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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester B.E. (CSE) (Credit System) Degree Examinations

Make up / Supplementary Examinations – July 2016

14CS402 – DESIGN AND ANALYSIS OF ALGORITHMS

tion: 3 Hours

Max. Marks: 100

*Note: 1) Answer **Five full** questions choosing **One full** question from **each Unit.***
2) Draw diagrams wherever necessary.

		Marks	BT*
	Unit – I		
a)	Discuss the following problem types with examples: i) String Processing ii) Combinatorial problem iii) Graph problems iv) Geometric problems	8	L*2
b)	Explain with formal definitions, the various asymptotic notations.	6	L2
c)	If M(n) denotes the number of moves in tower of Hanoi puzzle when n disks are involved, give a recurrence relation for M(n) and solve this recurrence relation.	6	L4
a)	Design an algorithm to compute the nth Fibonacci number recursively. Set up a recursive relation and solve it using the explicit formula.	8	L4
b)	i) Design a recursive algorithm for computing 2^n for any non-negative integer n that is based on the formula: $2^n=2^{n-1}+2^{n-1}$. ii) Set up a recurrence relation for the number of additions made by the algorithm and solve it.	6	L4
)	Give the formal definition of O-notation. If $f_1(n) \in O(g_1(n))$ and If $f_2(n) \in O(g_2(n))$, prove that $f_1(n)+f_2(n)) \in O(\max\{g_1(n), g_2(n)\}$.	6	L3
	Unit – II		
)	Explain divide-and-conquer technique with an example.	4	L2
)	Solve the following Knapsack problem using brute-force technique. How do you say that this technique is an example of NP-hard problem? Justify your answer. Number of items=4, Knapsack capacity=5.		

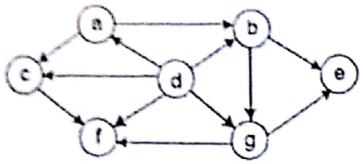
Item	Weight	Value
1	2	$12
2	1	$10
3	3	$20
4	2	$15

	Write the algorithm for quicksort and arrange the letters 'E,X,A,M,P,L,E' in alphabetical order. Show all the steps clearly and draw the tree of the recursive calls made.	6 10	L3 L5
	Illustrate Brute-force string matching algorithm with an example. Analyze its efficiency.	8	L3
	Outline the algorithm for selection sort and bubble sort. Compare their efficiencies.	6	L4
	Write a recursive algorithm for pre-order traversal of binary tree and find the number of recursive calls made.	6	L2

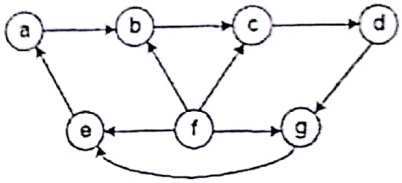
Unit – III

5. a) Draw diagrams of the single L-rotation and of the double RL-rotation in their general form. Construct an AVL tree for the list 3, 6, 5, 1, 2, 4. 10
   b) Sort the following list by heap sort by using the array representation of heaps. 2, 9, 7, 6, 5, 8. 10

6. a) Apply the DFS-based algorithm to solve the topological sorting problem for the following digraphs.



(a)

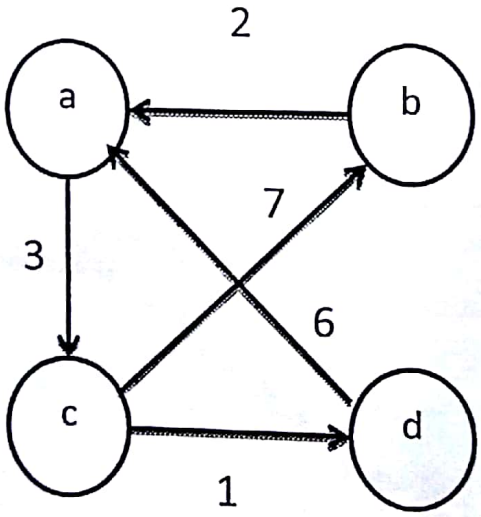


(b) 10

   b) i) Construct a 2-3 tree for the list C, O, M, P, U, T, I, N, G. (Use the alphabetical order of the letters and insert them successively starting with the empty tree.)
   ii) Assuming that the probabilities of searching for each of the keys (i.e., the letters) are the same, find the largest number and the average number of key comparisons for successful searches in this tree. 10

Unit – IV

7 a) Define hashing. Briefly explain the various techniques used in hashing. 10
   b) Explain the Floyd's algorithm to solve the All Pair Shortest Path problem. Apply this algorithm to find the All Pair Shortest Path for the following digraph.



