U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

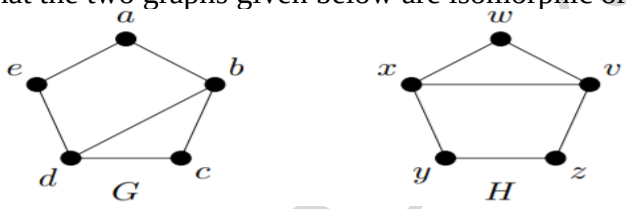
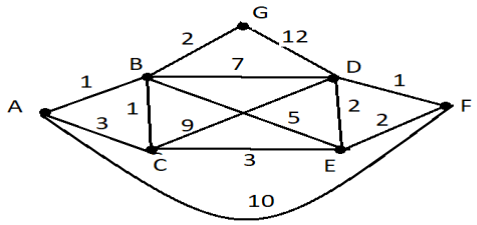
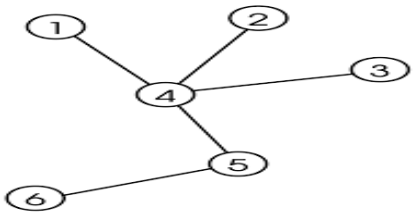
Autonomous Institute Affiliated to VTU

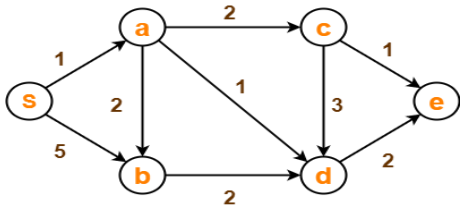
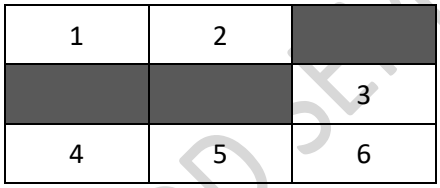
January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: CSE/ISE **Duration: 3 hrs.**
Course Code: 22MA3BSSDM **Max Marks: 100**
Course: Statistics and Discrete Mathematics

Instructions: 1. All questions have internal choices.
2. Missing data, if any, may be suitably assumed.
3. Use of Statistical tables is permitted.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - 1	*CO*	*PO*	Marks
1	a)	Verify that the two graphs given below are isomorphic or not. 	*1*	*1*	**6**
	b)	The diagram below shows roads connecting areas in a city. The numbers on each arc represent the distance in kilometer. Raja wants to travel all areas in this city traveling minimum distance. Apply Kruskal's algorithm to assist Raja in visiting every city. 	*1*	*1*	**7**
	c)	Suppose a new club has 7 members. These members meet each day for lunch at a round table. They decide to sit in such a way that every member has different neighbors at each lunch. Explain using graph theory in how many ways can this arrangement last and also list all possible cases with graph.	*1*	*1*	**7**
		OR			
2	a)	Obtain an adjacency matrix for the given graph and write three observations on it. 	*1*	*1*	**6**

		b)	Apply Dijkstra's algorithm to find the shortest distance from vertex 's' to vertex 'e' in the graph given below:  	*1*	*1*	**7**
		c)	Prove that a connected graph G remains connected even after removing an edge e from G if and only if e is a part of some cycle in G.	*1*	*1*	**7**
			UNIT - 2			
	3	a)	Define Catalan number. Using the moves $R:(x,y)\to(x+1,y)$ and $U:(x,y)\to(x,y+1)$, find the number of ways one can go from $(3,8)$ to $(11,16)$ and not rise above the line $y=x+5$.	*1*	*1*	**6**
		b)	Find the Rook polynomial for the board given below (for the non-shaded squares).  	*1*	*1*	**7**
		c)	Find the sequence generated by the functions (i) $2x^2(1-x)^{-1}$ and (ii) $\frac{1}{1-x}+2x^3$.		*1*	**7**
			OR			
	4	a)	Find the coefficient of x^0 in the expansion of $\left(3x^2-\frac{2}{x}\right)^{15}$.	*1*	*1*	**6**
		b)	Ten students take a quiz. Then for grading, the teacher asks the students to exchange papers. Find the probability that (i) No one is grading his paper. (ii) Every student gets his paper. (iii) Exactly one student gets his paper.	*1*	*1*	**7**
		c)	How many ways can 5 number of a's, 4 number of b's and 3 number of c's be arranged so that all the identical letters are not in a single block?	*1*	*1*	**7**
			UNIT - 3			
	5	a)	A shop has 4 diesel generator sets which it hires every day. The demand for a generator set on anaverage is a Poisson variate with a value 5/2. Obtain the probability that on a particular day. (i) There was no demand and (ii) A demand is refused.	*1*	*1*	**6**

