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Enrollment No. EN21CS301039

Faculty of Engineering / Science

End Sem (Odd) Examination Dec-2022

BC3BS05 / CS3BS04 / IT3BS01 Discrete Mathematics

Programme: B.Tech. / B.Sc. **Branch/Specialisation:** CSE / IT / Computer Science

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. The trivial subset of set $X=\{a, b, c\}$ is **1**

(a) X (b) $\{\emptyset, X\}$ (c) $\{\emptyset\}$ (d) None of these

ii. Let A and B be two disjoint sets then $|A \cup B|$ - **1**

(a) $|A \cup B| = |A| + |B|$ (b) $|A \cup B| = |A| - |B|$

(c) $|A \cup B| = |A||B|$ (d) None of these

iii. If $f: X \to Y$ and A , B are two subsets of Y then- **1**

(a) $f^{-1}(A \cup B) = f^{-1}(A) \cup f^{-1}(B)$

(b) $f^{1}(A \cup B) = f^{-1}(A) \cap f^{-1}(B)$

(c) $f^{-1}(A \cap B) = f^{-1}(A) \cup f^{-1}(B)$

(d) None of these

iv. The number of maximal elements in the set $\{1,2,3,4,5\}$ under relation divisibility is- **1**

(a) 2 (b) n (c) 3 (d) None of these

v. In group $G = \{1, -1, i, -i\}$ order of element i with respect to multiplication is- **1**

(a) 1 (b) 2 (c) 4 (d) None of these

vi. Let I be a set of integers under addition operation H is subgroup of even integers then elements in coset of H in G is- **1**

(a) $\{0, \pm 1, \pm 2 \ldots\}$

(b) $\{1,2,3 \ldots\}$

(c) $\{0, \pm 1, \pm 2 \ldots\}$ and $\{1,2,3 \ldots\}$

(d) None of these

P.T.O.

vii. Which is planar graph? 1

(a) K_4 (b) K_5 (c) K_6 (d) None of these

viii. The degree of pendant vertex is- 1

(a) 1 (b) 0 (c) 3 (d) 2

ix. The homogeneous solution of $a_r + Aa_{r-1} + Ba_{r-2} = 0$, when roots of axillary equation are real and distinct- 1

(a) $c_1 m_1{}^r + c_2 m_2{}^r$ (b) $(c_1 + rc_2)m^r$

(c) $c_1 e^{m1} + c_2 e^{m2}$ (d) None of these

x. In recurrence relation generating function of sequence (y_n) is given by- 1

(a) $\sum_{h=0}^{n} y_h t^h$ (b) $\sum_{h=0}^{\infty} y_h t^h$

(c) $\sum_{h=0}^{n} y_{h+1} t^{h+1}$ (d) $\sum_{h=0}^{n-1} y_h t^h$

Q.2 Attempt any two:

i. Define reflexive, symmetric and transitive relation. With example. 5

ii. How many solutions does equation $x_1+x_2+x_3+x_4=13$ have where x_1, x_2, x_3 are non-negative integers with $0 \leq x_i \leq 5$, i=1,2,3,4 5

iii. Show that if 5 points are selected in a square whose sides have length 1 inch, at least two of the points must be no more than $\sqrt{2}$ inches apart. 5

Q.3 Attempt any two:

i. Let B be the set of all positive divisors of 30 i.e $B = \{1, 2, 3, 5, 6, 10, 15, 30\}$ and the operations + and * on B are defined as $a+b$ $=L.C.M$ of a and b, $a*b = H.C.F.$ of a and b, $a' = 30/a$. Prove that (B, +, *, ') is Boolean Algebra. 5

ii. Show that the relation "divides" on N is a partial order relation. 5

iii. Change the Boolean function into disjunctive normal form 5

$f(x, y, z) = [x + (x' + y)'].[x + (y'. z')']$

Q.4 Attempt any two:

i. If H_1 and H_2 are two subgroups of a group (G, °), then $H_1 \cap H_2$ is also a subgroup of G but union of two subgroups is not necessarily a subgroup explain with an example. 5

ii. Find all generators in the cyclic group $\{1, 2, 3, 4, 5, 6\}$ under multiplication modulo 7. 5

iii. Prove that every cyclic group is abelian group. 5

Q.5 Attempt any two:

i. Define following with example: 5
(a) Graph colouring and chromatic number
(b) Vertex disjoint subgraph

ii. Prove that number of edges in a tree with *n* vertices is *n-1*. 5

iii. If the number of vertices in a graph is 10 each of degree 3. Find number of edges and number of regions in the graph. 5

Q.6 Attempt any two:

i. Solve the recurrence relation $a_r + 5a_{r-1} + 5a_{r-2} = 2 + r$ 5

ii. Find numeric function of generating function: 5
$A(z) = (1+z)^n + (1-z)^n$

iii. There are 10 students in the class, of which 8 are girls and 2 are boys. Find the number of ways to select: 5
(a) 2 girls and 1 boy
(b) 1 girl and 2 boys

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