10

8 a) Explain the distribution counting technique to sort the elements. 5
   b) Define dynamic programming problem solving technique. Give the algorithm to find the Binomial Coefficient using dynamic programming technique. 5
   c) Solve the following knapsack problem by applying dynamic programming technique by using memory functions. The knapsack capacity W=5.

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

10

Unit – V

a)	What is the principle idea of Branch and Bound Technique? Solve the following assignment problem using Branch and Bound method.				10	L4

	Job1	Job2	Job3	Job4
Person A	9	2	7	8
Person B	6	4	3	7
Person C	5	8	1	8
Person D	7	6	9	4

b)	Give Kruskal's algorithm. Discuss with an example, how Kruskal's method is different from Prim's method.				10	L3
a)	Solve the following Knapsack problem using Branch and Bound method. Consider the capacity of the Knapsack is 10				10	L3

Item	Weight	Value
1	7	42
2	3	12
3	4	40
4	5	25

b) Write a note on:

i) State space tree — 10 L1

ii) Dijikstra's method

Bloom's Taxonomy, L* Level

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Fourth Semester B.E. (CSE) (Credit System) Degree Examinations

April – May 2016

14CS402 – DESIGN AND ANALYSIS OF ALGORITHMS

Duration: 3 Hours | Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

			Marks	BT*
		Unit – I		
1.	a)	Discuss the general plan for analyzing efficiency of : i) Non-recursive algorithms ii) Recursive algorithms	8	L*2
	b)	Given a positive decimal integer n, write a recursive algorithm which computes the number of binary digits in the binary representation of n. Write the corresponding recurrence relation and solve it.	8	L4
	c)	Compare the orders of growth of the following: i) ½ n(n-1) and n^2 ii) $\log_2 n$ and $\sqrt{n}$	4	L4

2.	a)	Consider the following algorithm.
		Algorithm Secret(A[0..n − 1])
		//Input: An array A[0..n − 1] of n real numbers
		minval ← A[0];
		maxval ← A[0];
		for i ← 1 to n − 1 do
		if A[i] < minval
		minval ← A[i]
		if A[i] > maxval
		maxval ← A[i]
		return maxval – minval
		i) What does this algorithm compute? ii) What is its basic operation?
		iii) How many times is the basic operation executed?
		iv) What is the efficiency class of this algorithm?
			6	L5

	b)	Design a recursive algorithm to find the factorial of a given non-negative integer n. Set up a recurrence relation and solve it.	6	L4
	c)	What is an algorithm? With a neat block diagram explain the different phases in the process of algorithm design and analysis.	8	L2
		Unit – II		
	a)	Outline a brute-force exhaustive search algorithm to solve a travelling salesman problem with example.	6	L2
	b)	Write a non-recursive algorithm for binary search and analyse its efficiency for worst case.	6	L4
	c)	Apply divide and conquer method to find multiplication of integers 2101 and 1130.	8	L3
	a)	Solve the following recurrence equations using Master theorem. i) $T(n)=4T(n/2)+n^2$. ii) $T(n)=16T(n/4)+n$	4	L3
	b)	Write a recursive algorithm to find the height of a binary tree. Analyse its efficiency with an example.	6	L4
	c)	Write the quicksort algorithm. Apply the same on data set 5,3,1,9,8,2,4,7. The split positions must be clearly shown in the tree of recursive calls.	10	L2
		Unit – III		
	a)	Generate all permutations of {1, 2, 3, 4} by the Johnson-Trotter algorithm.	10	L5

P.T.O.

b) Define Heap. Construct a heap for the list 1, 8, 6, 5, 3, 7, 4 by successive keyinsertions (top-down algorithm).

6. a) Describe the working of insertion sort. Write the algorithm & complexity analysis for the same. Apply insertion sort to sort the list: N, I, T, T,E in ascending order.

