SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Mathematics
B. Tech. (CSE) Minor-I Examination (Odd) 2018-19

Entry No: 17BCS045

Date:

Total Number of Pages: [02]

Total Number of Questions: [05]

Course Title: Discrete Structures
Course Code: MTL 2024

Time Allowed: 1.5 Hours

Max Marks: [20]

Instructions / NOTE:

i. Attempt All Questions.
ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.

Q1. (a) Draw appropriate Venn diagram for the set $(A \setminus B) \cup (B \setminus A)$. [01] CO1

(b) Define function. Give one example with its graph. [01] CO1

(c) Prove the uniqueness of identity element in a group. [01] CO3

(d) Define homomorphism. Give one example. [01] CO3

Q2. (a) Each of the 90 students participated in at least one of the three track events A, B and C. If 20 students participated in A, 40 students participated in B, 60 students participated in C and 5 students participated in all three events. How many students participated in at least two of these events? [02] CO1

(b) How many numbers between 100 and 200 (both inclusive) are divisible by 2 or 3? [02] CO1

Q3. (a) Show that the relation R defined on the set $S = N \times N = \{(a,b):a,b \in N\}$ as $(a,b)R(c,d)$ if and only if $a + d = c + b$ is an equivalence relation. [02] CO1

(b) Define semigroup, monoid and group. Give one example of a monoid which is not a group. [02] CO3

Q4. (a) Determine whether following functions from R to R are bijective: [02] CO1

i) $f(x) = 3x + 4$

ii) $f(x) = x^2 + 2x$

(b) Let $f: X \to Y$ and $g: Y \to Z$ be functions such that gof is one-one. Prove that f is one-one. [02] CO1

Q5. (a) State and prove Lagrange's theorem. [02] CO3

(b) Check whether following functions from (R,+) to (R,+) are homomorphism: [02] CO1

i) $f(x) = x^2$

ii) $f(x) = |x|$

Course Outcomes

CO1. Understand the basic principles of sets, functions and relations and their applications.
CO2. Understand the concept of lattice and Boolean algebra with their application in simplification in switching circuits.
CO3. Understand the fundamentals of algebraic structures like group, ring, field and vector spaces.
CO4. Understand the concept of recurrence relations and generating functions and their applications in problems of combinatorics.
CO5. Write an argument using logical notation and determine if the argument is or is not valid.
CO6. Understand the concept of metric space and its application in brief.

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	1(a), 1(b), 2(a), 2(b), 3(a), 4(a), 4(b), 5(b)	14	50
CO3	1(c), 1(d), 3(b), 5(a)	6	50

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SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Mathematics
B. Tech. (Branch) Minor-I Examination (Odd) 2018-19

Entry No: | | | | | | | | | | Total Number of Pages: [01]

Date:30/09/2019 Total Number of Questions: [04]

Course Title: Discrete Structures
Course Code: MTL 2024

Time Allowed: 1.5 Hours Max Marks: [30]

Instructions:

i. Attempt All Questions.
ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.

Q1. (a) Give an example of an anti-symmetric relation [01] CO1

(b) Give an example of a function which is one-one but not onto. [01] CO1

(c) Define sub algebra with a suitable example. [01] CO2

(d) Define boundness law in a Boolean algebra. [01] CO2

(e) Define subspace of a vector space with a suitable example. [01] CO3

(f) Is X= {(1, 1,2), (7, 3, -1), (4, 4, 8)} linearly independent in $R^3(R)$? Justify. [01] CO3

Q2. (a) Let A be a set of n elements. Show that 2^{n^2-n} reflexive relations can be defined on the set A. [03] CO1

(b) Define partition of a set. Obtain all possible partitions of the set {a, b, c}. [03] CO1

(c) Let P(S) be power set of the set S={a, b, c}. Construct the Hasse diagram of P(S) with a partial ordering defined on P(S). [02] CO1

Q3. (a) Let Δ be a Boolean algebra then show that idempotent law follows from the absorption law. [02] CO2

(b) Let Δ be a Boolean algebra then show that $(A+B')*(B+C')*(C+A')=(A'+B)*(B'+C)*(C'+A)\ \forall A, B, C \in \Delta$. [03] CO2

(c) Let N be the set of natural numbers then show that it is a lattice by defining a suitable partial order relation on N and suitable least upper bound and greatest lower bound. [03] CO2

Q4. a) Show that every field is an integral domain. Is converse true? If not ustify your answer with suitable example. [03] CO3

(b) Let $V=\{a_0+a_1x+a_2x^2 \mid a_0, a_1, a_2 \in R\}$ of all polynomials of degree 2 over R. Find the basis and dimension of V. [03] CO3

(c) Define Homomorphism of rings with suitable example. [02] CO3

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
School of Mathematics
B. Tech. (CSE) Major Examination (Odd) 2017-18

Entry No: 17BCS0457
Date:29/11/2018

Total Number of Pages: [02]
Total Number of Questions: [06]

Course Title: Discrete Structures
Course Code: MTL 2024

Time Allowed: 3.0 Hours
Max Marks: [50]

Instructions / NOTE

i. Attempt All Questions.
ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
iii. Assume an appropriate data / information, wherever necessary / missing.

