Guru Nanak Dev Engineering College, Ludhiana
Department of Information Technology

Program	B Tech (IT)	Semester		5
Subject Code	PCIT-110	Subject Title		Discrete Mathematics
Mid Semester Test (MST) No.	1	Course Coordinator(s)		Jaskiran Kaur
Max. Marks	24	Time Duration		1 hour 30 minutes
Date of MST		Roll Number	2104554	

Note: Attempt all questions

Q. No.	Question	COs, RBT level	Marks
Q1	Define functions. Also name the different types of functions.	CO1, L1	2
Q2	Identify the smallest relation containing the relation $\{(1,2),(1,4),(3,3),(4,1)\}$ defined on set A= {1,2,3,4} that is: a) Reflexive b) Symmetric c) transitive	CO2, L6	2
Q3	Let R and S be the following relations on A = {1,2,3}: R= $\{(1,1),(1,2),(2,3),(3,1),(3,3)\}$, S= $\{(1,2),(1,3),(2,1),(3,3)\}$ Find: a) **RUS** b) R^c c) RoS d) $S^2=$ SoS e) R-S f) $R\oplus S$	CO1, L1	4
Q4	Given $f(x)= 3x^2 + 4x+7$ and $g(x)= x+1$ Find: a) fog b) gof	CO2, L1	4
Q5	A survey of faculty and students at a School revealed the following information: 51 admire Maths, 49 admire Language, 60 admire Craft, 34 admire Maths and Language, 32 admire Language and Craft, 36 admire Maths and Craft, 24 admire all three of the stooges, 1 admire none of the three courses. a. How many admire Craft, but not Language nor Maths? b. How many admire exactly one of the courses? c. How many admire exactly two of the course? d. How many admire all three?	CO6, L4	4
Q6	a) Compute whether the following relations are equivalent or Partial Order relations: i) A= {2, 3, 4} R= $\{(2, 2), (3, 3), (4, 4), (2, 3), (3, 4)\}$ ii) R= $\{(x, y): y=x+5$ & $x<4; x, y \in R\}$	CO1, L5	6
	b) Prove De Morgan's law using an example.	CO2, L3	2

Course Outcomes (CO) *Students will be able to:*

Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.

Use effectively algebraic techniques to analyze basic discrete structures and algorithms.

Understand asymptotic notation, its significance, and be able to use it to analyse asymptotic performance some basic algorithmic examples.

Understand some basic properties of graphs and related discrete structures, and be able to relate these to examples.

Recognize valid logical, mathematical arguments and construct valid arguments/ proofs.

[Total No. of Questions: 09]

[Total No. of Pages: 2]

Uni. Roll No. 2104559

Program: B.Tech. (Batch 2018 onward)

Semester: 5th

Name of Subject: Discrete Mathematics

Subject Code: PCIT-110

Paper ID: 16441

Max. Marks: 60

Time Allowed: 03 Hours

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A [Marks: 02 each]

Q1.

a) Define Poset.

b) What are Conjunction and Disjunction operations.

c) What is the application of Kruskal's algorithm?

d) What is Pigeonhole Principle?

e) Give an example of graph which is Eulerian but not Hamiltonian.

f) Write following statement in symbolic form: If Kevin is not in a good mood or he is not busy, then he will go to Mumbai.

Part – B [Marks: 04 each]

Q2. Let R be a relation R= {(1,1), (1,4), (2,3), (3,1), (3,4)} on set A={ 1,2,3, 4} . Find Reflexive , Symmetric and Transitive closure of R.

Q3. Explain the following statement: A complete graph with 5 vertices is not planner.

Q4. Consider following well-formed formulas in Prepositional Logic:

a) $P \rightarrow P'$

b) $(P \rightarrow P') \lor (P' \rightarrow P)$

Which of these is valid and not valid?

Q5. If R is an equivalence relation, prove that inverse R^{-1} is also an equivalence relation.

Q6. Prove that in any graph, there is even number of vertices of odd degree.

Page 1 of 2

P.T.O.

Q7. There are 200 individuals with a dermatological disorder. 120 were exposed to the chemical C1, 50 to chemical C2, and 30 to both the chemicals C1 and C2. What is the number of individuals exposed to
(i) Chemical C1 but not chemical C2?
(ii) Chemical C2 but not chemical C1?
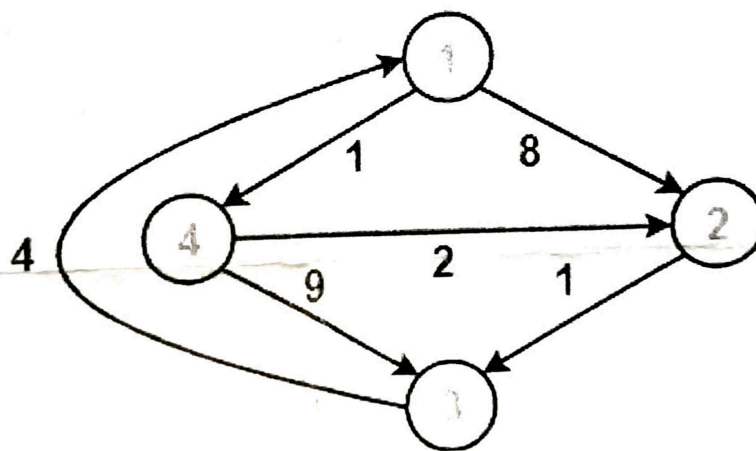(iii) Chemical C1 or chemical C2?