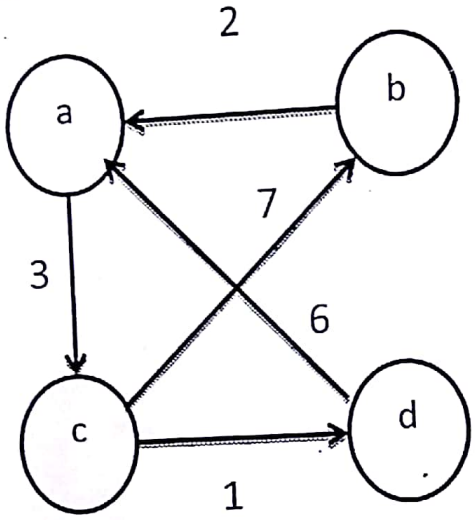
b) Draw diagrams of the single L-rotation and of the double RL-rotation intheir general form.Construct an AVL tree for the list 1, 2, 3, 4, 5, 6.

Unit – IV

7. a) Explain the Horspool string matching algorithm. Apply the same to find the pattern BARBER in the given text JIM_SAW_ME_IN_A_BARBER_SHOP.

b) Give the algorithm for Comparison Counting Sorting. Analyze its efficiency. Apply Comparison Counting Sorting algorithm to sort 62, 31, 84, 96, 19, and 47 in ascending order.

8. a) Explain the Floyd's algorithm to solve the All Pair Shortest Path problem. Apply this algorithm to find the All Pair Shortest Path for the following digraph.



b) Solve the following knapsack problem by applying dynamic programming technique by using memory functions. The knapsack capacity W=5.

Item	Weight	Value
1	2	$12
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Unit – V

9. a) Discuss state space tree. Let S={ 1,2,5,6,8} and d=9. Construct state space tree of the Backtracking algorithm to solve subset sum problem.

b) Give Kruskal's algorithm. How Kruskal's method is different from Prim's method. Illustrate with suitable example.

10. a) Construct Huffman tree for the following data and obtain its Huffman code.

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

b) Discuss Dijikstra's algorithm.

c) How Branch and Bound method is different from Backtracking technique?

BT* Bloom's Taxonomy, L* Level

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Unit – I		
Discuss the following problem types with examples: i) String Processing ii) Combinatorial problem iii) Graph problems iv) Geometric problems	8	L*2
Explain with formal definitions, the various asymptotic notations.	6	L2
If M(n) denotes the number of moves in tower of Hanoi puzzle when n disks are involved, give a recurrence relation for M(n) and solve this recurrence relation.	6	L4
Design an algorithm to compute the nth Fibonacci number recursively. Set up a recursive relation and solve it using the explicit formula.	8	L4
i) Design a recursive algorithm for computing 2^n for any non-negative integer n that is based on the formula: $2^n=2^{n-1}+2^{n-1}$. ii) Set up a recurrence relation for the number of additions made by the algorithm and solve it.	6	L4
Give the formal definition of O-notation. If $f_1(n) \in O(g_1(n))$ and If $f_2(n) \in O(g_2(n))$, prove that $f_1(n)+f_2(n)) \in O(\max\{g_1(n), g_2(n)\}$.	6	L3
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Write the algorithm for quicksort and arrange the letters 'E,X,A,M,P,L,E' in alphabetical order. Show all the steps clearly and draw the tree of the recursive calls made.	10	L5
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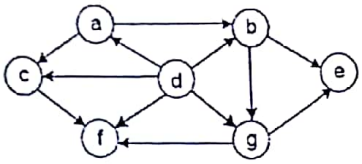

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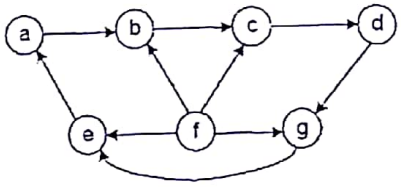

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   b) i) Construct a 2-3 tree for the list C, O, M, P, U, T, I, N, G. (Use the alphabetical order of the letters and insert them successively starting with the empty tree.)
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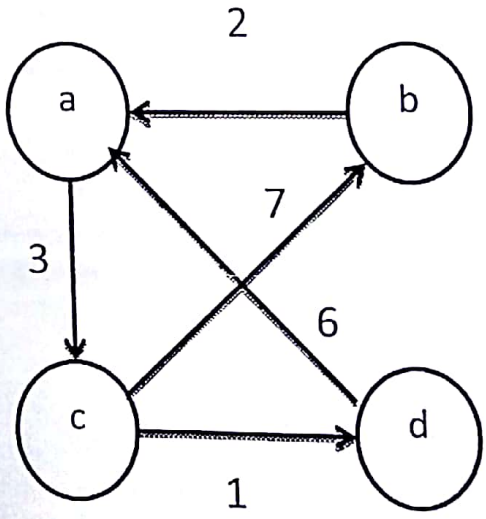

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Unit – V

a) What is the principle idea of Branch and Bound Technique? Solve the following assignment problem using Branch and Bound method.

