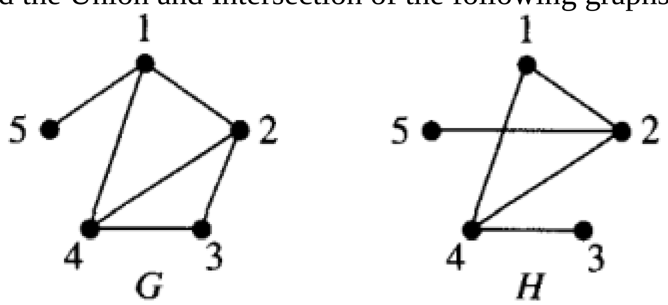
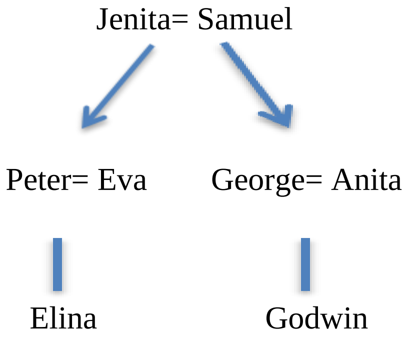
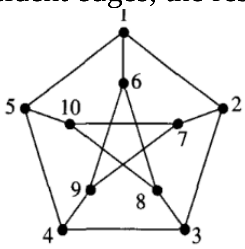
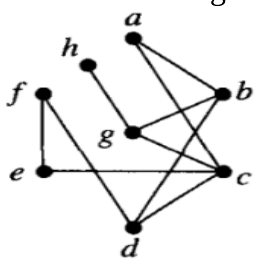
STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted during the academic year 2023 – 2024)

M. Sc. DEGREE EXAMINATION, NOVEMBER 2023
INFORMATION TECHNOLOGY
FIRST SEMESTER

COURSE : MAJOR CORE
PAPER : DISCRETE MATHEMATICS FOR COMPUTER SCIENCE
SUBJECT CODE: 23CS/PC/DM14
TIME : 3 HOURS **MAX. MARKS: 100**

Q. No.	SECTION A **Answer all questions: (10 x 2=20)**	CO	KL
1.	Define Complemented Lattice.	CO1	K1
2.	State the Principle of Mathematical Induction	CO1	K1
3.	Let p denote "Joe eats Sweets" and q denote "Angel eats Chips" Write the proposition for 1) If Joe eats Sweets, then Angel eats Chips. 2) Joe eats Sweets if and only if Angel eats Chips	CO1	K1
4.	Construct a truth table to show that (p ^ q) -> p is a tautology	CO1	K1
5.	Enumerate the two types of Quantification.	CO1	K1
6.	For the universal set N, Is 3x ((x - 3 = 1) ^ (x > 3)) true?	CO1	K2
7.	Interpret the Pigeonhole principle.	CO1	K2
8.	Outline any two properties of Asymptotic Domination.	CO1	K2
9.	Describe the Characteristics of a Tree.	CO1	K2
10.	Find the Union and Intersection of the following graphs. 	CO1	K2
Q. No.	**SECTION B** **Answer all the questions (4 x 5=20)**	**CO**	**KL**
11.	a) Use mathematical induction to show the following: For any natural number n such that n >= 4, prove that n! > n^2. **(OR)** b) Apply Square Root I algorithm to find the value of √17.	CO2	K3

12.	a) Use the Boolean laws to prove that (not p ^ q) V (p ^ not q) V (p ^ q) is logically equivalent to the formula p v q. Provide a circuit equivalent to the logic. **(OR)** b) Let x, y be elements of a Boolean algebra. Make use of the DNF for the Boolean expression (x ^ y) V (not x ^ not y) to design a combinatorial circuit.	CO2	K3
13.	a) Give an example of a universal set U and predicates P and Q such that (∀xP(x)) —> (∀ x.Q(x)) is true but ∀ x(P(x) –>Q(x)) is false. **(OR)** b)  For the family tree given in the above figure identify the elements of the relations (a) IsMarriedTo, (b) IsParentOf and (c) IsSameGeneration	CO2	K3
14.	a) Prove the following theorem. Let F : X ->Y where X and Y are finite with |X| = |Y|. Then, F is 1-1 if and only if F is onto **(OR)** b) Test the following. Let m ∈ N. Given m integers al, a2 .... am, there exist k and l with 0 <=k <1 <=m such that a_{k+1} + a_{k+2} + + a_l is divisible by m.	CO3	K4
Q. No.	**SECTION C** **Answer all the questions (6 x 10=60)**	**CO**	**KL**
15	a) Modify the following into CNF 1) $(P \to (Q \to R)) \to (P \to (R \to Q))$ 2) $(P \to Q) \to ((Q \to R) \to (P \to R))$ **(OR)** b) Theorem 1. Every formula is logically equivalent to a formula in DNF. Theorem 2. Every formula is logically equivalent to a formula in CNF. Apply Theorem 1 and 2 on the following formula and prove. (not (p -> q)) -> (q ^ not r)	CO2	K3

16	**a)** Prove the following using the principle of mathematical induction $\forall n \in N: 1.2+2.3+3.4+......+n(n+1) = [n(n+1)(n+2)] / 3$ **(OR)** b) The terms of a sequence are given recursively as $a_o=0$, $a_1=2$, and $a_n = 4(a_{n-1} - a_{n-2})$ for n>=2. Prove by induction that $b_n = n \cdot 2^n$ is a closed form for the sequence. That is, prove that $a_n = b_n$ for every n €N.	CO3	K4
17	a)) Prove that the Petersen graph shown here is non-Hamiltonian. (b) Prove that by removing any single vertex and its incident edges, the resulting graph is Hamiltonian.  **(OR)** b)Let G be a graph. Prove that G is bipartite if and only if G contains no odd cycle.	CO3	K4
18	a) Explain measuring the time complexity of an algorithm for polynomial and non-deterministic polynomial problems. **(OR)** b)How to measure the complexity of an algorithm in structured programming? Formulate with the help of counting statements.	CO4	K5
19	a)Portray the special types of relations with a suitable example. **(OR)** b)Write the loop invariant assertions using Bubble sort.	CO4	K5
20	a) Resolve the Depth First Search Algorithm to examine the vertices and the edges of the given graph.  **(OR)** b) Verify that O($\log_2$ (n!)) = O(n log(n)).	CO5	K6

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