<div align="center">Part – C</div>

<div align="right">[Marks: 12 each]</div>

Q8. Explain the following
 a) Hamiltonian Path and Hamiltonian Circuit
 b) Monoids and Groups

<div align="center">OR</div>

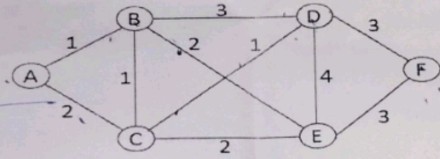Using Floyd Warshall Algorithm, find the shortest path distance between every pair of   vertices.

Q9. Solve the recurrence relation $a_n = 6a_n - 1 - 9a_n - 2$ with initial conditions $a_0 = 1$ and $a_1 = 4$.

<div align="center">OR</div>

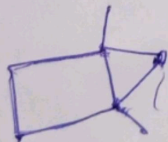Show that $(P \rightarrow Q) \rightarrow [(P \rightarrow Q) \rightarrow Q]$ is Tautology or not?

<div align="center">*************</div>

Guru Nanak Dev Engineering College, Ludhiana
Department of Information Technology

Program	B.Tech.(IT)	Semester	5
Subject Code	PCIT-110	Subject Title	Discrete Mathematics
Mid Semester Examination (MSE) No.	2	Course Coordinator(s)	Jaskiran Kaur
Max. Marks	24	Time Duration	1 hour 30 minutes
Date of MSE		Roll Number	

Note: Attempt all questions

Q. No.	Question	COs, RBT level	Marks
Q1	Illustrate the different properties of algebraic structures with examples.	CO2, L3	2
Q2	Construct all the possible spanning trees of K_4 complete graph.	CO4, L6	2
Q3	Solve the recurrence relation: $S_n = 2S_{n-1} + 3S_{n-2}$ for n >= 2; where S(0) = 3 and S(1) = 1.	CO6, L3	4
Q4	Define the following terms with examples: a) Bipartite Graph b) Hamiltonian Graph c) Chromatic number d) Rings	CO4, CO2, L1	4
Q5	Compare and contrast the minimum spanning tree algorithms: Prim's and Kruskal's Algorithm.	CO1, L4	4
Q6	a) Solve the following graph using Floyd Warshall's algorithm: 	CO4, CO1, L4	6
	b) Construct a graph which has all the vertices of even degree but is not an Euler circuit.	CO5, L6	2

Course Outcomes (CO) *Students will be able to:*

Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.	
Use effectively algebraic techniques to analyze basic discrete structures and algorithms.	
Understand asymptotic notation, its significance, and be able to use it to analyze asymptotic performance for some basic algorithmic examples.	
Understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples.	
Recognize valid, logical, mathematical arguments and construct valid arguments/ proofs.	

Guru Nanak Dev Engineering College, Ludhiana
Department of Information Technology

Program	B.Tech.(IT)	Semester		5
Subject Code	PCIT-110	Subject Title		Discrete Mathematics
Mid Semester Test (MST) No.	1	Course Coordinator(s)		Jaskiran Kaur
Max. Marks	24	Time Duration		1 hour 30 minutes
Date of MST		Roll Number		

Note: Attempt all questions

Q. No.	Question	COs, RBT level	Marks
Q1	Define functions. Also name the different types of functions.	CO1, L1	2
Q2	Identify the smallest relation containing the relation $\{(1,2),(1,4),(3,3),(4,1)\}$ defined on set A= $\{1,2,3,4\}$ that is: a) Reflexive b) Symmetric c) transitive	CO2, L6	2
Q3	Let R and S be the following relations on A = $\{1,2,3\}$: R= $\{(1,1),(1,2),(2,3),(3,1),(3,3)\}$, S= $\{(1,2),(1,3),(2,1),(3,3)\}$ Find: a) RUS b) R^c c) RoS d) S^2 = SoS e) R-S f) $R \oplus S$	CO1, L1	4
Q4	Given $f(x)= 3x^2 + 4x+7$ and $g(x)= x+1$ Find. a) fog b) gof	CO2, L1	4
Q5	A survey of faculty and students at a School revealed the following information: 51 admire Maths, 49 admire Language, 60 admire Craft, 34 admire Maths and Language, 32 admire Language and Craft, 36 admire Maths and Craft, 24 admire all three of the stooges, 1 admire none of the three courses. a. How many admire Craft, but not Language nor Maths? b. How many admire exactly one of the courses? c. How many admire exactly two of the course? d. How many admire all three?	CO6, L4	4
Q6	a) Compute whether the following relations are equivalent or Partial Order relations: i) A= $\{2, 3, 4\}$ R= $\{(2, 2), (3, 3), (4, 4), (2, 3), (3, 4)\}$ ii) R= $\{(x, y): y=x+5 \ \& \ x<4; x, y \in R\}$	CO1, L5	6
	b) Prove De Morgan's law using an example.	CO2, L3	2

Course Outcomes (CO) *Students will be able to:*

Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.

