

(3 Hours)
Total Marks: - 80
N.B.

1. Question no.1 is compulsory.
2. Attempt any three questions from the remaining five questions.
3. Figures to the right indicate full marks

- 1 (a) Let Set $A = \{1,2,3,4,12\}$ and the partial order relation R is the divides relation on set A . i.e. $a|b \iff aRb$ iff (a divides b) (10)
 - Draw the digraph of R
 - Draw the Hasse diagram for the poset (A,R)
 - Find the minimal elements, maximal elements, least & greatest element, if it exists
- (b) Check the validity of the following arguments: (5)
 - If I play football, I cannot study.
 - Either I study or I pass Statistics & Probability.
 - I play football

Therefore, I passed Statistics & Probability
- (c) Explain Problem Specific Constraints in Decision Making (5)
- 2 (a) BOB has four job offers. His offers came from companies A, B, C and D. He has to consider which company to choose on criteria such as Location, Salary, current projects and Long Term Prospects. Use AHP to help him choose the most suitable company **(CMI, consistency index and consistency ration need not be calculated)** (15)

The comparison matrix for pair wise criteria is given below

Criteria	Location	Salary	Current Projects	Long Term Prospects
Location	1	1/5	1/3	1/2
Salary	5	1	2	4
Current Projects	3	1/2	1	3
Long Term Prospects	2	1/4	1/3	1

Relative criteria for alternatives is

Location	A	B	C	D
A	1	1/2	1/3	5
B	2	1	1/2	7
C	3	2	1	9
D	1/5	1/7	1/9	1

Salary	A	B	C	D
A	1	1/4	3	1/9
B	4	1	2	1/4
C	1/3	1/2	1	3
D	9	4	1/3	1

Current Projects	A	B	C	D
A	1	9	7	1/5
B	1/9	1	3	1/4
C	1/7	1/3	1	2
D	5	4	1/2	1

Long Term Prospects	A	B	C	D
A	1	4	3	7
B	1/4	1	1/2	1/5
C	1/3	2	1	3
D	1/7	5	1/3	1

- 2 (b) Use Mathematical Induction to prove the property $P(n)$ (5)
 $P(n): n^3 + 2n$ is divisible by $3 \forall n \in \mathbb{N}$
- 3 (a) Use SAW method to determine the best Fighter Aircraft. The beneficiary criteria are maximum speed and Durability, non-beneficiary criteria are Maintenance Cost and Purchase Price. The measures for different criteria are given in the table below (10)

Type of Aircraft	Maintenance Cost in Rs	Purchase Price in Rs	Durability in years	Maximum Speed in Km/hr
A1	20000	2000000	5	7200
A2	10000	5000000	7	10600
A3	30000	3500000	6	6000

The weights for different criteria are as follows

Type of Aircraft	Maintenance Cost in Rs	Purchase Price in Rs	Durability in years	Maximum Speed in Km/hr
Weight	0.15	0.4	0.2	0.25

- (b) A company wants to introduce a new brand of ice cream in the market. The following alternatives are available with the company. (10)
- Open five new outlets: If demand is high, a profit of Rs 80000 per month is expected. If the demand is medium, profit can be Rs 50000 per month and for low demand, profit can be Rs 30000 per month.
 - Open ten new outlets: The profits can be Rs 150000, Rs 110000 and Rs 60000 for high demand, medium demand and low demand respectively.
- Past experience shows the probabilities of demand are 0.25, 0.45 and 0.3, respectively. Draw a decision tree and find the optimal decision.

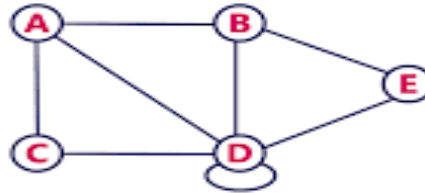
- 4 (a) How many slices of pizza can be obtained by making straight cuts with a pizza knife? (10)
 Assume that no cuts are parallel and all cuts do not intersect at the same position. Find the recurrence relation and solve using backtracking method

- 4 (b) What are Quantifiers? Write the following expressions in symbols (10)
- Every rational number is a real number.
 - No rational number is a real number.
 - Some rational numbers are not real numbers.
 - Some real numbers are prime numbers.

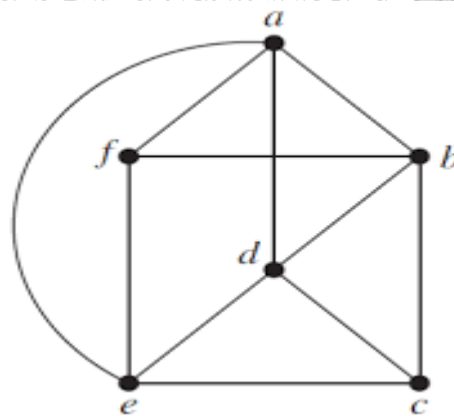
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5 (a) Find the solution of the recurrence relation $a_n = 4a_{n-1} + 1$ with boundary condition $b_1 = 4$ (10)

(b) Find the adjacency list and adjacency matrix for the following graph (10)



6 (a) Find the Euler Path, Euler Circuit, Hamilton Path and Hamilton Circuit for the following graph (10)



(b) Determine if the relation R on set A is reflexive, irreflexive, symmetric, asymmetric, antisymmetric and transitive. $A =$ set of positive integers and aRb iff $\text{GCD}(a,b)=1$ (10)