Section - A

Q1. (a) If the function $f(x)=x^2+1$ on the set {-2,-1,0,1,2}. Find the domain and range of f. [01] CO1

b) Which of the following is an example of disjoint sets? [01] CO1

A. A={multiple of 2} and B={multiple of 3}.
B. C={whole numbers} and D={Rational numbers}.
C. E={even numbers} and F={odd numbers}.
D. G={multiple of 5} and H={multiple of 10}.

(c)Define existential quantifier with a suitable example. [01] CO5

(d) Consider the statement "Computer x is under attack by an intruder." Identify the variable and predicate in this statement. [01] CO5

(e)What is logical meaning of theorem? State deduction theorem of statement calculus. [01] CO5

(f) What do mean by effective procedure? Explain with an example. [01] CO5

(g) What is the order of residue class ring $\frac{Z}{3Z}$. [01] CO3

Q2. (a) Define complemented lattice. Consider the lattice D_{70} with the partial order relation "divides", then Draw the Hasse diagram of D_{70} .Find the complement of each element of D_{70}. Find its g.l.b. and l.u.b., if exists. [04] CO2

(b) Give an example of a non-commutative ring. Is every ring is an integral domain? Justify your answer. State a result which shows relationship of an integral domain with a field. [03] CO3

Section - B

Q3. (a) Define a subspace of a vector space. Give an example of a subset of the set of real numbers R which is not a subspace of R. If the vectors [04] CO3

$(0,1,a)$, $(1,a,1)$, $(a,1,0)$ in $R^3(R)$ are linearly dependent, find value of a.

(b) What is the difference between a recurrence relation and a discrete numeric function? Find the generating function of the sequence 1, 4, 9, 16,… [04] CO4

Q4. (a) State Tower of Hanoi Problem. Model this problem using concept of recurrence relations and hence obtain a general solution of this problem. [05] CO4

(b) Solve the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2} + n.3^n$. [04] CO4

Q5. (a) Define the term argument in propositional logic. Show that the premises " It is not sunny this afternoon and it is colder than yesterday," we will go swimming only if it is sunny," "If we don't go swimming, then we will take a trip," and " If we take a trip , then we will go home by sunset" lead to the conclusion "we will be at home by sunset." [04] CO5

(b) Establish the equivalence $(p \to q) \wedge (r \to q) \equiv (p \vee q) \to q$. [05] CO5

Q6. (a) What is a metric? Let R be a set of real numbers, then define a metric on the set on R^3. Consider a pattern is to be identified due to three features. Let feature values of three unknown patterns P_1, P_2 and P_3 be {1, 0.9, 0.8},{0.6, 0.6, 0.9} and {0.6, 0.9, 1.0} respectively. Let Q be a known pattern with feature values {0.54, 0.1, 0.9}. Then using a suitable metric which of the pattern P_1, P_2 or P_3 is closer to the pattern Q. [05] CO6

(b) Define an open set and a closed set in a metric space. Can arbitrary intersection of open sets be open? Justify with an example. Give an example of a set which is neither open nor closed. [05] CO6

Course Outcomes

After successful completion of this course, students shall be able to:

1. Understand the basic principles of sets, functions and relations and their applications.
2. Understand the concept of lattice and Boolean algebra with their application in simplification in switching circuits.
3. Understand the fundamentals of algebraic structures like group, ring, field and vector spaces.
4. Understand the concept of recurrence relations and generating functions and their applications in problems of combinatorics.
5. Write an argument using logical notation and determine if the argument is or is not valid.
6. Understand the concept of metric space and its application in brief.

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	1(a), 1(b)	02	50
CO2	2(a)	04	50
CO3	1(h), 2(b), 3(a)	08	50
CO4	3(b),4(a), 4(b)	13	50
CO5	5(a), 5(b)	09	50
CO6	1(c), 1(d) 1(e), 1(f), 6(a), 6(b)	14	50

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Mathematics

B. Tech. (Branch) Minor-I Examination (Odd) 2018-19

Entry No: | | | | | | | | | | Total Number of Pages: [01]

Date:30/09/2019 Total Number of Questions: [04]

Course Title: Discrete Structures

Course Code: MTL 2024

Time Allowed: 1.5 Hours Max Marks: [30]

Instructions:

i. Attempt All Questions.

ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.

Q1. (a) Give an example of an anti-symmetric relation [01] CO1

(b) Give an example of a function which is one-one but not onto. [01] CO1

(c) Define sub algebra with a suitable example. [01] CO2

(d) Define boundness law in a Boolean algebra. [01] CO2

(e) Define subspace of a vector space with a suitable example. [01] CO3

(f) Is X= {(1, 1,2), (7, 3, -1), (4, 4, 8)} linearly independent in $\mathbf{R}^3(\mathbf{R})$? Justify. [01] CO3

Q2. (a) Let A be a set of n elements. Show that 2^{n^2-n} reflexive relations can be defined on the set A. [03] CO1

(b) Define partition of a set. Obtain all possible partitions of the set {a, b, c}. [03] CO1

[02] CO1

(c) Let P(S) be power set of the set S={a, b, c}. Construct the Hasse diagram of P(S) with a partial ordering defined on P(S).

