Code No: R1621052 **R16** SET - 1

**II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019**
**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) What is the minimal set of connectives required for a well formed formula? (2M)
   b) State principle of inclusion and exclusion. (2M)
   c) Give three examples for a Monoid? (2M)
   d) Find the number of Permutations the word MAYAJALAM? (3M)
   e) Write the general solution and particular solution of recurrence relation? (3M)
   f) Explain adjacency matrix of the graph? (2M)

## PART -B

2. a) Show that the following premises are inconsistent. (7M)
   (i) If jack misses many classes through illness, then he fails high school
   (ii) If jack fails high school, then he is uneducated.
   (iii) If jack reads lot of books, then he is not uneducated.
   (iv) Jack misses many classes through illness and lot of books.
   b) Show that $P \rightarrow S$ tautologically implied by $\neg P \vee Q$ , $\neg Q \vee R$ , $R \rightarrow S$ by automatic theorem proving. (7M)

3. a) If X = {2, 3, 6, 12, 24} and if $\leq$ be the partial order defined by $x \leq y$ if x divides y. Determine the number of edges in Hasse diagram of $(x, \leq)$. (7M)
   b) If R and S are reflexive, symmetric and transitive, show that $R \cap S$ is also reflexive, symmetric and transitive. (7M)

4. a) What are the properties of a Group? Show that the set G = {1} forms a group with respect to multiplication? (7M)
   b) Prove that H = {0, 2, 4} forms a subgroup of $(Z_6, +)$. (7M)

5. a) In how many ways can we choose 3 of the numbers from 1 to 100, so that their sum is divisible by 3? (7M)
   b) Compute the number of rows of 6 Americans, 7 Mexicans, and 10 Canadians in which an American invariably stands between a Mexican and a Canadian and in which a Mexican and a Canadian never stand side by side. (7M)



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6. a) Solve the recurrence relation (7M)
$a_n+a_{n-1}-8a_{n-2}-12a_{n-3}=0$ for n>=3,given that $a_0=1$,$a_1=5$ and $a_2=1$
b) Given $a_n = 4a_{n-1}-4a_{n-2}+(n^2+1)2^n$. Find the solution of non-homogeneous relation , $a_0=0$ and $a_1=1$ (7M)

7. a) Explain Kruskal's algorithm to find minimal spanning tree of the graph with suitable example? (7M)
b) Show that the complete graph $K_5$ and complete bipartite graph $K_{3,3}$ are not planar? (7M)



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## PART –A

| | | | |
|---|---|---|---|
| 1. | a) | Explain logical equivalence with an example? | (2M) |
| | b) | Draw the Hasse diagram for the power set (P(S), ≤), where S={1,2,3}. | (3M) |
| | c) | Define compatibility of relation and give suitable example. | (2M) |
| | d) | Explain binomial theorem with example. | (2M) |
| | e) | Describe Recurrence relations with example | (2M) |
| | f) | Discuss graph coloring problem with required examples. | (3M) |

## PART -B

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|---|---|---|---|
| 2. | a) | Symbolize the following statements: all men are good<br>no men are good some men are good<br>some men are not good | (7M) |
| | b) | Explain in detail about the Logical Connectives with Examples? | (7M) |
| 3. | a) | Let A = {1, 2, 3, 4, 5}, R ={(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (3, 4), (4, 3), (4, 4), (5, 5)} and S = {(1, 1), (2, 2), (3, 3), (4, 4), (5, 4), (4, 5), (5, 5)}. Find the smallest-equivalence relation containing R and S and compute the partition of A that it produces. | (7M) |
| | b) | Given S = {1, 2, 3, 4} and a relation R on S defined by<br>R = {< 1, 2 >,< 4, 3 >,< 2, 2 >,< 2, 1 >,< 3, 1 >}, show that R is not transitive. | (7M) |
| 4. | a) | Show that every cyclic group is abelian group, but the converse is not true. | (7M) |
| | b) | What are the conditions to be tested for determining whether two graphs are isometric to each other or not? Explain with an example | (7M) |
| 5. | a) | A book binder is to bind 10 different books in red, blue and brown cloth. In how many ways can he do this if each color of cloth is to be used for at least one book? | (7M) |
| | b) | Explain Multinominal theorem with an example. | (7M) |



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6. Solve simultaneous recurrence relations: (14M)
   (a) $a_n = 3\ a_n + 2\ b_{n-1}$
   (b) $b_n = a_{n-1} + 2\ b_{n-1}$.