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Understand asymptotic notation, its significance, and be able to use it to analyse asymptotic performance for some basic algorithmic examples.

Understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples.

Recognize valid, logical, mathematical arguments and construct valid arguments/ proofs.

Guru Nanak Dev Engineering College, Ludhiana
Department of Information Technology

Program	B.Tech.(IT)	Semester		5
Subject Code	PCIT-110	Subject Title		Discrete Mathematics
Mid Semester Test (MST) No.	1	Course Coordinator(s)		Er. Hanit Karwal
Max. Marks	24	Time Duration		1 hour 30 minutes
Date of MST	26 Sept, 2022	Roll Number		

Note: Attempt all questions.

Q. No.	Question	COs, RBT level	Marks
Q1	Define Partial Order Relation with example	CO1, L1	2
Q2	In how many ways can the letters of the word "SPECIAL" be arranged in a row such that the vowels occupy only odd positions	CO6, L2	2
Q3	Let R and S be the following relations on A = {1, 2, 3}: $R = \{(1, 1), (1, 2), (2, 3), (3, 1), (3, 3)\}$, $S = \{(1, 2), (1, 3), (2, 1), (3, 3)\}$ Find (a) R U S (b) R^C (c) R∘S (d) $S^2 = S \circ S$	CO, L3	4
Q4	Given $f(x) = 3x^2 + 4x + 7$ and $g(x) = x + 1$. Find (a) fog (b) gof	CO2, L3	4
Q5	A survey of faculty and students at a School revealed the following information: 51 admire Maths, 49 admire Language, 60 admire Craft, 34 admire Maths and Language, 32 admire Language and Craft, 36 admire Maths and Craft, 24 admire all three of the Stooges, 1 admires none of the three courses. a) How many admire Craft, but not Language nor Maths? b) How many admire exactly one of the Course? c) How many admire exactly two of the Course? d) How many admire all three?	CO6, L3	4
Q6	Solve the recurrence relation. $S_n = 2 S_{n-1} + 3 S_{n-2}$ for n >=2 ; where $S(0) = 3$ and $S(1) = 1$	CO6, L4	8

Course Outcomes (CO)	
Students will be able to	
1	Understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving.
2	Use effectively algebraic techniques to analyse basic discrete structures and algorithms.
3	Understand asymptotic notation, its significance, and be able to use it to analyse asymptotic performance for some basic algorithmic examples.
4	Understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples
5	Recognise valid, logical, mathematical arguments and construct valid arguments/proofs
6	Identify and formulate solutions of engineering problems related to counting and probability theory.

RBT Classification	Lower Order Thinking Levels (LOTS)			Higher Order Thinking Levels (HOTS)		
RBT Level Number	L1	L2	L3	L4	L5	L6
T Level Name	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating

[Total No. of Questions: 09]

Uni. Roll No. ....

[Total No. of Pages: 02]

Program: B.Tech (Batch 2018 onward)
Semester: 5th
Name of Subject: Discrete Mathematics
Subject Code: PCIT-110
Paper ID: 16441
Scientific calculator is Allowed

Time Allowed: 03 Hours

Max. Marks: 60

NOTE: 1. Parts A and B are compulsory

2. Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice

3. Any missing data may be assumed appropriately

Part – A

[Marks: 02 each]

Q1.

a) What is inclusion and exclusion principle?

b) State Pigeonhole principle.

c) Define Euler Graph.

d) What do you understand by Isomorphism of Graph.

e) Determine distinct number of permutations formed from all letters of the word "ENGINEERING".

f) Identify the Chromatic number of K^n graph (Complete Graph).

Part – B

[Marks: 04 each]

Q2. Compare Hamiltonian and Eulerian circuits with suitable examples.

Q3. Explain different properties of Groups and show that G= {1,2,3,4,5,6} is a Group.

Q4. If R is the equivalence relation on set A, then show that R^{-1} is also the equivalence relation on A.

Q5. If R= {(1,1), (2,2), (3,3), (1,2)}

Determine whether given relation is:

(a) Reflexive; (b) Symmetric; (c) Transitive

Q6. Solve the Recurrence relation:

$a_n = 3a_{n-1} + 2$ subject to $a_0 = 1$.

Q7. Minimize the following Boolean expression using Predicate Logic:

$F(A,B,C) = A'B + BC' + BC + AB'C'$

Page 1 of 2

P.T.O.

Q8. a. Find a generating function for 1,3,5,7,9,....

b. Functions f. g. h are defined on a set. X= {1,2,3} as f= {(1,2) (2,3) (3,1)} g = {(1,2} (2,1) {3,3)} h = {(1,1) (2,2) (3,1)} (i) Find fog, gof are they equal ? (ii) Find fogoh and fohog.
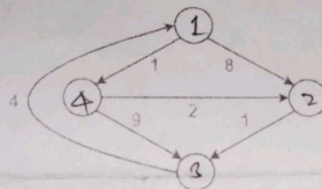
OR

a) In a group of 100 students. 72 students can speak English and 43 students can speak Hindi. Based on these data, answer the following questions:

i. Find the number of students who can speak English only.
ii. Find the number of students who can speak Hindi only.
iii. Find the number of students who can speak both English and Hindi.

b) What is Monoid? Also explain how it is different from a group.

