Code No: R1921051 **R19** SET - 1

II B. Tech I Semester Regular Examinations, March - 2021
MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE
(Computer Science &Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
All Questions carry **Equal** Marks
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1	a)	Obtain the Principal disjunctive normal form of $(P\to Q) \wedge (Q\leftrightarrow R)$	8M
	b)	Show that $R\wedge(P \vee Q)$ is a valid conclusion from the premises $P\vee Q$, $Q\to R$, $P\to M$ and $\neg M$.	7M
		Or	
2	a)	Obtain the Principal conjunctive normal form of $(P\wedge Q)\vee(\sim P\vee Q\vee R)$	8M
	b)	Show that $(\exists x)(P(x) \wedge Q(x)) \Rightarrow (\exists x) P(x) \wedge (\exists x) Q(x)$	7M
3	a)	Define Relation? List out the Properties of Binary operations?	7M
	b)	Let the Relation R be R={(1,2) ,(2,3),(3,3)} on the set A= {1,2,3}. What is the Transitive Closure of R?	8M
		Or	
4	a)	Prove that $(S,\leq)$ is a Lattice, where S= {1,2,3,6} and $\leq$ is for divisibility. Prove that it is also a Distributive Lattice?	15M
	b)		
5	a)	Write the 3-combinations and 3-permutations of {3.a, 2.b, 1.c, 3.d}.	7M
	b)	In how many ways can a committee of 5 teachers and 4 students be selected from 9 teachers and 15 students such that teacher A refuses if student B is in the committee.	8M
		Or	
6	a)	Expand the multinomial $(X_1+X_2+X_3+X_4)^4$.	7M
	b)	Find the number of non negative integral solution for the equation $X_1+X_2+X_3+X_4=50$, where $X_1>= 2$, $X_2>= 4$, $X_3 >= -3$, $X_4>= 7$.	8M
7	a)	Solve the recurrence relation. $u_n-2u_{n-1}-2u_{n-2}=5^n$, $n \geq 2$, $u_0= 1$, $u_1 = 1$	8M
	b)	Explain in brief about Partial fractions?	7M
		Or	
8	a)	Solve an=an-1 + n where a0 =2 by substitution?	7M
	b)	Find a particular solution for recurrence relation using the method of determined coefficients an- 5 an-1=3^n ?	8M
9	a)	Let G be the non directed graph of order 9 such that each vertex has degree 5 or 6. Prove that atleast 5 vertices have degree 6 or atleast 6 vertices have degree 5.	8M
	b)	Determine the number of edges in: i) Kn ii) Km,n iii) Pn.	7M
		Or	
10	a)	What is a Hamiltonian Cycle? Draw bipartite graph K3,4 and prove that this graph does not have a Hamiltonian cycle.	10M
	b)	Prove that a simple graph with n vertices and k components can have at most (n - k)(n – k + 1) edges.	5M
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1 a) Explain the term tautology? Show that $[(p\rightarrow q)\rightarrow r]\rightarrow[(p\rightarrow q)\rightarrow(p\rightarrow r)]$ is tautology ? 8M
b) State the inverse for the statement "If a triangle is not isosceles, then it is not equilateral". 7M

Or

2 a) Derive the following using CP rule if necessary 8M
$P \rightarrow (Q\rightarrow R)$, $Q \rightarrow (R\rightarrow S) \Rightarrow P \rightarrow (Q\rightarrow S)$
b) What is mean by contradiction? Explain it with an example. 7M

3 a) Let A ={a, b, c} be a set and relation R on A is as = {(a, a)(a, b)(b, c)(c, c)}. Is R. i) Reflexive ii) Symmetric iii)Transitive. 8M
b) Prove that the intersection of any two subgroups of a group G is again subgroup of G. 7M

Or

4 a) In a lattice $(L, \leq, \wedge, \vee)$ state and prove the laws indempotent, commutative, association and absorption. 7M
b) If R and S are equivalence relations on a set A. Prove that $R\cap S$ is an equivalence Relation. 8M

5 a) Find the number of integers between 1 and 250 that are divisible by any of the integers 2, 3 and 6. 8M
b) Find the coefficient of x^9y^3 in the expansion of $(2x - 3y)^{12}$. 7M

Or

6 a) How many bit strings of length 10 contain: 7M
i) At most four 1's ii) At least four 1's iii) Exactly four 1's
b) There are 40 computer programmers for a job. 25 know Java, 28 know Oracle and 7 know neither language. Using principle of inclusion exclusion find how many know both languages. 8M

7 a) Find the number of integer solutions of the equation $x_1 + x_2 + x_3 + x_4 + x_5 = 30$ Under the constraints $x_i \geq 0$ for all i = 1, 2, 3, 4, 5 and further x2 is even and x3 is odd. 8M
b) Solve the recurrence relation $a_n \cancel{-6a}_{n-1}+ \cancel{9a}_{n-2}= 0$ for $n \geq 2$. 7M

Or

8 a) Solve the recurrence relation $T(n) = 4T(n-1) + 2^n$, with $T(0) = 6$. 8M
b) What is a Generating function and explain the operations on generating functions? 7M

9 a) Show that a simple complete digraph with n nodes has the maximum number of Edges n (n-1). Assuming that there are no loops. 8M
b) State and explain graph coloring problem. Give its applications. 7M