	Job1	Job2	Job3	Job4
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10 L4

b) Give Kruskal's algorithm. Discuss with an example, how Kruskal's method is different from Prim's method. 10 L3

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) Write a note on:

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14CS402 – DESIGN AND ANALYSIS OF ALGORITHMS

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*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

Unit – I

		Marks	BT*
a)	Discuss the general plan for analyzing efficiency of : i) Non-recursive algorithms ii) Recursive algorithms	8	L*2
b)	Given a positive decimal integer n, write a recursive algorithm which computes the number of binary digits in the binary representation of n. Write the corresponding recurrence relation and solve it.	8	L4
c)	Compare the orders of growth of the following: i) ½ n(n-1) and n^2 ii) $\log_2 n$ and $\sqrt{n}$	4	L4
a)	Consider the following algorithm.		

```
Algorithm Secret(A[0..n − 1])
//Input: An array A[0..n − 1] of n real numbers
minval ← A[0];
 maxval ← A[0];
for i ← 1 to n − 1 do
    if A[i] < minval
       minval ← A[i]
    if A[i] > maxval
       maxval ← A[i]
return maxval – minval
```

i) What does this algorithm compute? ii) What is its basic operation?
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b)	Design a recursive algorithm to find the factorial of a given non-negative integer n. Set up a recurrence relation and solve it.	6	L5
c)	What is an algorithm? With a neat block diagram explain the different phases in the process of algorithm design and analysis.	6	L4

Unit – II

a)	Outline a brute-force exhaustive search algorithm to solve a travelling salesman problem with example.	8	L2
b)	Write a non-recursive algorithm for binary search and analyse its efficiency for worst case.	6	L2
c)	Apply divide and conquer method to find multiplication of integers 2101 and 1130.	6	L4
a)	Solve the following recurrence equations using Master theorem. i) $T(n)=4T(n/2)+n^2$. ii) $T(n)=16T(n/4)+n$	8	L3
b)	Write a recursive algorithm to find the height of a binary tree. Analyse its efficiency with an example.	4	L3
c)	Write the quicksort algorithm. Apply the same on data set 5,3,1,9,8,2,4,7. The split positions must be clearly shown in the tree of recursive calls.	6	L4

Unit – III

a)	Generate all permutations of {1, 2, 3, 4} by the Johnson-Trotter algorithm.	10	L2
		10	L5

P.T.O.

b) Define Heap. Construct a heap for the list 1, 8, 6, 5, 3, 7, 4 by successive keyinsertions (top-down algorithm).

6. a) Describe the working of insertion sort. Write the algorithm & complexity analysis for the same. Apply insertion sort to sort the list: N, I, T, T,E in ascending order.

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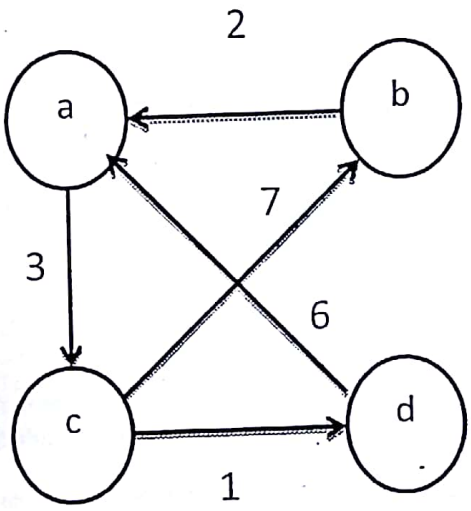

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Unit – V

9. a) Discuss state space tree. Let S={ 1,2,5,6,8} and d=9. Construct state space tree of the Backtracking algorithm to solve subset sum problem.

b) Give Kruskal's algorithm. How Kruskal's method is different from Prim's method. Illustrate with suitable example.

