Birla Institute of Technology & Science, Pilani (Rajasthan)

First Semester 2018-2019

Quiz – 1 (Set A)

Course Number:	CS F222	**Course Title:**	Discrete Structures for Computer Science	
Date and Time:	Sep 13, 2018 (9.00 To 9.45 AM)	**Max. Marks, Nature, & Set :**	30 (15 % Weightage) [Closed Book]	

ID.No.: ______________________________	**Marks Obtained:** →	
Name: ______________________________	**Examiner's Signature:** →	

Note: Each question from Q1 to Q20 carry 1 mark, whereas each question from Q21 to Q25 carry 2 marks. There is NO NEGATIVE MARKING. You need to mark to most appropriate option. Q21-25 are to be answered in the space provided along with the question.

Q.→	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20
Ans. →	D	D	X	X	C	X	A	D	C	A/C	D	D	X	C	B	B	B	A	C	C

Q.1 The number of relations on a set of n elements that are both antisymmetric and symmetric:

(A) 2^{n^2} (B) $2^{n(n-1)}$ (C) $2^{n(n+1)/2}$ (D) 2^n

Q.2 The number of ways to go down a 7-step staircase if you go down 1, 2, or 3 steps at a time, would be:

(A) 12 (B) 28 (C) 34 (D) 44

Q.3 which is the correct solution for the recurrence relation $T(n) = 4T\left(\frac{n}{2}\right) + n^2$, with the base case $T(1) = 1$. Assume $n = 2^k$, for some integer$k \geq 1$.

(A) n^2 (B) $n \log_2 n$
(C) $n\ (\log_2 n)^2$ (D) $n^2 \log_2 n$

Q.4 Let R be the relation on Z + (set of integers) given by xRy iff $x^2 - y^2 <= 2$.

(A) Reflexive and symmetric, but not transitive.
(B) Reflexive, not symmetric, and transitive.
(C) Reflexive not symmetric and not transitive.
(D) Not Reflexive, Not symmetric, and transitive.

Q.5 Which of the following statement is true for all sets A?

(I) If R is an equivalence relation on A, then RoR is an equivalence relation on A.
(II) If R is a partial order relation on A, then RoR is a partial order relation on A.
(III) If R is a relation on A but R is not an equivalence relation, then RoR is not an equivalence relation on A.

(A) II (B) III (C) I, II (D) I, II, III

Q.6 Exactly which of the following relations R1, R2, R3 on Z+ (set of positive integers) are antisymmetric?

R1 = {(a, b) if $a^2 - b^2 = 3(a - b)$}
R2 = {(a, b) if a <= 2b}
R3 = {(a, b) if |a – b| < 4}.

(A) R1, R3 (B) R2, R3 (C) R1, R2 (D) R1

Q.7 Let R be the relation $R = \{ (a, b) \mid a < b \}$ on the set of integers. Which of the following statement is correct?

(A) $R^{-1} = \{ (a, b) \mid a > b \}$ and $\overline{R} = \{ (a, b) \mid a \geq b \}$
(B) $R^{-1} = \{ (a, b) \mid a \geq b \}$ and $\overline{R} = \{ (a, b) \mid a > b \}$
(C) $R^{-1} = \{ (a, b) \mid a > b \}$ and $\overline{R} = \{ (a, b) \mid a > b \}$
(D) $R^{-1} = \{ (a, b) \mid a \geq b \}$ and $\overline{R} = \{ (a, b) \mid a \geq b \}$
$\overline{R}$ = complement of R.

Q8. Let R be the relation {(1, 2), (1, 3), (2, 3), (2, 4), (3, 1)}, and let S be the relation {(2, 1), (3, 1), (3, 2), (4, 2)}. Which one of the following is the correct value of the reflexive closure of S ° R?

(A) { (2,2), (2,3), (3,2), (3,3), (3,4) (4,3), (4,4)}
(B) { (1,1), (2,2), (2,3), (3,2), (3,3), (3,4) (4,3), (4,4)}
(C) {(1, 1), (1, 2), (2, 1), (2, 2)}
(D) None of the above

Q.9 If R = {(x, y) | x and y are bit strings containing the same number of 0s}. Which one of the following is true with respect to the equivalence class of various binary strings?

(A) [1] = all strings which represent odd number
(B) [00] = all strings that contain two consecutive 0's
(C) [101] = all string which contain exactly one 0
(D) [1010] not = [00]

Q.10 Let R is the relation on set A = {1, 2, 3, 4, 5, 6} such that aRb if $|a - b| \leq 3$. Which of the following is true?

(A) R is not a partial order relation
(B) R^2 is the transitive closure of relation R
(C) R^3 is $A\ X\ A$
(D) R^2 is an equivalence relation

Q.11 Which of the relation(s) on the given sets is(are) antisymmetric?

S1: A = {1, 2, 3, 4, 5}, R = {(1, 3), (1, 1), (2, 4), (3, 2), (5, 4), (4, 2)}
S2: set of real numbers xRy iff $x^2 = y^2$.

