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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Information Science and Engineering

Semester End Examination; July / August - 2022

Design and Analysis of Algorithms

Time: 3 hrs *Max. Marks: 100*

Course Outcome

The Students will be able to:

CO1: Use asymptotic notations to analyze the performance of algorithms.

CO2: Analyze the design of algorithms using Brute force, Decrease & Conquer.

CO3: Analyze the design of algorithms using Divide & Conquer, Transform & Conquer.

CO4: Analyze the design of algorithms using Space and Time Tradeoffs, Dynamic Programming.

CO5: Analyze the design of algorithms using Greedy technique, Backtracking, Branch & Bound techniques.

Note: *i) **PART-A** is compulsory. One question from each unit for maximum of 2 marks.*
*ii) **PART-B** Answer any **TWO** sub questions (from a, b, c) from each unit for a Maximum of 18 marks.*

Q. No.	Questions	Marks	BLs	COs
	I : PART - A	**10**		
I a.	Define two kinds of algorithm efficiency.	2	L1	CO1
b.	Highlight any two differences between depth first search and breadth first search.	2	L1	CO2
c.	List three major variations of Transform-and conquer.	2	L1	CO3
d.	Define; i) Hashing and ii) Collision in hashing.	2	L1	CO4
e.	State n-queen's problem.	2	L1	CO5
	II : PART - B	**90**		
	UNIT - I	**18**		
1 a.	Explain the various stages of algorithm design and analysis process with a diagram.	9	L2	CO1
b.	i) Define θ(big-theta) asymptotic natation. Prove that 1/2 n(n-1) ∈ $\theta(n^2)$.	5	L3	CO1
	ii) Write an algorithm to find largest element in a given array. Analyze its time efficiency.	4	L4	CO1
c.	i) Explain two ways of representing graphs.	5	L2	CO1
	ii) Write an algorithm to determine whether all elements in a given array are distinct. Analyse its time efficiency.	4	L4	CO1
	UNIT - II	**18**		
2 a.	i) Using bubble sort algorithm, arrange the letters of the word 'QUESTION' in alphabetical order.	6	L3	CO2
	ii) Define topological sorting problem with an example.	3	L1	CO2
b.	Write an algorithm to implement insertion sort. Analyze its best, worst and average case efficiency.	9	L1	CO2

Contd…2

c. Write an algorithm for DFS. With an example, Explain how this algorithm can be used to solve topological sorting problem. — 9 L4 CO2

UNIT - III **18**

3 a. Write an algorithm to implement merge sort with an example. Discuss its time efficiency. — 9 L2

b. i) Using quick sort, arrange the letters of the word 'QUICKSORT' in alphabetical order. — 6 L3 CO3

ii) Define AVL tree. Give an example for:
I) AVL tree II) Binary search tree that is not an AVL tree — 3 L1 CO3

c. i) Apply binary search for the following array:

3	14	27	31	39	42	55	70	74	81	85	93	98

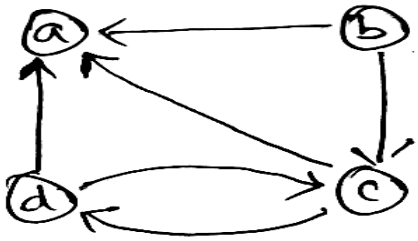
Elements to be searched = 11 — 6 L3 CO3

ii) Define heap tree with an example — 3 L1 CO3

UNIT - IV **18**

4 a. Write Horspool's algorithm. Apply Horspool algorithm to search for the pattern BAOBAB in the text.
BESS_KNEW_ABOUT_BAOBABA — 9 L3 CO4

b. Write warshall's algorithm. Apply the same to find the transitive closure of the following graph:



9 L3 CO4

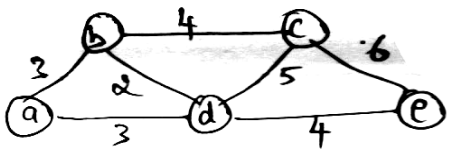
c. Solve the following knapsack problem with given capacity w = 5 using dynamic programming:

Item	Weight	Value
1	2	$12
2	1	$10
3	3	$20
4	2	$15

9 L3 CO4

UNIT - V **18**

5 a. Write kruskal's algorithm to find the minimum cost spanning tree. Trace the algorithm for the following graph:



9 L3 CO5

Contd…3

b. i) Construct a Huffman tree for the following data: 6 L3 CO5

Character	A	B	C	D	E
Probability	0.4	0.1	0.2	0.15	0.15

ii) Define P and NP problem. 3 L1 CO5

c. i) Compare branch and bound algorithm with back tracking 4 L4 CO5

ii) Draw the state space tree for the sum of subset problem of the instance. 5 L3 CO5

S = {5, 7, 8, 10} and d= 15

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