	b)	Fit a least squares quadratic curve to the following data: x: 0, 1, 2, 3, 4 y: 1, 1.8, 1.3, 2.5, 2.3	*1*	*1*	**7**
	c)	The two regression equations of the variables x and y are $x = 19.13 - 0.87y$ and $y = 11.64 - 0.50x$. Find (i) the mean of x's, (ii)the mean of y's (iii)the correlation coefficient between x and y.	*1*	*1*	**7**
		OR			
6	a)	Find the equation of the least fitting straight line $y = ax + b$ for the data given below: x: 5, 10, 15, 20, 25 y: 16, 19, 23, 26, 30	*1*	*1*	**6**
	b)	If the total cholesterol values for a certain population are approximately normally distributed with a mean of 200*mg/ml* and standard deviation of 20*mg/ml*. Find the probability that an individual selected at random from this population will have a cholesterol value: (i) Between 180 and 200 *mg/ml*. (ii) Greater than 225 *mg/ml*. (iii) Less than 150 *mg/ml*.	*1*	*1*	**7**
	c)	Compute the coefficient of correlation for the following data: x: 1, 2, 3, 4, 5 y: 2, 5, 3, 8, 7	*1*	*1*	**7**
		UNIT - 4			
7	a)	In a random sample of 100 tube lights produced by company A, the mean lifetime(*mlt*) of tube light is 1190 hours with a standard deviation of 90 hours. Also, in a random sample of 75 tube lights from company B, the mean lifetime is 1230 hours with a standard deviation of 120 hours. Is there a difference between the mean lifetimes of the two brands of tube lights at $\alpha = 0.01$?	*1*	*1*	**6**
	b)	The average weekly losses of man-hours due to strikes in an institute before and after a disciplinary program was implemented are as follows: Is there reason to believe that the disciplinary program is effective at a 5% level of significance? Before: 45, 73, 46, 124, 33, 57, 83, 34, 26, 17 After: 36, 60, 44, 119, 35, 51, 77, 29, 24, 11	*1*	*1*	**7**
	c)	The time taken by a worker to perform a job by method I and method II is given below: Method I: 20, 16, 26, 27, 23, 22, - Method II: 27, 33, 42, 35, 32, 34, 38 Do the data show that the variance of time distribution from the population from which these samples are drawn does not differ significantly at a 5% level of significance?	*1*	*1*	**7**

			OR			
	8	a)	Among 64 offspring of a certain cross between pigs, 34 were red, 10 were black and 20 were white. According to a genetic model, these numbers should be in proportions 9:3:4. Apply Chi-Square distribution to check whether the data is consistent with the model at a 5% significance level?	*1*	*1*	**6**
		b)	Mice with an average lifespan of 32 months will live up to 40 months when fed by a certain nutritious food. If 64 mice fed on this diet have an average lifespan of 38 months and a standard deviation of 5.8 months, is there any reason to believe that the average lifespan is less than 40 months at a 5% level of significance?	*1*	*1*	**7**
		c)	Random samples of specimens of coal from two mines A and B were drawn and their heat-producing capacity (in millions of calories/tons) was measured yielding the following results: Mine A: 8350, 8070, 8340, 8130, 8260, - Mine B: 7900, 8140, 7920, 7840, 7890, 7950 Is there a significant difference between the means of these two samples at a 1% level of significance?	*1*	*1*	**7**
			UNIT - 5			
	9	a)	Show that 31 divides $15^{10}-1$.	*1*	*1*	**6**
		b)	Apply Chinese remainder theorem to solve the system of linear congruence $x \equiv 3(\text{mod}5), x \equiv 2(\text{mod}6)$ and $x \equiv 4(\text{mod}7)$.	*1*	*1*	**7**
		c)	Solve the polynomial congruence $x^3+3x+5 \equiv 0(\text{mod}9)$.	*1*	*1*	**7**
			OR			
	10	a)	Find the remainder when 5^{11} is divisible by 7.	*1*	*1*	**6**
		b)	Solve the linear congruence $12x \equiv 6(\text{mod}21)$.	*1*	*1*	**7**
		c)	When eggs in a basket are removed 2 and 3 at a time, there remain 1 and 2 respectively. But no eggs remain when they are removed 7 at a time. Find the smallest number of eggs that could have been contained in the basket.	*1*	*1*	**7**

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