3, 4\}$ and define a relation R on S as $R = \{(0, 0), (0, 4), (1, 1), (1, 3), (2, 2), (3, 1), (3, 3), (4, 0), (4, 4)\}$. Then, the distinct equivalence classes are _____.

(A) $\{0, 4\}$ and $\{1, 3\}$

(B) $\{0, 4\}, \{1, 3\}$, and $\{2\}$

(C) $\{1, 3\}$ and $\{2\}$

(D) None of the above

$$[10 \times 1 = 10]$$

2. Consider the set $A = \{a, b, c\}$ and a relation R defined in it as $R = \{(a, a), (b, b), (c, c), (b, c), (c, a)\}$.

    (i) Find the symmetric closure of R.
    (ii) Find the transitive closure of R.

$$[5 + 5 = 10]$$

3. (a) Let $\epsilon = 0.0005$, and let R_ϵ be the relation defined as $\{(x, y) \in \mathbb{R}^2 : |x - y| < \epsilon\}$, where R_ϵ could be interpreted as the relation "approximately equal". Prove or disprove that R_ϵ is reflexive, symmetric, and transitive.

    (b) Give an example of a relation on the set of positive integers which is

    (i) symmetric and reflexive, but not transitive
    (ii) reflexive and transitive, but not symmetric

$$[5 + (2.5 + 2.5) = 10]$$

*************** **End of Question Paper** ******************