(A) Only S1 (B) Only S2 (C) Both S1 and S2 (D) Neither S1 nor S2

Q.12 Let A = {2,3,57,8}. Which of the following relation is an equivalence relation?

(A) R = {(a,b) | a < 2b}
(B) R = {(a,b) | a mod 3 = b mod 2}
(C) R = {(a,b) | b mod a = 0}
(D) R = {(a,b) | a + b is even}

Q.13 Which one of the following is the transitive closure of the relation given by the matrix? $\begin{bmatrix}1&1&0&1\\1&0&0&1\\0&0&1&0\\1&0&0&1\end{bmatrix}$

(A) $\begin{bmatrix}1&1&0&1\\1&1&0&1\\1&1&0&1\\0&0&0&1\end{bmatrix}$ (B) $\begin{bmatrix}1&1&1&1\\1&1&1&1\\0&0&1&0\\1&1&1&1\end{bmatrix}$

(C) $\begin{bmatrix}1&1&1&1\\1&1&1&1\\1&1&1&1\\1&1&1&1\end{bmatrix}$ (D) $\begin{bmatrix}1&1&0&1\\1&0&0&1\\0&0&1&0\\1&1&0&1\end{bmatrix}$

Q.14 Which of the following statement is FALSE
(A) It is not possible to obtain two consecutive even terms in the Fibonacci sequence
(B) not possible to obtain three consecutive odd terms in the Fibonacci sequence
(C) Fibonacci sequence is a bounded sequence.
(D) The characteristic roots of Fibonacci recurrence relation are irrationals.

Q.15 Let r(R), s(R) and t(R) be the reflexive, symmetric and transitive closures of a relation R respectively. Which of the following statement is NOT correct?

(A) r(s(R)) = s(r(R)) (B) s(t(R)) = t(s(R))
(C) r(t(R)) = t(r(R)) (D) t(s(r(R))) = r(t(s(R)))

Q.16 The number of bit operations required to compute the transitive closure of a relation defined on a set with 4 elements, using connectivity relation R* and using Warshall's Algorithm are respectively:

(A) 256, 64 (B) 384, 128 (C) 640, 128 (D) 384, 64

Q.17 If R is the equivalence relation defined on the set B={1,2,3,4} by R = {(1,1),(1,2),(2,1),(2,2),(3,3),(3,4),(4,3), (4,4)} then the number of equivalence classes is:
(A) 1 (B) 2 (C) 3 (D) 4

Q.18 **A** relation R is defined on ordered pairs of integers as follows : (x, y) R (u, v) if x < u and y > v. Then R is

(A) Neither a Partial Order nor an Equivalence Relation
(B) A Partial Order but not a Total Order
(C) A Total Order
(D) An Equivalence Relation

Q.19 The Hasse diagram for the partial order R = {(a, b), (a, c), (a, d), (a, e), (b, e), (b, d), (c, d), (a, a), (b, b), (c, c), (d, d), (e, e)} has levels.
(A) 1 (B) 2 (C) 3 (D) 4

Q.20 If *C* is a condition that elements of the *n*-ary relations *R* and *S* may satisfy, then
(I) $s_C(R \cup S) = s_C(R) \cup s_C(S)$.
(II) $s_C(R \cap S) = s_C(R) \cap s_C(S)$.

(A) Only I (B) Only II
(C) Both I and II (D) Neither I nor II

Q21. A vending machine dispensing books of stamps accepts only 1 Rupee coins, 1 Rupee currency notes, and 2 Rupee currency notes. Let a_n denote the number of ways of depositing n Rupees in the vending machine, where the order in which the coins and currency notes are deposited matters.

The recurrence relation for $\boldsymbol{a_n = 2a_{n-1} + a_{n-2}}$ with initial condition $\boldsymbol{a_0 = 1}$, $\boldsymbol{a_1 =}$ __**2**__

Q22. The recursive definition of the function $a_n = n^2 + n$ can be given as $\boldsymbol{a_n = a_{n-1} + 2n}$ with the initial condition $a_1 = \mathbf{2}$

Q.23 Consider the following C code of a recursive function named "fun". Write (in one sentence) the output printed by this function, when called as **fun(arr, 0, n-1)** where "arr" is an array of integers of size n.

```
void fun(int arr[], int l, int n, int sum=0)
{
  if (l > n)
  {
    printf("%d ", sum);
    return;
  }
  fun(arr, l+1, n, sum+arr[l]);
  fun(arr, l+1, n, sum);
}
```

______ **Sum of all subsets of the array** ______

Q.24 Draw the hasse diagram for the POSET ({1,2,4,5,10,12,20,25}, |)

Q.25 The diagram at the right is the matrix representation of a relation R.

Which of the following properties are applicable to the relation R.

Reflexive, Symmetric, Antisymmetric, Transitive

$$M_R = \begin{pmatrix}1&0&1&0\\1&1&0&1\\1&1&1&0\\1&1&0&1\end{pmatrix}$$

______ **Reflexive only** ______