Exam. Code: 0922
Sub. Code: 33526

2015

B.E. (Information Technology) Fourth Semester

ASM-401: Discrete Structures

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: ***Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section.***

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I. **(5×2=10)**

a. Define order and degree of a recurrence relation. Determine the order and degree of the Fibonacci sequence whose first two terms are 0 and 1, respectively.

b. What do you mean by derangements? How many derangements are possible for the set {1, 2, 3, 4} ?

c. Define a partially ordered set (POSET). Can a relation be both a POSET and an equivalence relation? Justify your answer with an example.

d. If $f(x) = x^2$, $-3 \leq x \leq 3$, find its range. Check whether $f(x)$ is bijective?

e. Prove by mathematical induction that if a set A has n elements, then its power set has 2^n elements.

Section- A

II.

a. Prove or disprove that: **(5)**

i. $(P \rightarrow Q) \vee (R \rightarrow P)$ is a Tautology.
ii. $P \rightarrow (\sim P) \leftrightarrow (\sim p)$ is a Contradiction.
iii. $(P \vee (Q \wedge R))$ and $((P \vee R) \wedge (P \vee Q))$ are logically equivalent.

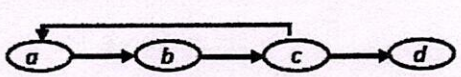
b. Write down the following arguments in symbolic form and test the validity of the consequences. **(5)**

i. If you get the job and works hard, then you will be promoted. If you get promotion, then you will be happy. You will not be happy, therefore, either you will not get the job or you will not work hard.

ii. All engineering students study mathematics. Among them, only computer science engineering students study discrete mathematics. Anyone who studies discrete mathematics is good at reasoning. Arun is not good at reasoning. Therefore, Arun is not a computer science engineering student.

III.

a. Compute the Transitive closure using Warshall's algorithm for the relation defined by following di-graph on the set $A = \{a, b, c, d\}$: **(5)**



b. State the Pigeonhole Principle and use it to determine the minimum number of students required in a class to ensure that at least 6 students receive the same grade, given that there are five possible grades: A, B, C, D, and F. **(5)**

P.T.O.

IV.

a. Determine whether the relation of divisibility on the set **A = {1, 2, 3, 4, 6, 12}** is a Lattice. Write its adjacency matrix. **(5)**

b. Consider the function f : N→N, where N is the set of natural numbers including zero. Determine which of the following functions are invertible for natural number x: **(5)**

i. $f(x)=x^2+3$

ii. $f(x)= x \pmod 7$

Section- B

V.

a. Solve the recurrence relation $a_r + 5a_{r-1} + 6a_{r-2} = 3r^2$ with initial conditions $a_0 = 2$ and $a_1 = 3$. **(5)**

b. India and Australia are playing a one-day international cricket series, where the series ends when one team wins 4 matches. No match ends in a draw. In how many ways can the series be won? **(5)**

VI.

a. Prove that a graph *G* has chromatic number 2 if and only if *G* is a non-empty bipartite graph. **(5)**

b. Prove that the number of vertices of odd degree in a graph is always even. **(5)**

VII.

a. State and prove Lagrange's theorem for finite groups. **(5)**

b. Differentiate between a Ring and a Field. Provide a suitable example to illustrate the difference. **(5)**

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