Q9. Compare and contrast the differences between Floyd Warshall's and Kruskal's Algorithm.

Using Floyd Warshall Algorithm, find the shortest path distance between every pair of vertices.

OR

Consider the following undirected, weighted graph:

Using Dijkstra's Algorithm, determine the shortest path from source to every other vertex.

(Source= A)

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[Total No. of Questions: 09]
Uni. Roll No. 2004899

[Total No. of Pages: 02]

Program: B.Tech. (Batch 2018 onward)
Semester: 5th
Name of Subject: Discrete Mathematics
Subject Code: PCIT-110
Paper ID: 16441
Scientific calculator is Allowed

Time Allowed: 03 Hours

Max. Marks: 60

NOTE: 1. Parts A and B are compulsory
2. Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3. Any missing data may be assumed appropriately

Part – A
[Marks: 02 each]

Q1.

a) What is inclusion and exclusion principle?

b) State Pigeonhole principle.

c) Define Euler Graph.

d) What do you understand by Isomorphism of Graph.

e) Determine distinct number of permutations formed from all letters of the word "ENGINEERING".

f) Identify the Chromatic number of K^n graph (Complete Graph).

Part – B
[Marks: 04 each]

Q2. Compare Hamiltonian and Eulerian circuits with suitable examples.

Q3. Explain different properties of Groups and show that G= {1,2,3,4,5,6} is a Group.

Q4. If R is the equivalence relation on set A, then show that R^{-1} is also the equivalence relation on A.

Q5. If R= {(1,1), (2,2), (3,3), (1,2)}

Determine whether given relation is:

(a) Reflexive; (b) Symmetric; (c) Transitive

Q6. Solve the Recurrence relation:

$a_n = 3a_{n-1} + 2$ subject to $a_0 = 1$.

Q7. Minimize the following Boolean expression using Predicate Logic:
$F(A,B,C) = A'B + BC' + BC + AB'C'$

Page 1 of 2

P.T.O.

Q8. a. Find a generating function for 1,3,5,7,9,.....

b. Functions f, g, h are defined on a set. X= {1,2,3} as f= {(1,2) (2,3) (3,1)} g = {(1,2} (2,1) (3,3)) h = {(1, 1) (2.2) (3.1)} (i) Find fog, gof are they equal ? (ii) Find fogoh and fohog.
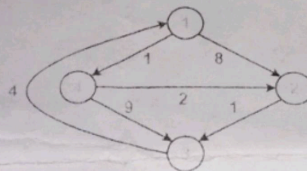
OR

a) In a group of 100 students, 72 students can speak English and 43 students can speak Hindi. Based on these data, answer the following questions:

i. Find the number of students who can speak English only.
ii. Find the number of students who can speak Hindi only.
iii. Find the number of students who can speak both English and Hindi.

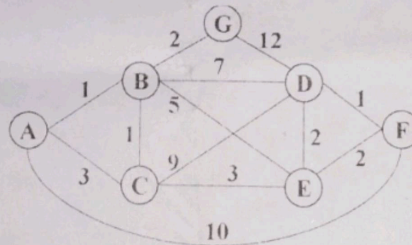b) What is Monoid? Also explain how it is different from a group.

Q9. Compare and contrast the differences between Floyd Warshall's and Kruskal's Algorithm.

Using Floyd Warshall Algorithm, find the shortest path distance between every pair of vertices.

OR

Consider the following undirected, weighted graph:

Using Dijkstra's Algorithm, determine the shortest path from source to every other vertex. (Source= A)

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Page 2 of 2

MORNING

[Total No. of Questions: 09]

Uni. Roll No. ....

[Total No. of Pages: 2]

MORNING

0 3 JUN 2023

Program: B.Tech. (Batch 2018 onward)

Semester: 5th

Name of Subject: Discrete Mathematics

Subject Code: PCIT-110

Paper ID: 16441

Scientific calculator is Allowed

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A   [Marks: 02 each]

Q1.

a) Differentiate between Graph and Tree.

b) What is invertible function?

c) State Pigeonhole principle.

d) List the closure properties of a relation.

e) Discuss common properties shared by monoid and group.

f) Find the number of eight-letter words that can be formed using BLOGGING.

Part – B   [Marks: 04 each]

Q2. A single card is drawn from an ordinary deck of 52 cards. Find the probability p that the card is a: (a) face card (jack, queen or king); (b) heart;

(c) face card and a heart;   (d) face card or a heart.

Q3. There are four bus lines between A and B, and three bus lines between B and C. Find the number m of ways that a man can travel by bus: (a) from A to C by way of B; (b) roundtrip from A to C by way of B; (c) roundtrip from A to C by way of B but without using a bus line more than once.

Q4. Define each with an example:

i) Euler Graph ii) Hamilton Graph iii) Connected Graph iv) Regular Graph

Q5. Consider the third-order homogeneous recurrence relation $a_n = 6a_{n-1} - 12a_{n-2} + 8a_{n-3}$

P.T.O.

(a) Find the general solution.