Q3. (a) Let Δ be a Boolean algebra then show that idempotent law follows from the absorption law. [02] CO2

(b) Let Δ be a Boolean algebra then show that $(A+B')*(B+C')*(C+A')=(A'+B)*(B'+C)*(C'+A)\ \forall A, B, C\in\Delta$. [03] CO2

(c) Let N be the set of natural numbers then show that it is a lattice by defining a suitable partial order relation on N and suitable least upper bound and greatest lower bound. [03] CO2

Q4. a) Show that every field is an integral domain. Is converse true? If not ustify your answer with suitable example. [03] CO3

(b) Let $V=\{a_0+a_1x+a_2x^2 \mid a_0,a_1,a_2\in R\}$ of all polynomials of degree 2 over R. Find the basis and dimension of V. [03] CO3

(c) Define Homomorphism of rings with suitable example. [02] CO3

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA

School of Mathematics

B. Tech. (CSE, 3rd Sem.) Major Examination (Odd) 2019-20

Entry No: | | | | | | | | | |

Total Number of Pages: [02]

Date:13/12/2019

Total Number of Questions: [06]

Course Title: Discrete Structures

Course Code: MTL 2024

Time Allowed: 3.0 Hours

Max Marks: [50]

Instructions:

i. Attempt All Questions.
ii. Support your answer with neat freehand sketches/diagrams, wherever appropriate.
iii. Assume an appropriate data / information, wherever necessary / missing.

SECTION-A

Q1. (a) How many reflexive relations can be defined on a singleton set? [01] CO1

(b) Let p and q be two propositions then which of the following is not true? [01] CO5

A. $p \wedge T \equiv p$ is identity law.
B. $p \vee T \equiv T$ is tautology law.
C. $p \wedge p \equiv p$ is idempotent law.

(c) Let $f(x)=(x-1)(x-2)(x-3)$ be a function whose domain and co-domain is the set of real numbers. Then which of the following is true? [01] CO1

A. f is a one-one and onto function.
B. f is a one-one but not an onto function.
C. f is not one-one but an onto function.

(d) Define subgroup of group with a suitable example. [01] CO3

(e) Give an example of a group which has an element of order 4. [01] CO3

Q2. (a) Let D_{12} be the set of all divisors of 12, then show that it forms a lattice. Construct a Hasse diagram for D_{12}. [05] CO2

(b) Let $S=\{a,b,c\}$ and $P(S)$, the power set of S be the boolean algebra. Find two sub algebras of $P(S)$ and verify that union of two sub algebras need not be sub algebra of $P(S)$. [05] CO2

Q3 (a) Prove that intersection of two subgroups of a group G is a subgroup of G and union of these subgroups need not be a subgroup of G. [05] CO3

(b) What is linear combination of vectors in a vector space? Write the vector (2, 3) of vector space R^2 as a linear combination of vectors (1, 2) and (-1, 1). If the vectors $(0,1,a)$, $(1,a,1)$, $(a,1,0)$ in $R^3(R)$ are linearly dependent, find value of a. [05] CO3

0 1 0
1 a 1
a 1 0

0(1) − 1 (−a) + a
(1 − a²)

a −

Section-B

Q4. (a) Solve the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2} + 3^n$. [03] CO4

(b) Solve the recurrence relation $a_n = 3a_{n-1} + 2,\ a_0 = 1$ by method of generating functions. [04] CO4

(c) Define a quantifier. Let x and y are two real numbers then represent the following using suitable quantifiers. [03] CO5

(i) $x + y = 0$ (ii) $x > x + 1$

Q5. (a) Define a generating function. Find the generating function of a sequence whose r^{th} term is given by $a_r = 2^r + 3^r$, $r \geq 0$. [04] CO4

(b) What is an argument in the propositional logic? When does an argument is valid? Can we always check the validity of an argument easily using a truth table? If not, why? [04] CO5

Q6. (a) Define the term metric on a set X. Let X=R^2, the set of the points in the two dimensional coordinate plane. Let x=(x_1, x_2) and y=(y_1,y_2) in X, define a metric d(x, y)=max.$\{|x_1-y_1|,|x_2-y_2|\}$. Then describe the unit sphere $S_1(0,0)$ centred at origin in the metric space (R^2, d). [03] CO6

(b) Define interior of a set in a metric space. Let (X, d) be metric space and A and B are two subsets of X. The show that $(A \cap B)^0 = A^0 \cap B^0$. Also give an example to show that $(A \cup B)^0 \neq A^0 \cup B^0$. [04] CO6

Course Outcomes:

After successful completion of this course, students shall be able to;

1. Understand the basic principles of sets, functions and relations and their applications.
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