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2 SEM TDC CSc G 1

2013

(May)

COMPUTER SCIENCE

(General)

Course : 201

(Discrete Structures)

Full Marks : 80

Pass Marks : 32

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Select the correct answer : 1×8=8

(a) Consider the set $A = \{a, b\}$. Then, the family of all the subsets of A is called the —— of A.

(i) universal set

(ii) non-empty set

(iii) power set

(iv) ordered set

(b) A function F is defined as —— if it is both one-to-one and onto.

(i) injective

(ii) surjective

(iii) bijective

(iv) identity

(c) A relation R is said to be an equivalence relation if R is

(i) reflexive and symmetric

(ii) anti-symmetric

(iii) reflexive and transitive

(iv) reflexive, symmetric and transitive

(d) The equation $a_r^3 + 3a_{r-1} + 2a_{r-2}$ is a recurrence relation of degree

(i) 1

(ii) 2

(iii) 3

(iv) 0

(e) The particular solution of the recurrence relation $a_r - 5a_{r-1} + 6a_{r-2} = 1$ is

(i) 1/2

(ii) 2

(iii) 1/3

(iv) 1

(f) The function —— is both upper and lower bound on $f(n)$.

(i) $f(n) = \Omega(g(n))$

(ii) $f(n) = \theta(g(n))$

(iii) $f(n) = O(g(n))$

(iv) $f(n) = \omega(g(n))$

(g) A graph without cycles is called a/an

(i) path

(ii) simple path

(iii) simple cycle

(iv) acyclic

(h) Consider the following statements :

p : Ramen is coward

q : Ramen is lazy

r : Ramen is rich

The symbolic form of the statement is given below :

Ramen is coward or lazy but not rich is

(i) $(p \vee q) \wedge \sim r$

(ii) $(p \wedge q) \wedge r$

(iii) $(p \vee q) \vee r$

(iv) $p \wedge q \sim r$

2. Answer any *four* questions :

(a) State De Morgan's laws. Show that $p \Leftrightarrow q$ and $(p \Rightarrow q) \wedge (q \Rightarrow p)$ are equivalent. 2

(b) Define a spanning tree. Compute the value of the following prefix expression :

$$- * 2 / 8, 4, 5$$

2+2=4

(c) Find the value of x, if

$$(1/4!) + (1/5!) = (x/6!)$$

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(d) Find the coefficient of x^7 in the expression of $(1+3x-2x^3)^{10}$.

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(e) Let the function $f: R \to R$ be defined by

$$f(x) = \begin{cases} 2x+5, & x > 9 \\ x^2 - |x|, & x \in [-9, 9] \\ x-4, & x < -9 \end{cases}$$

Determine $f(3)$.

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(f) State the formal definition of summation. Give any three important properties involving summation.

1+3=4

3. Answer any *eight* questions :

(a) If

$$A = \{1, 4\}, B = \{4, 5\}, C = \{5, 7\}$$

determine—

(i) $(A \times B) \cup (A \times C)$

(ii) $(A \times B) \cap (A \times C)$

3½+3½=7

(b) Define linear homogeneous and non-linear homogeneous recurrence relations. Solve the recurrence relation

$$a_r - 6a_{r-1} + 8a_{r-2} = 0$$

4+3=7

(c) Define the common asymptotic notations used to analyse complexity of algorithms. For $f(x) = 3x^3 + 2x^2 + 9$, show that $f(x) = O(x^3)$.

5+2=7

(d) Explain the various types of graphs with examples.

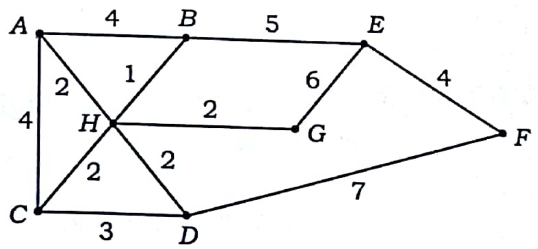
7

(e) Define Hamiltonian path and circuit. Prove or disprove—"A graph containing an Euler path must be cyclic".

4+3=7

(f) State the techniques for binary tree traversal. Find the minimum spanning tree from the directed graph G given below :

3+4=7



(g) Use generating function to solve the recurrence relation

$$a_{n+2} - 2a_{n+1} + a_n = 2^n, \quad a_0 = 2, a_1 = 1$$

7

(h) A tree has 3 vertices of degree 3 each. What is the number of leaves in this tree?

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(i) How many integral solutions are there to the system of equations

$$x_1 + x_2 + x_3 + x_4 + x_5 = 20$$

$$\text{and } x_1 + x_2 = 15$$

where $x_k \geq 0$, $k = 1, 2, 3, 4, 5$? 7

(j) If x is a real number, then show that

$$\lfloor 2x \rfloor = \lfloor x \rfloor + \left\lfloor x + \frac{1}{2} \right\rfloor$$

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