(b) Find the solution with initial conditions $a_0 = 3$, $a_1 = 4$, $a_2 = 12$

Q6. For any sets A and B prove that: $A - B = A$, iff $A \cap B = \Phi$.

Q7. Suppose the following list of letters is inserted into an empty binary search tree:

J, R, D, G, W, E, M, H, P , A, F , Q

(a) Find the final tree T. (b) Find the inorder traversal of T.

Part – C [Marks: 12 each]

Q8. In a group of 1000 people, there are 750 who can speak Hindi and 400 who can speak Bengali. How many can speak Hindi only? How many can speak Bengali? How many can speak both Hindi and Bengali?

OR

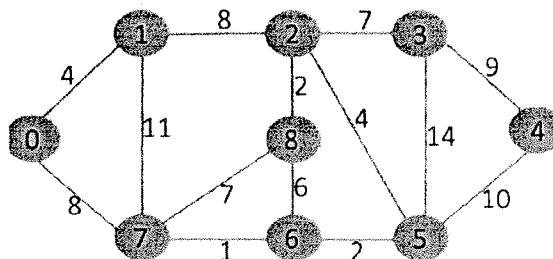List the number of arrangements that can be made from letters of word 'DELHI'

(i) Taking all at a time (ii) Taking three at a time (iii) Beginning with D and ending with E
(iv) D and E occupy end position (v) Vowels being always together

Q9. Find the minimum spanning tree using Kruskal's Algorithm
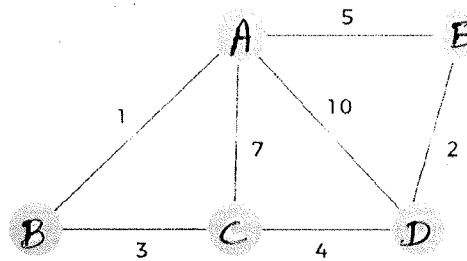
OR

Find the shortest path from the source to all vertices in the given graph using Dijkstra's Algorithm

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[Total No. of Questions: 09]
Uni. Roll No. ....

[Total No. of Pages: 02]

Program: B.Tech. (Batch 2018 onward)
Semester: 5th

EVENING

Name of Subject: Discrete Mathematics

3 0 DEC 2022

Subject Code: PCIT-110
Paper ID: 16441
Scientific calculator is Allowed

Time Allowed: 03 Hours

Max. Marks: 60

NOTE: 1. Parts A and B are compulsory
2. Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3. Any missing data may be assumed appropriately

Part – A

[Marks: 02 each]

Q1.

   a)   What is inclusion and exclusion principle?

   b)   State Pigeonhole principle.

   c)   Define Euler Graph.

   d)   What do you understand by Isomorphism of Graph.

   e)   Determine distinct number of permutations formed from all letters of the word "ENGINEERING".

   f)   Identify the Chromatic number of K^n graph (Complete Graph).

Part – B

[Marks: 04 each]

Q2.   Compare Hamiltonian and Eulerian circuits with suitable examples.

Q3.   Explain different properties of Groups and show that G= {1,2,3,4,5,6} is a Group.

Q4.   If R is the equivalence relation on set A, then show that R^{-1} is also the equivalence relation on A.

Q5.   If R= {(1,1), (2,2), (3,3), (1,2)}

Determine whether given relation is:

   (a) Reflexive; (b) Symmetric; (c) Transitive

Q6.   Solve the Recurrence relation:

$a_n = 3a_{n-1} + 2$ subject to $a_0 = 1$.

Q7.   Minimize the following Boolean expression using Predicate Logic:
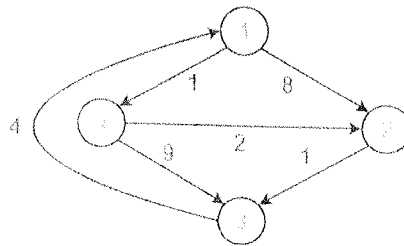
$F(A,B,C) = A'B + BC' + BC + AB'C'$

Part – C

Q8. a. Find a generating function for 1,3,5,7,9,....

b. Functions f, g, h are defined on a set. X = {1,2,3} as f = {(1,2) (2,3) (3,1)} g = {(1,2} (2,1) {3,3)} h = {(1, 1) (2,2) (3,1)} (i) Find fog, gof are they equal ? (ii) Find fogoh and fohog.

OR

a) In a group of 100 students, 72 students can speak English and 43 students can speak Hindi. Based on these data, answer the following questions:

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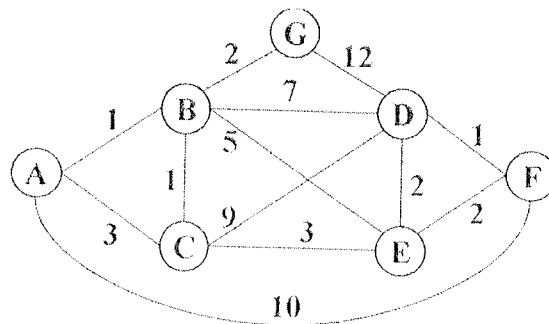
Q9. Compare and contrast the differences between Floyd Warshall's and Kruskal's Algorithm.

Using Floyd Warshall Algorithm, find the shortest path distance between every pair of vertices.

