University of Mumbai

Examination 2020 under cluster 4 (Lead College: PCE, New Panvel)

Examinations Commencing from 10th April 2021 to 17th April 2021

Program: **Computer Engineering**

Curriculum Scheme: Rev 2019

Examination: SE Semester III (For Direct Second Year-DSE)

Course Code: CSC302 and Course Name: Discrete Structures and Graph Theory

Time: 2 hour Max. Marks: 80

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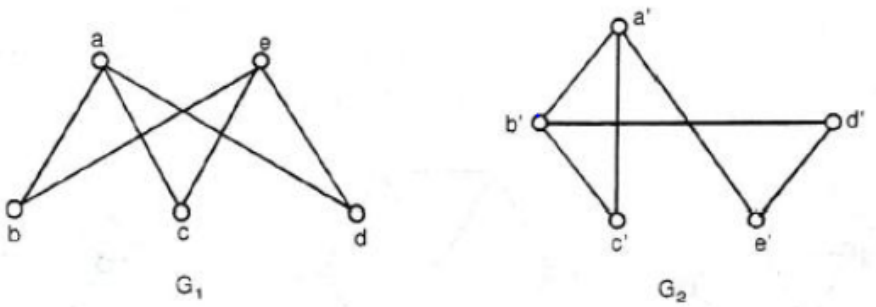
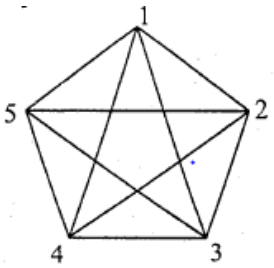
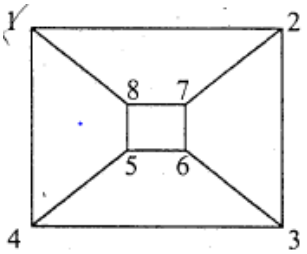
Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks.**
1.	What is a negation of the following statement " 8 is even & -11 is negative"?
Option A:	8 is even & -11 is not negative
Option B:	8 is odd & -11 is not negative
Option C:	8 is even or -11 is not negative
Option D:	**8 is odd or -11 is not negative**
2.	The number of elements in the P(X) of X= {{a},{b}, {c,d}, {e,f}} is
Option A:	12
Option B:	8
Option C:	9
Option D:	**16**
3.	**If two sets A and B have no common elements between them, then such sets are known as ?**
Option A:	**Disjoint**
Option B:	Intersection
Option C:	Complement
Option D:	Union
4.	Which of the following is not the example of a partial order relation?
Option A:	R={(a,b) | a,b $\in$Z, a$\leq$ b}
Option B:	R={(a,b) | a,b $\in$Z, a/b $\in$Z}
Option C:	R={(a,b) | a,b $\in$P(X) , a $\subseteq$ b}
Option D:	**R={(a,b) | a,b $\in$Z, a < b}**
5.	Let a set S = {1, 2, 3, 4, 6, 9, 12, 18, 24} and R be the partial order relation of divisibility. Number of edges in its Hasse diagram are
Option A:	10
Option B:	**11**
Option C:	9
Option D:	8
6.	Domain for which the functions defined by $f(x) = 2x^2-1$ & $g(x) = 5-x$ are equal to
Option A:	{2, 3/2}
Option B:	{-2, -3/2}

Option C:	{2, 3/2}
Option D:	**{-2, 3/2}**
7.	Let G be a simple undirected graph. There are some odd degree vertices. If a node x is added to G and made it adjacent to each odd degree vertex of G, then the resultant graph will be
Option A:	regular
Option B:	**Euler**
Option C:	Complete
Option D:	Hamiltonian
8.	A sufficient condition that a triangle T be a right triangle is that $a^2 + b^2 = c^2$. An equivalent statement is
Option A:	T is a right triangle unless $a^2 + b^2 = c^2$.
Option B:	If T is a right triangle then $a^2 + b^2 = c^2$.
Option C:	**If $a^2 + b^2 = c^2$ then T is a right triangle**
Option D:	T is a right triangle only if $a^2 + b^2 = c^2$.
9.	How many strings of length 8 either begin with 2 zeros or end with 4 ones?
Option A:	80
Option B:	42
Option C:	**76**
Option D:	64
10.	Let A={a,b,c,d} R={(a,a), (b,c), (c,b), (d,a)} & S={(a,d),(c,b), (b,a), (c,d)} What is the composition of relations RoS?
Option A:	{(a,a), (a,b), (c,c), (a,c)}
Option B:	**{(a,a), (b,a), (c,c), (c,a)}**
Option C:	{(a,d), (b,b), (c,a), (b,d), (d,d)}
Option D:	{(a,d), (b,b), (c,a), (d,d)}
11.	What is a length of the walk of a graph?
Option A:	Total number of edges in a graph
Option B:	**The number of edges in a walk**
Option C:	Total number of vertices in a graph
Option D:	The number of vertices in walk
12.	Which of the following statement is not a tautology?
Option A:	$p \rightarrow (p \vee q)$
Option B:	$(p \wedge q) \rightarrow (p \rightarrow q)$
Option C:	$(p \rightarrow q) \rightarrow q$
Option D:	$(p \wedge q) \rightarrow (p \vee q)$
13.	Which of the following Poset is a Distributed Lattice?
Option A:	D_{50}
Option B:	**D_{30}**
Option C:	D_{20}
Option D:	D_{40}

