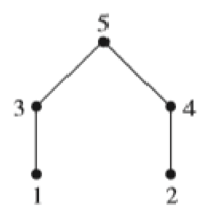
University of Mumbai
Program: Computer Engineering Curriculum Scheme: Rev2019
Examination: Second Year Semester: III
Course Code: CSC302 Course Name : Discrete Structures and Graph Theory
Time: 2.5 hour Max. Marks: 80

Q1. All questions compulsory 2 marks each (20 Marks)

Q1.	Let P(x): x is even, Q(x): x is prime, R(x,y):x+y is even. The proposition (∀x)(∃y) R(x,y) can be written as
Option A:	For all y, there exists a x such that x+y is even
Option B:	For all x, there exist a y such that x+y is even
Option C:	For all y, there exists a x such that x+y is not even
Option D:	For all x, there exist a y such that x+y is not even
Q2.	The disjunctive normal form of the expression p ^ (p→q) is
Option A:	p ^ (~p V q)
Option B:	p V (~p ^ q)
Option C:	(p^ ~p) V (p^q)
Option D:	(p^ ~p) V (p^q)
Q3.	Let R={(1,1),(1,2),(1,4),(2,4),(3,1),(3,2),(4,2),(4,3),(4,4)} be a relation on S={1,2,3,4}. The symmetric closure of R can be given by
Option A:	R1={(1,2),(4,3),(3,4),(2,2),(3,1),(1,3,),(3,3),(4,4)}
Option B:	R1={(1,1),(1,2),(2,2),(2,1),(3,3),(4,3),(3,4),(4,4),(3,1),(1,3)}
Option C:	R1={(1,1),(1,2),(2,1),(1,4),(4,1),(2,4),(4,2),(3,1),(1,3),(3,2),(2,3),(4,3),(3,4),(4,4)}
Option D:	R1={(1,2),(2,1),(4,3),(2,2)}

Q4.	Which of the following function is bijective?
Option A:	$f: R \rightarrow R \; defined \; as \; f(x) = x^2$
Option B:	$f: R \rightarrow R \; defined \; as \; f(x) = 3^x$
Option C:	$f: R \rightarrow R \; defined \; as \; f(x) = x^3 - x$
Option D:	$f: R \rightarrow R \; defined \; as \; f(x) = x^3 + 1$
Q5.	Determine the relation of the partial order whose Hasse diagram is given below. 
Option A:	R = {(1,1),(1,2),(1,3),(1,4),(1,5),(2,2),(2,4),(2,5),(3,3),(3,5),(4,4),(4,5),(5,5)}
Option B:	R = {(1,1),(1,3),(1,5),(2,2),(2,4),(2,5),(3,3),(3,5),(4,4),(4,5)}
Option C:	R = {(1,1),(1,3),(1,5),(2,2),(2,4),(2,5),(3,3),(3,5),(4,4),(4,5),(5,5)}
Option D:	R = {(1,1),(1,3),(1,4),(1,5),(2,2),(2,3),(2,4),(2,5),(3,3),(3,5),(4,4),(4,5),(5,5)}
Q6.	Solution of linear homogenous recurrence relation: $a_n = 3a_{n-1} - 2a_{n-2} \; with \; a_0 = 1 \; , a_1 = 3 \; , n \geq 2$ is

Option A:	$a_n = (-1) + 2^n$
Option B:	$a_n = (-1) + 3.2^n$
Option C:	$a_n = (-1)(-1)^n + 2^n$
Option D:	$a_n = (-1) + 2.2^n$
Q7.	Consider the (2,6) encoding function e defined by e(00)=000000 , e(01)=011110 , e(10)=101010 , e(11)=111000.Then minimum distance of e is
Option A:	1
Option B:	0
Option C:	2
Option D:	3
Q8.	An (m ,n) coding function $e: B^m \to B^n$ can detect k or less errors if and only if its minimum distance is
Option A:	At least k+2
Option B:	At least k+1
Option C:	At least 2k+1
Option D:	At least 2k+2
Q9.	Determine the number of edges in a graph with 6 nodes, 2 of degree 5 and 4 of degree 3.
Option A:	8
Option B:	10
Option C:	9
Option D:	11
Q10.	If a graph G has m vertices and n edges then number of edges in its complement are

Option A:	[n(n-1)/2]-m
Option B:	[m(m-1)/2]-n
Option C:	[m(m-1)] - (n/2)
Option D:	[n(n-1)] – (m/2)

Q2. (20 Marks Each)	Solve any Four Questions out of Six 05 marks each
A	Prove using Mathematical Induction 2 + 5 + 8 + … + (3n-1) = n(3n+1)/2.
B	Use the laws of logic to show that [(p→q) ^ ~q] → ~p is a tautology.
C	Let A={1,2,3,4,5}. A relation R is defined on A as aRb iff a<b. Compute R^2 and R^∞.
D	Let A = {1, 4, 7, 13} and R = {(1,4),(4,7),(7,4),(1,13)}. Find Transitive Closure using Warshall's Algorithm.
E	Let A = {a, b, c}. Draw Hasse Diagram for (p(A), ⊆).
F	Determine whether A = {2, 4, 12, 16} is a lattice under divisibility. Draw it's Hasse Diagram.

Q3. (20 Marks Each)	Solve any Two Questions out of Three 10 marks each
A	Define Abelian Group. Prove that G={1,2,3,4,5,6} is a finite abelian group of order 6 with respect to multiplication module 7.
B	Consider the (3,5) group encoding function defined by e(000) = 00000 e(001) = 00110 e(010) = 01001 e(011) = 01111 e(100) = 10011 e(101) = 10101 e(110) = 11010 e(111) = 11000

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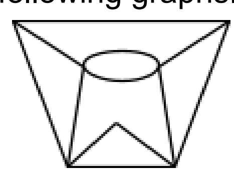
	Decode the following words relative to a maximum likelyhood decoding function. i. 11001 ii. 01010 iii. 00111
C	Let the functions f, g and h defined as follows: f: R → R, f(x) = 2x+3 g: R → R, g(x) = 3x+4 h: R → R, h(x) = 4x Find gof, fog, foh, fogoh, gofoh.

Q4. (20 Marks Each)	Solve any Two Questions out of Three 10 marks each
A	In a group of 300 persons, 160 drink tea and 170 drink coffee, 80 of them drink both. How many persons do not drink either?
B	Determine the Eulerian (Euler) and Hamiltonian paths and circuits, if exists, in the following graphs. 
C	Determine if, following graphs G_1 and G_2 are isomorphic or not.