OR

Consider the following undirected, weighted graph:

Using Dijkstra's Algorithm, determine the shortest path from source to every other vertex. (Source= A)

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NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

Part – A [Marks: 02 each]

Q1.

a) Define Poset.

b) What are Conjunction and Disjunction operations.

c) What is the application of Kruskal's algorithm?

d) What is Pigeonhole Principle?

e) Give an example of graph which is Eulerian but not Hamiltonian.

f) Write following statement in symbolic form: If Kevin is not in a good mood or he is not busy, then he will go to Mumbai.

Part – B [Marks: 04 each]

Q2. Let R be a relation R= {(1,1), (1,4), (2,3), (3,1), (3,4)} on set A={ 1,2,3, 4} . Find Reflexive , Symmetric and Transitive closure of R.

Q3. Explain the following statement: A complete graph with 5 vertices is not planner.

Q4. Consider following well-formed formulas in Prepositional Logic:

a) $P \rightarrow P'$

b) $(P \rightarrow P') \lor (P' \rightarrow P)$

Which of these is valid and not valid?

Q5. If R is an equivalence relation, prove that inverse R^{-1} is also an equivalence relation.

Q6. Prove that in any graph, there is even number of vertices of odd degree.

Page 1 of 2

P.T.O.

Q7. There are 200 individuals with a dermatological disorder. 120 were exposed to the chemical C1, 50 to chemical C2, and 30 to both the chemicals C1 and C2. What is the number of individuals exposed to
(i) Chemical C1 but not chemical C2?
(ii) Chemical C2 but not chemical C1?
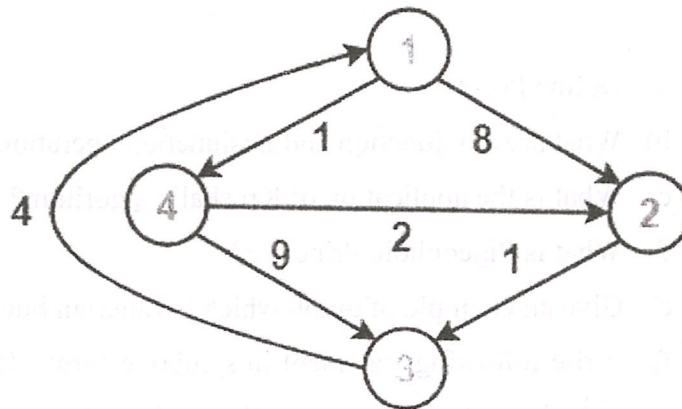(iii) Chemical C1 or chemical C2?

Part – C [Marks: 12 each]

Q8. Explain the following
a) Hamiltonian Path and Hamiltonian Circuit
b) Monoids and Groups

OR

Using Floyd Warshall Algorithm, find the shortest path distance between every pair of vertices.

Q9. Solve the recurrence relation $a_n = 6a_n - 1 - 9a_n - 2$ with initial conditions $a_0 = 1$ and $a_1 = 4$.

OR

Show that $(P \rightarrow Q) \rightarrow [(P \rightarrow Q) \rightarrow Q]$ is Tautology or not?

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[Total No. of Questions: 09]   [Total No. of Pages: 02]

Uni. Roll No. ....

Program: B.Tech. (Batch 2018 onward)   **EVENING**

Semester: 5th   **3 0 MAY 2024**

Name of Subject: Discrete Mathematics

Subject Code: PCIT-110

Paper ID: 16441

Scientific calculator is Not Allowed

Time Allowed: 03 Hours   **Max. Marks: 60**

NOTE:

1) Parts A and B are compulsory

2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice

3) Any missing data may be assumed appropriately

<div align="center">Part – A   [Marks: 02 each]</div>

Q1.

    a)   Differentiate equal and equivalent sets.

    b)   With suitable example describe the term POSET.

    c)   List the applications of graph theory.

    d)   Obtain the CNF of the form $(\sim p \rightarrow r) \wedge (p \leftrightarrow q)$.

    e)   "The identity element of a group is always a unique". Comment and justify.

    f)   Write generating function of the sequence $2^{n+1} + 5^n$.

<div align="center">Part – B   [Marks: 04 each]</div>

Q2. Let A= {1,2,3} the relation R on A be defined as R = {(1,1), (1,3), (3,1), (3,3)}. Determine whether R forms a n equivalence relation or not?

Q3. In a group of 50 persons, 14 drink tea but not coffee and 30 drink tea. Find

(i) How many drinks tea and coffee both?

(i) How many drinks coffee but not tea?

Q4. State and prove Euler's theorem.

Q5. Determine the minimum number of people to have guarantee that at least two of them have birthday that occur on same day of the week.

Q6. Evaluate the different properties required to make an abelian group.

<div align="center">**Page 1 of 2**</div>

Q7. Justify the significance of hash functions in computer science.

<p align="center">Part – C   [Marks: 12 each]</p>

Q8. Compare the Hamiltonian graphs and Eulerian graphs. Give an example of the following:

EVENING

3 0 MAY 2024

   a. A graph which is Hamiltonian but not Eulerian.
   b. A graph which is Eulerian but not Hamiltonian.
   c. A graph which is both Hamiltonian and Eulerian.
   d. A graph which is neither Hamiltonian nor Eulerian.

