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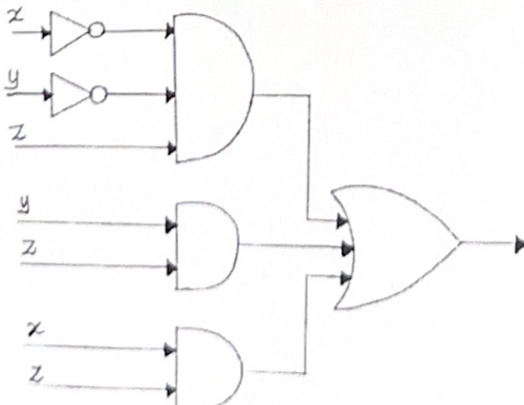
VIT

Vellore Institute of Technology
(Deemed to be University under section 3 of UOC Act, 1956)

Continuous Assessment Test (CAT-2) – October 2024

Programme	: B.Tech.	Semester	: Fall Semester 2024-25
Course	: Discrete Mathematics and Graph Theory	Code	: BMAT205L
Faculty	: Sakthidevi K. Pavithra R. Anitha G. Gnanaprasanna K. Aarthi B. Sumathi S.	Slot	: C1+TC1+TCC1
Time	: 90 Minutes	Class Number	: CH2024250102262 CH2024250102263 CH2024250102264 CH2024250102081 CH2024250102064 CH2024250102065
		Max. Marks	: 50

Answer All Questions

Q. No.	Question Description	Marks
1.	(a) Twenty-five crates of apples are delivered to a store. The apples are of three different sorts, and all the apples in each crate are of the same sort. Show that among these crates there are at least nine containing the same sort of apples.	5
	(b) In the final round of a cooking competition, Ben had to choose 1 fish dish, 2 vegetable dishes and 2 dessert dishes to cook from the lists of 4 fish dishes, 6 vegetable dishes and 5 desert dishes. After ben makes his selection, Adam must choose 3 dishes each from any two of three categories: fish, vegetables or desserts. Both participants were not allowed to choose the same dish. Find the number of ways Ben and Adam can choose their dishes.	5
2.	(a) Solve the following recurrence relation using generating function: $a_n = 3a_{n-1} - 4a_{n-2}$, where $a_0 = 2, a_1 = -1$.	7
	(b) In a secure online account, usernames are required to have exactly 5 characters, which can be either upper case or lower case 1. How many different usernames can be created? 2. How many usernames can be generated using only lower-case letters?	3
3.	(a) Let R denotes a relation on the set of pairs of $N \times N$ positive integers such that $(x, y)R(u, v)$ if and only if $xv = yu$. Check whether R is reflexive, symmetric and transitive.	3
	(b) Write the output of the given circuit and simplify it using Boolean identities. Also determine the SoP and PoS for the simplified output. 	7

4.	<p>Consider $(D_4,)$ and $(D_{15},)$. The elements in $P = D_4 \times D_{15}$ represent the product of a and b where $a \in D_4$ and $b \in D_{15}$.</p> <p>(a) Draw the Hasse diagrams for $(D_4,)$, $(D_{15},)$ and $(P,)$.</p> <p>(b) Find the LUB of $\{2, 15, 20\}$.</p> <p>(c) Find the GLB of $\{10, 12\}$.</p> <p>(d) Check whether $(P,)$ is a lattice.</p>	10
5.	<p>A network of interconnected devices is modelled as a graph, where each device is represented as a vertex and an edge represents a direct connection between two devices. The adjacency matrix of the illustrated graph G, is</p> $\begin{bmatrix} 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$ <p>i. Construct a graph for the above adjacency matrix to depict the network</p> <p>ii. Determine the vertex set $V(G)$ and $E(G)$</p> <p>iii. Determine the Incident Matrix of G</p> <p>iv. Determine the degree of vertices of each vertex.</p> <p>v. Is the graph connected? Justify your answer with an explanation.</p> <p>vi. Is the graph complete? Justify your answer with an explanation.</p>	10