14.	Which of the following functions f: Z X Z → Z is not onto?
Option A:	f(a, b) = a – b
Option B:	f(a, b) = a + b
Option C:	**f(a, b) = | b|**
Option D:	f(a, b) = a
15.	Let A={0,1,2,3,4,5} a group under the operation of addition modulo 6 i.e. $+_6$. What is a subgroup generated by the element 2?
Option A:	{0,1,2,3,4,5,6}
Option B:	**{0,2,4}**
Option C:	{0,1,4,6}
Option D:	{2,4}
16.	If there are 25 rooms in a girls' hostel, what is the minimum number of girls required so that at least 5 are living in one room?
Option A:	85
Option B:	**101**
Option C:	100
Option D:	90
17.	What is the identity element In the group G = {2, 4, 6, 8) under multiplication modulo 10?
Option A:	5
Option B:	**6**
Option C:	12
Option D:	9
18.	Determine the number of edges in a graph with 6 nodes which contains 2 of degree 5, 2 of degree 3 & 2 of degree 2.
Option A:	12
Option B:	**10**
Option C:	9
Option D:	11
19.	For which of the following, hasse diagram is drawn?
Option A:	lattice
Option B:	**partially ordered set.**
Option C:	sublattice
Option D:	boolean algebra
20.	If 35 books in a Department contain total 56351 pages, then one of the books has atleast _____ pages.
Option A:	**1611**
Option B:	1610
Option C:	1598
Option D:	1612

Q2. **(20 Marks)**	**Solve any Four questions out of Six.** **5 marks each**
A	Let A={i, j, k, l, m} MR= $\begin{bmatrix} 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \end{bmatrix}$ Find the transitive closure of it using Warshall's algorithm.
B	Prove by mathematical induction that 2+5+8+……+(3n-1)= n(3n+1)/2
C	Explain a distributive lattice with the suitable example. Prove that in a distributive lattice, the complement of any element is unique.
D	What is a bijective function? Find inverse of the following bijection: f: R→R defined by f(x)= (1-2x)/3
E	Verify whether ((PVQ) Λ ┐(┐ P Λ (┐ Q V ┐ R))V(┐ P Λ ┐ Q)V(┐ P Λ ┐ R) is tautology.
F	Determine whether following graphs are isomorphic. Justify your answer.  G_1 G_2

Q3. **(20 Marks)**	**Solve any Two Questions out of Three .** **10 marks each**
A	Explain the following terms with the suitable example. i) Hamming Distance ii) Monoid iii) Cyclic Group iv) group code v) Ring
B	i) What is an adjacency matrix & incidence matrix? Explain both with the suitable example.

	ii) What is Eulerian path & a circuit? Determine which of the following graphs consist of Eulerian path and/or a circuit.  G_1  G_2
C	What is a group? Let S={0,3,6,9,12} i) Prepare the composition table w.r.t. the operation of addition modulo 15. ii) Show that it is an abelian group. iii) Find the inverses of all the elements. iv) Whether it is a cyclic group?

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Question Number	Correct Option (Enter either 'A' or 'B' or 'C' or 'D')
Q1.	D
Q2.	D
Q3.	A
Q4	D
Q5	B
Q6	D
Q7	B
Q8.	C
Q9.	C
Q10.	B
Q11.	B
Q12.	C
Q13.	B
Q14.	C
Q15.	B
Q16.	B
Q17.	B
Q18.	B
Q19.	B
Q20.	A

Q. 2 A) 1 mark for each matrix (W_1 to W_5)

$MR = W_0 = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \end{bmatrix}$ $W_1 = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 \end{bmatrix}$

$W_2 = \begin{bmatrix} 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 \end{bmatrix}$ $W_3 = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \end{bmatrix}$

$W_4 = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$ $W_5 = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$

B)

Basis step (for n=1) 2 marks

Inductive step (show that p(k) $\rightarrow$ p(k+1)) 3 marks

C)

Define a distributive lattice. 1 mark

Give the suitable example. 2 marks

Prove that the complement of each element is unique 2 marks

D) Define a bijective function. 1 mark

Find the inverse of a given function 4 marks

E) Explain the term tautology 1 mark

Verify whether given expression is a tautology using laws of logic 4 marks

F) Definition of the isomorphic graphs. 2 marks

Determine whether given graphs are isomorphic or not 3 marks

(graphs are not isomorphic)

Q. 3 A)

Explain each term 1 mark each

Give the suitable example of each term 1 mark each

B) i) Explain the terms adjacency matrix & incidence matrix 2 mark

Suitable example with the graph for each of the matrices. 3 marks

ii) Explain what is Eulerian path & a circuit in the graph. 1 mark

for Graph G_1 2 marks

The degree of each vertex is even.
∴ There is an Eulerian circuit in a graph.
One Eulerian circuit is $1 \to 2 \to 3 \to 4 \to 5 \to 3 \to 1 \to 4 \to 2 \to 5 \to 1$
∴ The graph is Eulerian.

For Graph G_2 2 marks

Degree of each vertex is odd.
∴ There is no Eulerian circuit & no Eulerian path. The graph is not Eulerian.

C)

Explanation of the term group 2 marks

composition table w.r.t. $+_{15}$ 2 marks

$+_{15}$	0	3	6	9	12
0	0	3	6	9	12
3	3	6	9	12	0
6	6	9	12	0	3
9	9	12	0	3	6
12	12	0	3	6	9

Show that it is an abelian group 2 marks

Inverses of all the elements 2 marks

Determine whether it is a cyclic group 2 marks