10. a) Construct Huffman tree for the following data and obtain its Huffman code.

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Probability	0.4	0.1	0.2	0.15	0.15

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BT* Bloom's Taxonomy, L* Level

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Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

			Marks	BT*
		Unit – I		
1.	a)	Write sequential search algorithm. Derive the best, worst and average case efficiency for sequential search algorithm.	6	L*4
	b)	Describe in detail O, Ω, Θ notations, with suitable examples.	9	L2
	c)	If $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ then prove that $t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$	5	L5
2.	a)	Using limits compare the order of growth for the following: i) $\frac{1}{2} n(n-1)$ and n^2 ii) $\log_2 n$ and $\sqrt{n}$ iii) $n!$ and 2^n	9	L5
	b)	Arrange the following functions according to their order of decay from highest to lowest: $\log n$, $2n^4+4$, $8n^2$, $n \log n$, $n!$, $6n$	6	L6
	c)	Setup and solve a recurrence relationship for the Towers of Hanoi puzzle.	5	L5
		Unit – II		
3.	a)	Solve the following instance of knapsack problem using exhaustive search approach: n=4, capacity M=10		

Item	Weight	Profit
1	7	$42
2	3	$12
3	4	$40
4	5	$25

	b)	Write Master theorem. Using the same solve the following recurrences: i) $T(n)= 2T(n/2) + n$ ii) $T(n)= 2T(n/2) + n^2$ iii) $T(n)= 2T(n/2) + 1$	6	L5
	c)	Describe brute force string matching algorithm with a suitable example.	9 5	L5 L2
4.	a)	Describe divide-and-conquer algorithm design technique.	4	L2
	b)	Sort the following input in ascending order using quick sort algorithm: 5,3,1,9,8,2,4,7. Also derive the best and worst case efficiency of quick sort algorithm.	8	L4
	c)	Sort the list E,X,A,M,P,L,E in alphabetical order using bubble sort technique. Also represent the efficiency of bubble sort algorithm.	8	L4
		Unit – III		
5.	a)	Differentiate between DFS and BFS graph traversal techniques.	6	L4
	b)	Write Johnson Trotter algorithm. Also generate permutations for n = 3.	6	L3
	c)	Define AVL tree. Construct an AVL tree for the input: 5,6,8,3,2,4,7 by successive insertions.	8	L3
6.	a)	Define a Heap. Construct a heap for the input 2,9,7,6,5,8 using bottom-up approach.	6	L3

b) Write insertion sort algorithm. Sort the following input using the same: 89,45,68,90,29,34,17. Also derive the worst case efficiency. 10 L
c) Explain topological sorting problem using suitable example. 4 L

Unit – IV

7. a) Sort the following input using distribution counting method: 13,11,12,13,12,12. 6 L
b) Apply Horspool string matching algorithm on the input text: JIM_SAW_ME_IN_A_ BARBERSHOP and pattern: BARBER 8 L
c) Write dynamic programing technique based binomial coefficient computing algorithm. Also derive the efficiency. 6 L

8. a) Compute transitive closure for the following input using Warshall's algorithm.

0 1 0 0
0 0 0 1
0 0 0 0
1 0 1 0

5 L

b) Write Floyd's algorithm for all pair shortest paths algorithm and derive its efficiency. 6 L
c) Explain dynamic programming approach of solving problems. Also solve the following instance of knapsack problem using the dynamic programming approach.

N=4, W=5. Also compute the items selected.

Item	Weight	Profit
1	2	$12
2	1	$10
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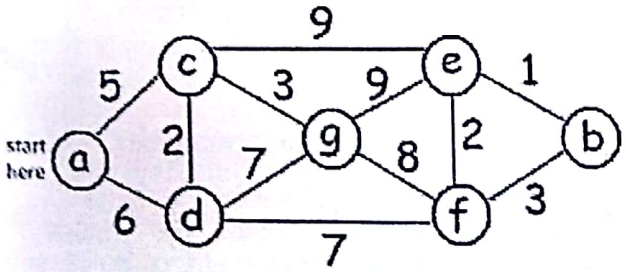
9

Unit – V

9. a) Explain Prim's Algorithm in detail. Apply Prim's algorithm to find minimum cost spanning tree for the following graph.



