II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2018
MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE
(Com to CSE & IT)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) List all implications in statement calculus (2M)
   b) Explain compatibility of relations with example (2M)
   c) Explain right cosets and left cosets with suitable example (2M)
   d) How many integers from 1 to 50 are multiples of 2 or 3 but not both? (3M)
   e) Explain applications of generating functions? (3M)
   f) What are bipartite graphs? (2M)

PART –B

2. a) Explain well formed formulas with suitable example (7M)
   b) Show that the formulas $p \vee (q \wedge r)$ and $(p \vee q) \wedge (p \vee r)$ are logically equivalent using PCNF? (7M)

3. a) Prove that $(A-C) \cap (B-C) = (A \cap B) - C$ for the sets A,B,C (7M)
   b) Prove that $D_{42} \equiv \{ S_{42}, D\}$ is a complemented lattice (7M)

4. a) Show that the necessary and sufficient condition for a non empty subset H of a group G to be a sub group is $a \in H, b \in H \Rightarrow a*b^{-1} \in H$ (7M)
   b) Find GCD of 615 and 1080 and find u and v such that GCD (615, 1080) = 615u+ 1084v. (7M)

5. a) Shirts numbered consecutively from 1 to 20 are worn by 20 students of a class when any three of these students are chosen to be a debating team from the class, the sum of their shirt numbers is used as the code number of the team. Show that if any 8 of the 20 is selected, then from these 8 we may form at least two different teams having the same code numbers? (7M)
   b) There are four bus lines between A and B and five bus lines between B and C. in how many ways can a man travel (i) round trip by bus from A to C via B? (ii) round trip by bus from A to C via B if he does not want to use a bus line more than once? (7M)
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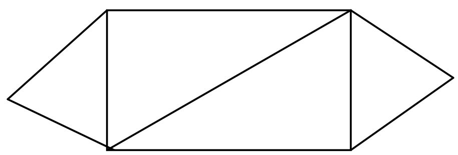
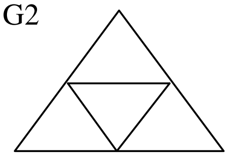
6. a) Solve the recurrence relation $a^2_{n+2} - 5\, a^2_{n+1} + 4\, a^2_n = 0$ for $n \geq 0$, given $a_0 = 0$, and $a_1 = 13$. (7M)
   b) Solve the recurrence relation $F_{n+2} = F_{n+1} + F_n$ for $n \geq 0$, given $F_0 = 0$, $F_1 = 1$ (7M)

7. a) Show that in every graph the number of vertices of odd degrees is even (7M)
   b) Explain isomorphism of two graphs? Check whether the given graphs G1 and G2 are isomorphic or not? Give reasons (7M)

G1



G2



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PART –A

1. a) Explain free and bound variables with suitable example each (2M)
   b) Explain equivalence classes with suitable examples? (2M)
   c) List and explain properties of lattices? (3M)
   d) In a group of 50 students 24 like cold drinks and 36 like hot drinks and each student likes at least one of the two drinks. How many like both cold drinks and Hot drinks? (3M)
   e) What is particular solution? Explain with suitable example? (2M)
   f) Explain Breadth First Search with suitable example? (2M)

PART –B

2. a) Prove $\forall x(P(x) \vee A(x))$, $\neg P(x)$, $\forall x(A(x) \rightarrow H(x)) \Rightarrow H(x)$ (7M)
   b) If there were a meeting, then catching the bus was difficult. If they arrived on time then catching the bus was not difficult. They arrived on time therefore there was no meeting. Show that the statements constitute a valid argument. (7M)

3. a) Explain different types of functions with suitable example? (7M)
   b) If f = $\begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 3 & 1 \end{pmatrix}$ then find f^{-1} and show that $(f \circ f^{-1}) = (f^{-1} \circ f) = I$? (7M)

4. a) Show that the composition of semi group homomorphism is also a semi group homomorphism. (7M)
   b) Let a, b, c $\in$ Z the set of integers then (i) if a|b and a|c then a|(b+c) and a|(b-c) (ii) if a|b and a|c then for any integers m and n ,a|(bm+cn) (7M)

5. a) Suppose a department consists of eight men and nine women in how many ways can we select a committee of (i) Four persons that has at most one man? (ii) Four persons that has persons of both sexes? (iii) Four persons so that two specific persons are not included? (7M)
   b) Prove that every set of 37 positive integers contains at least two integers that leave the same remainder up on division by 36? (7M)

6. a) Solve the recurrence relation $a_n = 8\, a_{n-1} + 16\, a_{n-2}$ for $n \geq 2$, $a_0 = 16$, $a_1 = 80$. (7M)
   b) Solve the recurrence relation $a_k - 7\, a_{k-1} + 10\, a_{k-2} = 6 + 8k$, $a_0 = 1$, $a_1 = 2$ (7M)
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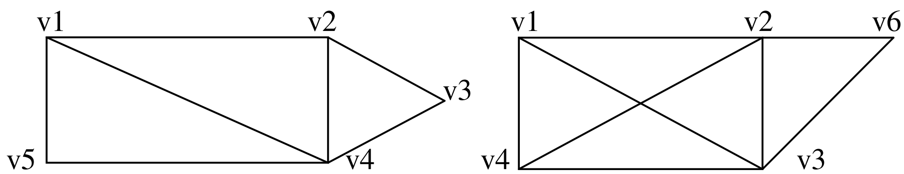
7. a) Explain edge disjoint and vertex disjoint sub graphs with suitable example? (7M)

b) Find union ,intersection and G1 delta G2 for the following graphs G1and G2 (7M)



(G1) (G2)

