Question Paper

Exam Date & Time: 06-Jul-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

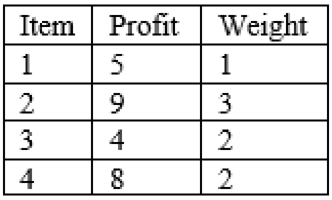
FOURTH SEMESTER B.TECH. (INFORMATION TECHNOLOGY) DEGREE EXAMINATIONS - JUNE/JULY 2023
SUBJECT: ICT 2257/IT-2257 - DESIGN AND ANALYSIS OF ALGORITHMS
(MAKEUP)

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

Missing data, if any, may be suitable assumed.

1A) There are four items with associated profit and weight statement given below. The Maximum capacity of Knapsack container is 4Kgs, Explore the applicability of the Greedy strategy to solve the following Knapsack container Problem with the following constraints: (5)



Item	Profit	Weight
1	5	1
2	9	3
3	4	2
4	8	2

i) Greedy strategy to cases by choosing the cases with the items with maximum profit, and the item with minimum weight does the strategy works? Justify your answer. Mention the bounding condition for 0/1 Knapsack problem.
ii) Greedy strategy to choose the items with ratio proportion considering (profit/weight) ratio does the strategy works? Justify your answer with clearly showing the steps of applying the greedy strategy.
iii) Convert the above knapsack 0/1 problem to Fractional knapsack container problem? and devise and trace the Greedy algorithm to solve the above fractional knapsack problem by clearly showing the steps.

1B) For the graph given in Fig. 1B, find the max clique of its complement using Branch and bound strategy. Make use of appropriate bounding function. (3)

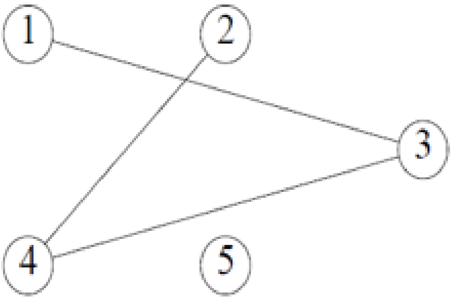


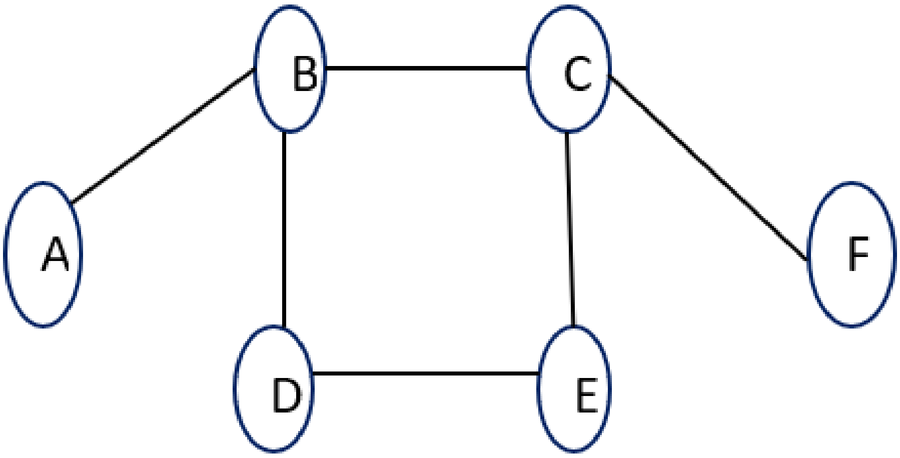
Fig 1B

1C) Explain what would be the implications of P = NP and P != NP. (2)

2A) Design and analyze the algorithm, using Dynamic Programming strategy to solve the below given 0/1 Knapsack Problem and trace the algorithm, by showing all the computation steps clearly to find the optimized solution. Find the complexity of bounding functions for dynamic programming strategy. (5)

Given that N= 4 items, Max weight =5
Given (Weight, Value) = (2,3), (3,4), (4,5), (5,6)

2B) Apply the approximation algorithm on the given graph and find the vertex cover set and the number of vertices in that set. Find the minimum vertex cover(s) in this problem. (3)



2C) Prove or disprove the following equalities using the formal definition of the corresponding asymptotic notation and also using limits theorem. (2)

- $n^2 - 1000 = \omega(n^2)$
- $n! = O(n^n)$

3A) Generate a hash table for the following values: 11, 9, 6, 28, 19, 46, 34, 14. Assume the table size is 9 and the primary hash function is h(k) = k % 9. (5)
i) Hash table using quadratic probing
ii) Hash table with a secondary hash function of h2(k) = 7 - (k % 7)

3B) Demonstrate with a suitable example, any three possible ways to remove the keys and yet maintaining the properties of a B-Tree. (3)

3C) Differentiate between Greedy and Dynamic Programming. (2)

4A) i) Apply quicksort to sort the list E, X, A, M, P, L, E in alphabetical order. Draw the tree of the recursive calls made. (5)
ii) Is quicksort a stable sorting algorithm?
iii) Solve the average-case recurrence for quicksort.

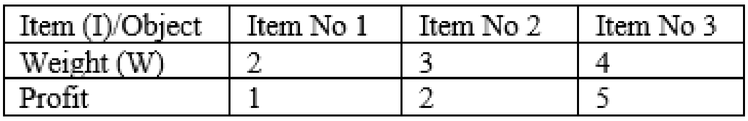
4B) Analyse best, worst and average case complexities using step count method and also find space complexity for the following code snippet (3)

```
Function(int A[])
{
for (i = 0; i < n; i++)
{
key =A [i]
j = i-1
for (j = i-1; j>=0 && A[j]>Key; j--) {
A[j+1] ← A[j]
}
A[j+1] ← key
}
}
```

4C) Using linear probing, create a hash table to store the given values 11, 9, 6, 28, 19, 36, 54, 16, 18, and 20. Assume the table size is 11 and the primary hash function is h(k) = k % 11. (2)

5A) Construct the AVL tree for the data: 10, 20, 15, 30, 40, 50, 60, 70, 75, 80, 90, 85. (5)
After constructing the tree, delete the node with keys 15 and 75.

5B) Given Knapsack Capacity is M= 6 (3)



Item (I)/Object	Item No 1	Item No 2	Item No 3
Weight (W)	2	3	4
Profit	1	2	5

Solve the given 0/1 Knapsack problem using Back tracking method. Apply the bounding function.

5C) Is it possible to use the graph traversal method for finding the shortest path between any two nodes in the given graph? Justify. (2)

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