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

Autonomous Institute Affiliated to VTU

December 2023 Supplementary Examinations

Programme: B.E. **Semester: III**

Branch: CSE/ISE **Duration: 3 hrs.**

Course Code: 22MA3BSSDM **Max Marks: 100**

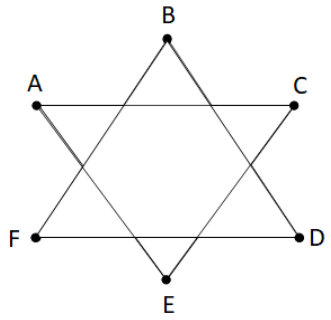
Course: Statistics and Discrete Mathematics

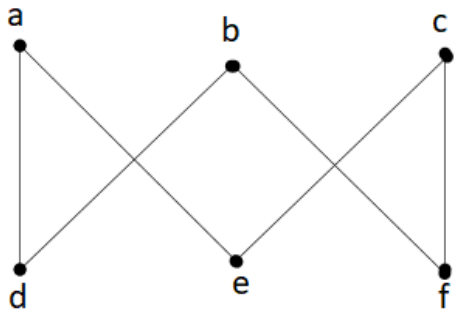
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.
3. Use of Statistical tables is permitted.

UNIT - I

1 a) Six people are seated around a circular table. Each person shakes hands with everyone at the table. Draw a graph that models this situation and identify the type of graph. Also, construct an edge disjoint subgraph. **6**

b) Define Isomorphism of graphs. Prove or disprove that the following graphs are isomorphic. **7**





c) The following table gives the aerial distance between six cities A, B, C, D, E, F. **7**

	B	C	D	E	F
A	800	900	1800	700	650
B		650	1300	1350	1200
C			850	1650	1500
D				2500	2350
E					200

Using Kruskal's Algorithm, find an air route of shortest distance covering all the cities and also find the shortest distance.

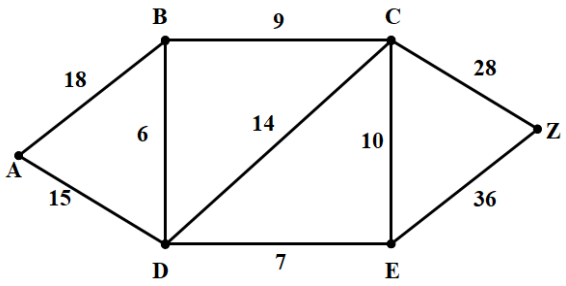
OR

2 a) Obtain the adjacency matrix by constructing the graph for the given incidence matrix. **6**

$$\begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \end{array}\begin{array}{c} \begin{array}{cccccc} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 \end{array} \\ \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

b) Suppose a new club has 9 members. These members meet each day for lunch at a round table and they decide to sit in such a way that every member has different neighbor at each lunch. How many days does this arrangement last? Justify with the possible sitting arrangements? **7**

c) The given network shows roads connecting areas in a city. The numbers on each arc represent the distance, in miles, along each road. A salesman lives in area *A* and works in area *Z*. Apply Dijkstra's algorithm to find the minimum distance for the salesman's journey to work. **7**



UNIT - II

3 a) Determine the coefficient of **6**

(i) x^{27} in $\left(x^4+x^5+x^6+...\right)^5$

(ii) xyz^2 in $\left(2x-y-z\right)^4$

b) Apply the expansion formula to obtain the rook polynomial for the board shown below (made up of unlabeled parts): **7**

1		2
3	4	5
	6	

c) In how many ways 5 number of *a*'s, 4 number of *b*'s and 3 number of *c*'s can be arranged so that all the identical letters are not in a single block? **7**

UNIT - III

4 a) If θ is the angle between two regression lines, show that **6**

$tan\,\theta = \frac{1-r^2}{r}\left(\frac{\sigma_x\sigma_y}{\sigma_x^2+\sigma_y^2}\right)$. Explain the significance when $r = 0$ and $r = \pm 1$.

b) Predict the mean radiation dose at an altitude of 4500 feet by fitting an exponential curve of the form $y = ab^x$ to the given data: **7**

Altitude (x)	50	450	780	1200	4400	4800	5300
Dose of radition (y)	28	30	32	36	51	58	69

c) In a certain town, the duration of shower is exponentially distributed with mean 4 minutes. What is the probability that the shower will last for **7**

(i) Less than 8 minutes.
(ii) 8 minutes or more.
(iii) Between 8 and 10 minutes.

UNIT - IV

5 a) It has previously been recorded that the average depth of ocean at a particular region is 67.4 fathoms. Is there a reason to believe this at 0.01 level of significance, if the readings at 40 random locations in that particular region showed a mean of 69.3 with standard deviation of 5.4 fathoms? **6**

b) At 5% level of significance, is there enough evidence to support the claim that the thickness of ceramic tile of vendor A is slightly greater than the vendor B. The researcher randomly collected samples from both the vendors. **7**

Tile thickness vendor A	22	14	20	22	20	16	16	14	21	19
Tile thickness vendor B	17	22	14	12	24	21	22	15	21	18

Assume that the populations sampled are approximately normally distributed having same variance.

c) It is desired to test whether the number of gamma rays emitted per second by a certain radioactive substance is a random variable having the Poisson distribution with mean 2.4. Use the following data obtained for 300 one-second intervals to test this null hypothesis. **7**

Number of Gamma rays	0	1	2	3	4	5	6	7 or more
Frequency	19	48	66	74	44	35	9	5

OR

6 a) Is there a reason to believe that the variation in lifestyle expected in south and north India is same or not from the following data? Use 1% level of significance. **6**

South	34	39.2	46.1	48.7	49.4	45.9	55.3	42.7	43.7	– –	– –
North	49.7	55.4	57	54.2	50.4	44.2	53.4	57.5	61.9	56.6	58.2

b) Artificial Intelligence (AI) training institute evaluating the effectiveness of training by comparing AI knowledge of the students before and after the execution of live projects. At a 5% level of significance, does this information provide sufficient evidence to indicate that the live projects will improve the students' AI knowledge? **7**

student	1	2	3	4	5	6	7	8
Before project execution	55	56	72	59	46	50	63	44
After project execution	65	78	60	58	59	57	74	61

c) In a random sample of 100 tube lights produced by company *A*, the mean lifetime of tube light is 1190hrs with standard deviation of 90hrs. Also, in a random sample of 75 tube lights from company *B* the mean lifetime is 1230hrs with standard deviation of 120hrs. is there a difference between the mean lifetimes of the two brands of tube lights at significant level of 1%? **7**

UNIT - V

7 a) Find the remainder when 72^{1001} is divided by 31. **6**

b) Calvin keeps pet in his backyard. If he divides them into 5 equal groups, 4 are left over. If he divides them into 8 equal groups, 6 are left over. If he divides them into 9 equal groups, 8 are left over. What is the smallest number of pets that Calvin could have? **7**

c) Solve: $x^3+3x+5\equiv 0(\mathrm{mod}9)$ **7**

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