<p align="center">OR</p>

Find minimum spanning tree for the following graph using Kruskal's algorithm.
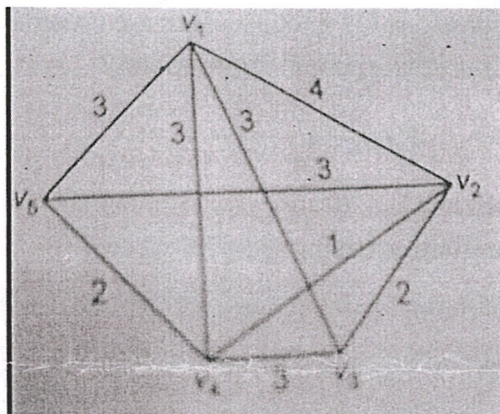
Q9. Solve the following recurrence relation

$T_k - 7T_{k-1} + 10 T_{k-2} = 6 + 8k$ with base conditions $T_0 = 1$ and $T_1 = 2$.

<p align="center">OR</p>

There are two shopping malls next to each other, one with sign board as "Good items are not cheap" and second with sign board as "Cheap items are not good". Examine whether these two statements mean same or different?

<p align="center">************</p>

MORNING

[Total No. of Questions: 09]   2 7 FEB 2024   [Total No. of Pages: 04]
Uni. Roll No. ....

Program: B.Tech. (Batch 2018 onward)
Semester:5th
Name of Subject: Discrete Mathematics
Subject Code: PCIT-110
Paper ID: 16441

Time Allowed: 03 Hours   Max. Marks: 60

NOTE:

1) Parts A and B are compulsory
2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
3) Any missing data may be assumed appropriately

<center>Part – A   [Marks: 02 each]</center>

Q1.

    a)   Draw a graph with seven vertices containing a Hamiltonian circuit but not Eulerian Circuit.

    b)   Show that a k5 complete graph is planar.

    c)   Prove that following is a contingent:

$$(q \wedge p) \vee (q \wedge \sim p)$$

    d)   List different operations on sets.

    e)   State Pigeonhole principle with example.

    f)   Find the chromatic number of the following graph:

<center>**Page 1 of 4**</center>

<center>**P.T.O.**</center>

Part – B

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[Marks: 04 each]
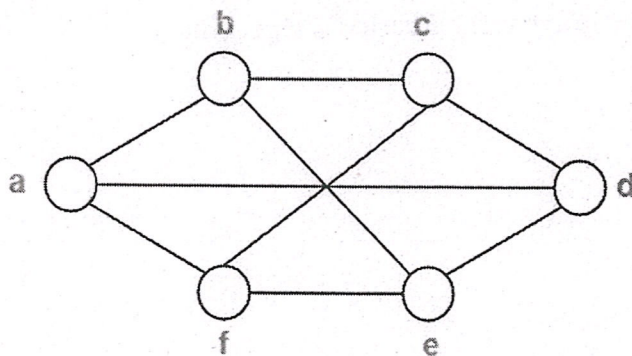
Q2. Solve the recurrence relation:

$$a_n - 7a_{n-1} + 12a_{n-2} = 2^n \text{ for a0= 1, a1= -1}$$

Q3. Let R and S be the following relations on A = {1,2,3}:
R= {(1,1), (1,2), (2,3), (3,1), (3,3)},
S= {(1,2), (1,3), (2,1), (3,3)}
Find:
    RUS   b) R^c c) **RoS**   d) $S^2 = SoS$ e) **R-S**   f) $R \oplus S$

Q4. A survey of faculty and students at a School revealed the following information: 51 admire Maths, 49 admire Language, 60 admire Craft, 34 admire Maths and Language, 32 admire Language and Craft, 36 admire Maths and Craft, 24 admire all three of the stooges, 1 admire none of the three courses.
a.   How many admire Craft, but not Language nor Maths?
b.   How many admire exactly one of the courses?
c.   How many admire exactly two of the course?
How many admire all three?

Q5. Consider the group G= {1,2,3,4,5,6} under the multiplication modulo:

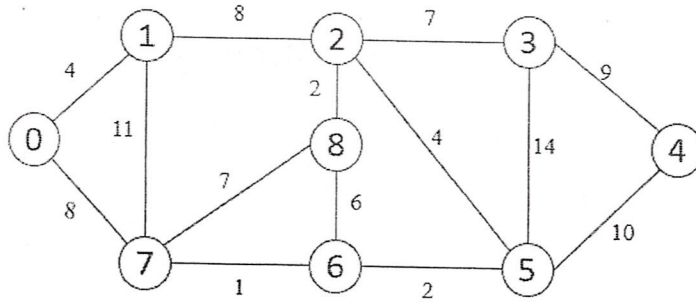a) Prove that G is a Group.

Q6. Define the following terms:

a) Eulerian Circuit
b) Inclusion- exclusion principle
c) Isomorphic Graphs
d) Composition of functions

Q7. List the various properties for an algebraic system to be a ring with suitable examples.