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PART –A

1. a) Explain universe of discourse with example (2M)

b) Let R= { <1,2>,<2,1>,<3,2>,<3,4>,<2,2>} and S={<4,2>,<2,3>,<2,5>,<3,1>,<1,3>}, find (R o S) o R and R o (S o R). (3M)

c) Explain complemented lattices with suitable examples? (2M)

d) In how ways can the letters of the word 'ORANGE' be arranged so that the consonants occupy only the even positions? (2M)

e) What is the generating function of the infinite series; 1,1,1,1,…1,1,1,1,…? (3M)

f) Explain connected components with suitable example? (2M)

PART –B

2. a) Prove $\forall x(P(x) \rightarrow R(x))$, $(\exists x)((P(x) \land S(x)) \Rightarrow (\exists x)((R(x) \land S(x))$ (7M)

b) Show that the following premises are inconsistent (7M)
$P\rightarrow Q$, $P\rightarrow R$, $Q\rightarrow \neg R$, P

3. a) Let $f:R\rightarrow R$ and $g:R\rightarrow R$, where R is a set of real numbers. Find (f o g) and (g o f), when $f(x) = x^2$ and $g(x) = x+4$. State whether these functions are injective ,surjective and bijective or not (7M)

b) Let X = {1,2,3,4} be a set and R is a relation on the set X such that R = {(1,1),(1,4),(4,1),(4,4),(2,2),(2,3),(3,2),(3,3)}.Draw its matrix and graph. Also prove that R is an equivalence relation. (7M)

4. a) Explain the basic properties of integers with suitable examples? (7M)

b) Let G be a set of all non zero real numbers and let a*b = ab/2. Show that <G,*> is an abelian group. (7M)

5. a) Show that if any five numbers from one to eight are chosen, then two of these will have their sum equal to nine. (7M)

b) Define binomial theorem? What is the coefficient of $x^{101}y^{99}$ in the expansion of $(2x-3y)^{200}$? (7M)

6. a) Find the coefficient of x^n in the following functions (7M)
(i)$(x^2 + x^3 +x^4 + \ldots\ldots)^4$ (ii)$(1 + x^2 + x^4 + \ldots..)^7$

b) Solve the recurrence relation $(a^2)_{n+2} -5 (a^2)_{n+1} +4(a^2)_n = 0$, given $a_0 =4$, and $a_1 = 13$. (7M)
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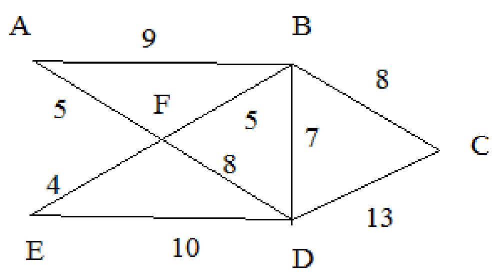
7. a) If G is a simple graph with no cycles, prove that G has at least one pendent vertex. (7M)

b) Write Kruskals algorithm to find minimal spanning tree and find minimal spanning tree for the given graph. (7M)



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PART –A

1. a) Explain the rules of generalization and specification? (2M)
   b) How to draw a hasse's diagram? Explain with an example (2M)
   c) Explain sub semi group with suitable example? (2M)
   d) Explain sum rule and product rule with example? (2M)
   e) Solve the recurrence relation – $F_n = 10F_{n-1} - 25F_{n-2}$ where $F_0=3$ and $F_1=17$. (3M)
   f) What are the applications of Eulerian graph in computer science? Explain (3M)

PART –B

2. a) Explain pcnf and find pcnf of the formula $(\neg P \to R) \wedge (Q \leftrightarrow P)$ (7M)
   b) Using principle disjunctive normal form show that the following formulas are equivalent $P \vee (\neg P \wedge Q) \Leftrightarrow (P \vee Q)$ (7M)

3. a) Show that for any two sets A and B, $A - (A \cap B) = A - B$ (7M)
   b) Let $f = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 1 & 3 \end{pmatrix}$ and $g = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 4 & 1 & 2 & 3 \end{pmatrix}$ find (f o g) and (g o f). (7M)

4. a) Show that (Z,*) is a group, where * is defined by a*b = a+b+1 (7M)
   b) Write an Euclidean algorithm to find greatest common divisor and find GCD(42823 ,6409) (7M)

5. a) Prove the identity $C(n,r)\,C(r,k) = C(n,k)\,C(n-k, r-k)$, for $n \geq r \geq k$. Deduce that, if n is a prime number, then C(n, r) is divisible by n. (7M)
   b) A message is made up of 12 different symbols and is to be transmitted through a communication channel. In addition to the 12 symbols the transmitter will also send a total of 45 blank spaces between the symbols, with at least three spaces between each pair of consecutive symbols. In how many ways can the transmitter send each message? (7M)

6. a) Find the coefficient of x^{27} in the following functions (7M)
   (i)$(x^4 + x^5 + x^6 + \ldots\ldots)^5$ (ii)$(x^4 + 2x^5 + 3x^6 + \ldots..)^5$
   b) If $a_0 = 0$, $a_1 = 1$ $a_2 = 4$ and $a_3 = 37$ satisfy the recurrence relation $a_{n+2} + b\,a_{n+1} + c\,a_n = 0$ for $n \geq 0$. Determine the constants b and c and then solve the recurrence relation for a_n . (7M)
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7. a) Show that every graph with four or fewer vertices is planar. (7M)

   b) Explain Hamiltonian cycle and Hamiltonian path with suitable example also draw (i) a graph which has an Euler circuit but no Hamiltonian cycle and (ii)a graph with Hamiltonian cycle but no Euler circuit. (7M)