Or

10 a) Show that the complete bi-partite graph K3, 3 is not planar graph. 7M
b) Write short notes on DFS and BFS. 8M
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1	a)	Define Well Formed Formula? Explain about Tautology with example?	8M
	b)	Without constructing the Truth Table prove that $(p\rightarrow q)\rightarrow q=p\vee q$?	7M
		Or	
2	a)	Obtain the Principal conjunctive normal form of $(P\rightarrow Q) \wedge (Q\leftrightarrow R)$	7M
	b)	Show that $S \vee R$ is tautologically implied by $(P \vee Q) \wedge (P \rightarrow R) \wedge (Q \rightarrow S)$ using Automatic Theorem Proving?	8M
3	a)	Explain properties of binary relations with examples.	7M
	b)	Draw the Hasse diagram for the partial ordering $\{(A, B): A \leq B\}$ on the power set e(S) where S={a, b, c} and $\leq$ is subset relation	8M
		Or	
4	a)	Draw the Hasse diagram for the divisibility on the set {1,2,3,6,12,24,36,48,96}.	8M
	b)	Define equivalence relation. Show that the relation equal on set of integers is equivalence relation.	7M
5	a)	Write the 3-combinations and 3-permutations of {3.a, 2.b, 1.c, 3.d}.	7M
	b)	There are 35 students and 04 teachers. In how many ways every student shakes hand with other students and all the teachers.	8M
		Or	
6	a)	How many different five digit numbers can be formed from the digits 0,1,2,3 and 4?	7M
	b)	In how many ways can 23 different books be given to 5 students so that 2 of the students will have 4 books each and the other 3 will have 5 books each?	8M
7	a)	Let A={1, 2,3 ,4} and f and g be functions from A to A given by f={(1,4), (2,1), (3,2),(4,3)} and g={ (1,2), (2,3), (3,4), (4,1)} prove that f and g are inverse of each other	8M
	b)	Explain Generating function and explain various operation on generating Function.	7M
		Or	
8	a)	Solve the recurrence relation. $u_n-2u_{n-1}-2u_{n-2}=5^n$, $n \geq 2$, $u_0= 1$, $u_1 = 1$	7M
	b)	Find the particular solution of the recurrence relation $a_{n+2} - 4\, a_{n+1} + 4\, a_n = 2^n$?	8M
9	a)	In any planar graph, show that $\lvert V\rvert-\lvert E\rvert+\lvert R\rvert=2$.	7M
	b)	Prove that complete graph of 5 vertices is non planar.	8M
		Or	
10	a)	Write an algorithm for breadth-first search spanning tree.	8M
	b)	Write Kruskal"s Algorithm and explain it with an example.	7M
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Code No: R1921051 **R19** SET - 4

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Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
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1 a) Define tautology. Show that $[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$ is a tautology, by constructing a truth table. 8M

b) Prove the following logical equivalence without using truth table. 7M
$(p \rightarrow q) \wedge [\rceil q \wedge (r \vee \rceil q)] \iff \rceil(q \vee p)$

Or

2 a) a)Prove that 8M
i) $\sim (P\uparrow Q) \leftrightarrow \sim P \downarrow \sim Q$
ii) $\sim (P\downarrow Q) \leftrightarrow \sim P \uparrow \sim Q$ Without using truth table?

b) Write conditional proposition and logical equivalence with suitable examples. 7M

3 a) If R and S are equivalence relations on a set A. Prove that $R \cap S$ is an equivalence Relation. 7M

b) Let B = { a, b, c} and A = P (B) be the power set of B. Draw the Hasse diagram for $\subseteq$ and poset A. 8M

Or

4 a) Prove that every subgroup of a cyclic group is cyclic. 7M

b) In any group (G,*), by proving the inverse of every element is unique. Show that $(a*b)^{-1} = b^{-1} * a^{-1}$, $\forall a\ b \in G$. 8M

5 a) Compare and contrast Euler and Hamiltonian graphs using examples? 8M

b) What is the coefficient of x^3y^7 in $(x+y)^{10}$? 7M

Or

6 a) Find the number of integers between 1 and 250 that are divisible by any of the integers 2,3 and 6. 8M

b) Find the coefficient of x^9y^3 in the expansion of $(2x - 3y)^{12}$. 7M

7 a) Solve $an + 2n\, a_{n-1} - 3n(n-1)a_{n-2} = 0$. 7M

b) Solve the recurrence relation $an - 8\, a_{n-1} + 21\, a_{n-2} - 18\, a_{n-3} = 0$ for $n \geq 3$ using generating functions? 8M

Or

8 a) Solve the recurrence relation $T(n) = 4T(n-1) + 2^n$, with $T(0) = 6$. 8M

b) Explain in brief about Partial fractions? 7M
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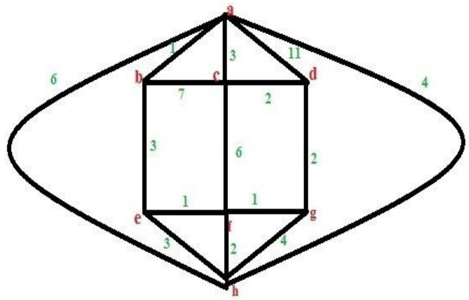
9 a) Write short notes on DFS and BFS. 8M

b) Construct the minimal cost spanning tree for the cities shown in above graph using krushkals algorithm? 7M



Or

10 a) State and explain graph coloring problem. Give its applications. 7M

b) Construct the minimal cost spanning tree for the cities shown in above graph using Prim's algorithm? 8M