7. a) Differentiate between Eulerian graph and Hamiltonian graph with an example each. (7M)

   b) Describe an algorithm to decide whether a graph is bipartite or not (7M)



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## PART –A

| | | | |
|---|---|---|---|
| 1. | a) | Examine the disjunctive normal form of the formula: P↔Q? | (2M) |
| | b) | What is a partial order relation? | (2M) |
| | c) | Explain lattice with example. | (2M) |
| | d) | In how many ways can 20 similar books be placed on 5 different shelves? | (3M) |
| | e) | Define generating function and give suitable example. | (2M) |
| | f) | State the criteria to detect the planarity of a connected graph. | (3M) |

## PART –B

| | | | |
|---|---|---|---|
| 2. | a) | Translate the given statements into propositional logic using the propositions provided:<br>P:The message is scanned for viruses<br>Q:The message was sent from an unknown system<br>i) The message is scanned for viruses whenever the message was sent from an unknown system.<br>ii) It is necessary to scan the message for viruses whenever it was sent from an unknown system. | (7M) |
| | b) | Test the consistency of the following statement:<br>The contract is satisfied iff the building is completed by November 30. The building is completed by November 30 iff the electrical subcontractor completes his work by November 10. The bank loses company iff the contract is not satisfied. The electrical sub contractor completes his work by November 10 iff the bank loses money. | (7M) |
| 3. | a) | Given S = {1,2,3,....,10}and a relation R on S where R = {<x, y> / x+y +10}, what are the properties of the relation R? Explain | (7M) |
| | b) | Determine all the bijections from {1, 2, 3} onto {a, b, c, d}. | (7M) |
| 4. | a) | Show that intersection of any two subgroups of a group G is also a sub group of G. | (7M) |
| | b) | Explain Euclidian algorithm to find The Greatest Common Divisor of two numbers with suitable example? | (7M) |



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5. a) How many different five digit numbers can be formed from the digits 0,1,2,3 and 4? (7M)
   b) A new state flag is to be designed with 6 vertical stripes in yellow, white, blue and red. In how many ways can this be done so that no two adjacent stripes have the same color? (7M)

6. a) Solve $a_n - 2a_{n-1} - 3a_{n-2} = 5^n$, $n \geq 2$, given $a_0 = -2$, $a_1 = 1$. (7M)
   b) Show that $n^3 + 2n$ is divisible by 3 for all $n \geq 1$ by induction. (7M)

7. a) Explain an algorithm to find the minimal spanning tree with an example. (7M)
   b) Define Eulerian Graph and prove that a non empty connected graph G is Eulerian if and only if its vertices are all of even degree. (7M)



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**PART –A**

| | | | |
|---|---|---|---|
| 1. | a) | Explain contra positive with example. | (3M) |
| | b) | Define Relation? List out the Operations on Relations. | (3M) |
| | c) | State Fermat's theorem. | (2M) |
| | d) | State the properties of the pigeon hole principle. | (2M) |
| | e) | Find the generating function for n^2-2? | (2M) |
| | f) | What are the advantages of adjacency matrix representation? | (2M) |

**PART -B**

| | | | |
|---|---|---|---|
| 2. | a) | Assume x is a particular real number. Determine whether the following two statements are logically equivalent.<br>i) $x<2$ or it is not the case that $1<x<3$<br>ii) $x\leq 1$or either $x<2$ or $x\geq 3$. | (7M) |
| | b) | Check the validity of the following argument.<br>i)Either Smith attended the meeting or Smith was not invited for the meeting<br>ii)If the directors wanted Smith at the meeting, then Smith was invited at the meeting<br>iii)Smith did not attend the meeting<br>iv) If the directors did not want Smith at the meeting and Smith was not invited to the meeting, then Smith is on his way out of the company.<br>Therefore, Smith is on his way out of the company. | (7M) |
| 3. | a) | Let L be lattice. Then prove that $a\wedge b = a$ if and only if $a\vee b = b$. | (7M) |
| | b) | Define the dual of a statement in a lattice L. Why does the principle apply to L? | (7M) |
| 4. | a) | Explain Eulers Theorem with an example. | (7M) |
| | b) | Explain Fermat's theorem with an example | (7M) |
| 5. | a) | How many ways are there to seat 10 boys and 10 girls around a circular table, if boys and girls seat alternatively | (7M) |
| | b) | In how many ways can the digits 0,1,2,3,4,5,6,7,8 and 9 be arranged so that 0 and 1 are adjacent and in the order of 01. | (7M) |



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6. a) Solve the Recurrence Relation $u_n+5u_{n-1}+6u_{n-2}=42(4)^n$ ? (7M)
   b) Solve the recurrence relation t(n) = 3t(n/2)+n (7M)

7. a) Explain about the adjacency matrix representation of graphs. Illustrate with an example. (7M)
   b) Write about the basic rules for constructing Hamiltonian cycles. (7M)



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