This question paper contains 3 printed pages. *Your Roll No. .....*

Sl. No. of Ques. Paper	: 6570	FC-2
Unique Paper Code	: 32341202	
Name of Paper	: Discrete Structures	
Name of Course	: B.Sc. (Hons) Computer Science (CBCS)	
Semester	: II	
Duration :	: 3 hours	
Maximum Marks	: 75	

(Write your Roll No. on the top immediately on receipt of this question paper.)

Section A is compulsory and carries 35 marks. Attempt any four questions from Section B. Parts of a question must be answered together. Symbols have their usual meanings.

Section A

1 (a) In a survey of 60 people, it was found that 25 people read newspaper H, 26 read newspaper T, 26 read newspaper I, 9 read both H and I,11 read both H and T, 8 read both T and I, 3 read all three newspapers. Find 5

(i) The number of people who read at least one of the three newspapers.

(ii) The number of people who read exactly one newspaper.

(b) Let R be a binary relation on the set of all positive integers such that 5

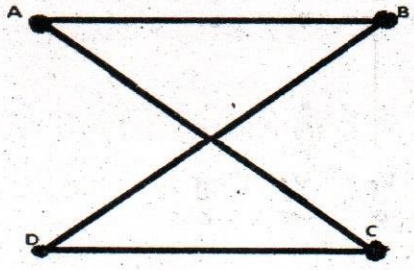
$$R = \{ (a, b) \mid a - b \text{ is an odd positive integer} \}$$

Is R i) Reflexive ? ii) Symmetric? iii) Antisymmetric? iv) Transitive?

(c) Define Hamiltonian path and Hamiltonian Circuit. Draw a graph that has: 5

(i) An Euler path and Hamiltonian circuit.
(ii) Neither Eulerian nor Hamiltonian path
(iii) A Hamiltonian but non-Eulerian path

(d) How many paths of length four are there from A to D in the simple graph G in the following figure. 5



(e) Determine the numeric function for the following generating function: 5

$$A(z) = (1+ z^2) / (4 - 4z - z^2)$$

P.T.O

(f) Use Master method to find the asymptotic bounds for the following recurrence 5
$T(n) = 125\ T(n/5) + n^3$

(g) Show that $\bar{p}$ is a tautologically implied by $\overline{(p \wedge \bar{q})}, \bar{q} \vee r, \bar{r}$ 5

Section B

2 (a) Show that $n^4 - 4n^2$ is divisible by 3 for all $n \geq 2$ by induction. 5

(b) Determine whether the function f is a bijection from W to W (W is the set of natural numbers including 0) where $f(x) = x^2 + 2$. If the function g, where g: W→ Z, is defined as $g(x) = x - 4$, find fog and gof. 5

3 (a) Six boys and six girls are to be seated in a row, in how many ways can they be seated if 5

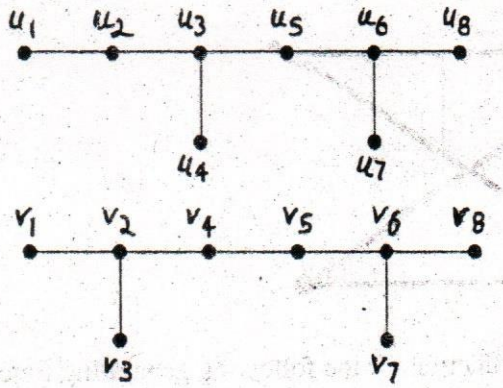
(i) All boys are to be seated together and all girls are to be seated together

(ii) No two girls should be seated together.

(b) Consider a set A = {2,7,14,28,56,84} and the relation aRb if and only if a divides b. Give the Hasse diagram for the partial order set (A,R) 5

4 (a) Define planar graph. Is $K_{3,3}$ planar ? Justify your Answer. 5
Suppose that a connected planar graph has 30 edges. If a planar representation of this graph divides the plane into 20 regions, how many vertices does this graph have?

(b) What do you mean by graph invariant? Are the following pair of graphs isomorphic? Justify. 5



5 (a) (i) What is the chromatic number of K_n? Does this result contradict the four color theorem? 5

(ii) Prove that a connected graph is a tree if and only if the number of vertices in the graph is one more than the number of edges.

(b) Let f(n) and g(n) be asymptotically positive functions. Prove or disprove the given conjecture: 5

$$f(n) = O(g(n)) \text{ implied } g(n) = O(f(n))$$

6 (a) Determine the particular solution for the difference equation. 5

$$a_r - 3a_{r-1} + 2a_{r-2} = 2^r$$

(b) Let **'a'** be a numeric function such that 5

$$a_r = \begin{cases} 2 & 0 \le r \le 3 \\ 2^{-r} + 5 & r \ge 4 \end{cases}$$

Determine (i) $S^2\mathbf{a}$ (ii) $S^{-2}\mathbf{a}$

7 (a) Show the validity of the following argument: If Ram gets the job and works hard, then he will be promoted. If Ram gets promotion, then he will be happy. He will not be happy. Therefore, either he will not get the job or he will not work hard. 5

(b) (i) Show that $(p \rightarrow q) \wedge (r \rightarrow q)$ and $(p \vee r) \rightarrow q$ are logically equivalent. 5

(ii) Given that the value of $p \rightarrow q$ is false, determine the value of $(\bar{p} \vee \bar{q}) \rightarrow q$.