Part – C   [Marks: 12 each]

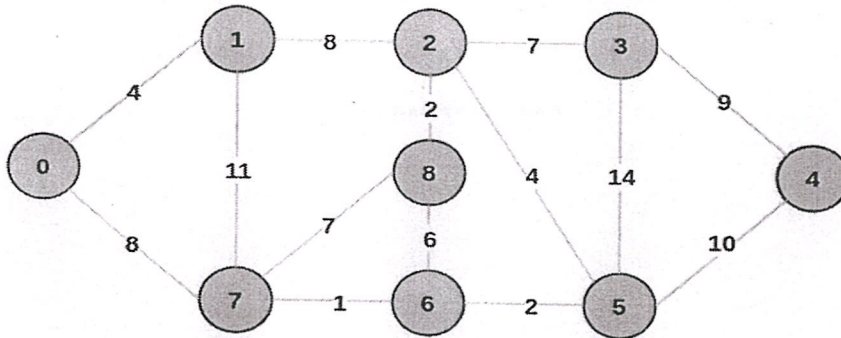**Q8.** a) Find the MST for the graph using Kruskal's algorithm:
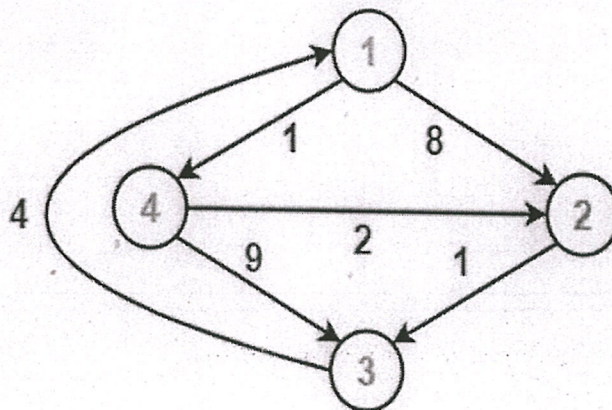
PTO

b) Discuss the various properties of algebraic structures.
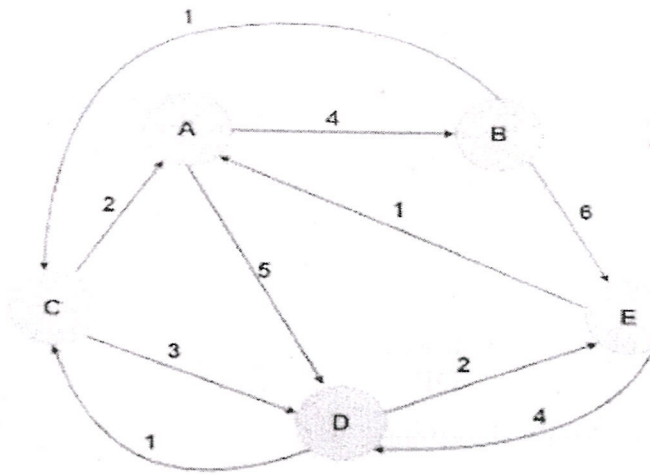
OR

Find the MST for the graph using Prim's algorithm:

Q9. Solve the graph using Floyd Warshall's algorithm:

OR

Solve the graph using dijkstra's algorithm:

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PTO

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[Total No. of Questions: 09]   [Total No. of Pages:02]

MORNING

Uni. Roll No. ....   1 2 MAY 2023

Program/ Course: **B.Tech. (Sem. 5ᵗʰ)**
Name of Subject: **Discrete Mathematics**
Subject Code: **PCIT-110**
Paper ID: **16441**

Time Allowed:3 Hours   Max. Marks:60

NOTE:

1) **Parts A and B are Compulsory**
2) **Part C** has Two Questions Q8 and Q9. Both are compulsory, but with internal choice.
3) Any missing data may be assumed appropriately.

Part – A   [Marks: 02 each]

Q1.
a) What do you meant by Pigenhole concept?
b) List the closure properties of relation.
c) Differentiate between inclusion and exclusion principle.
d) What is the difference between a cycle and Hamiltonian cycle?
e) Which is better Kruskal or Prims ?
f) Compare monoid and ring.

Part – B   [Marks: 04 each]

Q2. Explain the different properties of groups and show that G= { 1,2,3,4,5,6 } is a group.

Q3. Discuss the various types of relations with an example of each.

Q4. Compare between propositional and Predicate Logic.

Q5. Consider an electronic circuit having several nodes with connections between them. Is it possible to print that circuit on a single board such that none of the connections cross each other i.e. they do not overlap or intersect? Explain with the help of planarity of graphs.

Q6. Illustrate the difference between Hamiltonian and Eulerian circuits with an example.

Q7. Compare between Floyd Warshall and Kruskal Algorithm.

Part – C   [Marks: 12 each]

Q8. Assume a group of 100 students, 72 can speak English, 43 can speak Punjabi. Based on this data, provide answer to following

1. Find number of student who can speak English only.
2. Find number of student who can speak Punjabi only
3. Find number of student who can speak both Punjabi and English

OR

Write the meaning of Cardinality of a Set, finite set, infinite set, proper subset, Universal set.

Q9. Write short notes on a) Partial order relations b) Chromatic number c) Hashing functions

OR

Explain the various applications of Graph Theory. Also distinguish between Isomorphic and homomorphic graphs

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