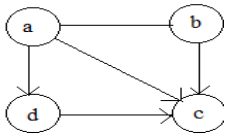
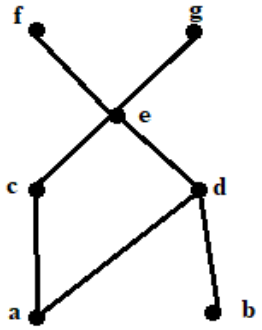
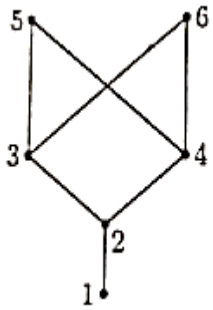
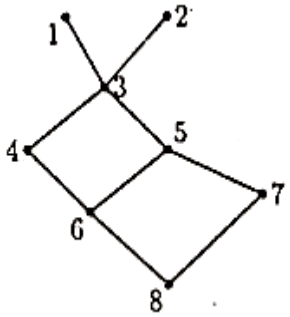
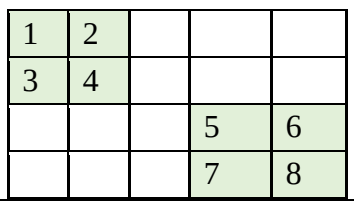
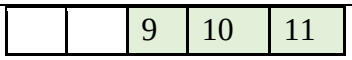
Department of Mathematics
Question Bank

Branch: CSE/IS/DS

Subject	**Discrete Mathematics and Graph Theory**	
Subject Code	**21CIDS31**	
Module 2	**Principles of Counting and Inclusion-Exclusion**	

#	Questions	CO's	Marks	BLT
1.	State the Pigeonhole principle. Also, prove that if 5 colours are used to paint 26 doors, then atleast 6 doors will have the same colour.	2	05	3
2.	Find the least number of ways of choosing three different numbers from 1 to 10 so that all choices have the same sum.	2	04	3
3.	i. Let A={2,8,14,18} Let R be a relation on A defined by xRy if and only if $x - y > 5$ a) Write down R as a set of ordered pairs. b) Write M(R). c) Draw a directed graph of the relation. d) Determine the indegree and out-degree of the vertices in the digraph. ii. Let A={1,2,3,4} let R be a relation defined by xRy iff x divides y [divisibility relation]. a) Write R as ordered pairs. b) Write Matrix of relation. c) Draw digraph. d) Find indegree & outdegree	2	05	2
4.	Let $A = \{1,2,3,4\}$. Determine the nature of the following relations on A: i. $R_1 = \{(1,1),(2,2),(3,3),(4,4),(1,2),(2,1),(3,4),(4,3),(4,4)\}$ ii. $R_2 = \{(1,2),(1,3),(3,1),(1,1),(3,3),(3,2),(1,4),(4,2),(3,4)\}$ iii. R_3 represented by the following diagraph: 	2	04	2
5.	Define equivalence relation. On set of all integer Z the relation R is defined by $(a,b) \in R \Leftrightarrow a^2 - b^2$ is an even integer. Show that R is an equivalence relation.	2	06	3
6.	Define POSET. Verify that R_1, R_2 is a partial order set on A. Also draw Hasse Diagram. i) Let $A = \{1,2,3,6,8\}$ and $R_1 = \{(1,1),(1,2),(1,3),(1,6),(1,8),(2,2),(2,6),(3,3),(3,6),(6,6),(8,8)\}$ ii) Let $A = \{1,2,3,4,5\}$ and $R_2 = \{(1,1),(1,3),(1,4),(1,5),(2,2),(2,3),(2,4),(2,5),(3,3),(3,4),(3,5),(4,4),(5,5)\}$	2	06	4

7.	Show that divisibility relation of D_{30} is a partial order and draw its Hasse Diagram	2	06	4
8.	Consider the Hasse diagram of POSET (A,R) given below. If A={c,d,e} in Fig 01 , B={3,4,5}in Fig 02 ,C={2,3,6}in Fig 03 find (if any) **i)** All upper bounds **ii)** All lower bounds. **iii)** The least upper bound. **iv)** Greatest lower bound.  Fig 01  Fig 02  Fig 03	2	06	3
9.	Compute the transitive closure R^{∞} by using Warshall's Algorithm. Let $A = \{1,2,3,4\}$ and l i) $M_R = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ ii) $M(R) = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix}$	2	10	3
10.	Among 100 students , 32 study mathematics , 20 study physics , 45 study biology , 15 study mathematics and biology , 7 study mathematics and physics , 10 study biology and physics and 30 do not study any of the subjects. **a.** Find the number of students studying all three subjects? **b.** Find the number of students studying exactly one of three subjects?	2	06	3
11.	How many integers between 1 and 300 (inclusive) are a. Divisible by at least two of 5, 6, 8? b. Divisible by exactly two of 5, 6, 8?	2	06	4
12.	While at race track, a person bets on each of the ten horses in a race to come in accordance to how they are favored. In how many ways can they reach the finish line so that he losses all his bets?	2	04	3
13.	For the positive integers 1, 2, 3,…, n there are 11660 derangements where 1,2,3,4,5 appear in the first five positions. What is the value of 'n'?	2	04	3
14.	 	2	06	4

	Find the rook polynomial for the board shown below (shaded part) using product formulae. 			
15.	Find the Rook polynomial for the 3x3 board by using the expansion formula.	2	06	4
16.	Four persons P1, P2, P3. Pa who arrive late for a dinner party find that only one chair at each of five tables T1, T2, T3, T and Ts is vacant. P will not sit at T or T2 P2 will not sit at T. Ps will not sit at Ty or T4, and P, will not sit at Ta or Ts. Find the number of ways they can occupy the vacant chairs.	2	06	4