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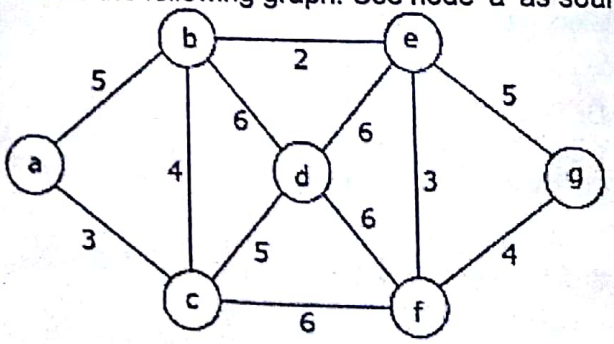
b) Explain Dijkstra's Algorithm in detail. Apply Dijkstra's algorithm to find single source shortest path for the following graph. Use node 'a' as source.



10

Q. a) Construct Huffman's coding tree for the following input table. Also encode the following: i) DAD ii) BAD_AD

	characters				
probability	A	B	C	D	_
	0.35	0.1	0.2	0.2	0.15

8 L6

b) Describe n queens problem for n=4. 4 L2

c) Using branch and bound approach solve the following assignment problem.

	Job 1	Job 2	Job 3	Job 4
Person a	9	2	7	8
Person b	6	4	3	7
Person c	5	8	1	8
Person d	7	6	9	4

8 L5

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

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Fourth Semester B.E. (CSE / ISE) (Credit System) Degree Examinations

April – May 2017

15CS402 / 15IS402 – DESIGN AND ANALYSIS OF ALGORITHMS

Duration: 3 Hours

Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

			Marks	BT*
		Unit – I		
1.	a)	Define the basic asymptotic notations.Give example for each.	8	L*2
	b)	Write an algorithm to check whether all the elements in a given array are distinct and analyze its complexity.	6	L4
	c)	Write the general plan for analyzing the efficiency of recursive algorithm.	6	L2
2.	a)	Write a recursive algorithm to compute the n^{th} fibonacci number and analyze its complexity.	8	L4
	b)	Solve the following recurrence relation: x(n) = x(n/3)+1 for n>1; x(1)=1	6	L3
	c)	Write Middle School Procedure algorithm to find GCD of two numbers.	6	L2
		Unit – II		
3.	a)	Apply Quick Sort algorithm on the following characters: M, E, R, G, E, S, O, R, T.Show the split positions clearly using the tree structure.	8	L3
	b)	Explain Strassen's matrix multplication method to multipy two matrices with an example.	6	L3
	c)	Write brute force algorithm for string matching.	6	L2
4.	a)	Write a brute algorithm for bubble sort and analyze its efficiency.	8	L4
	b)	Define Exhaustive Search technique. How this technique is used to solve Knapsack problem? Explain with an example.	6	L3
	c)	Write a short note on various tree traversals.	6	L2
		Unit – III		
5.	a)	Solve topological sorting problem using DFS algorithm, with an example.	8	L3
	b)	Sort the following array using insertion sort. 25, 3, 17, 26, 15, 7, 6.	6	L3
	c)	Explain the different variations of decrease and conquer technique.	6	L2
6.	a)	What is an AVL tree?Explain the various rotations of AVL tree with an example.	8	L2
	b)	Describe the Johnson Trotter algorithm for generating permutations. Generate all permutations of {3, 5, 7} using Johnson Trotter algorithm.	6	L3
	c)	Construct a heap for the list 1, 8, 6, 5, 3, 7, 4 by the bottom-up algorithm.	6	L3

P.T.O.

Unit – IV

7. a) 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

10

b) Write Horspool's algorithm for string matching. Apply Horspool algorithm to search for the pattern BAOBAB in the text BESS_KNEW_ABOUT_BAOBABS 10

8. a) Use Floyd's method to solve the following all pairs shortest path problem.

	a	b	c	d
a	0	∞	3	∞
b	2	0	∞	∞
c	∞	7	0	1
d	6	∞	∞	0

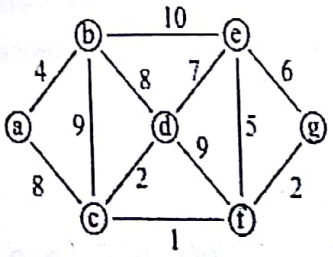
8

b) Write an algoritm for distribution counting. 6

c) Write Warshall's algorithm to find the transitive closure. 6

Unit – V

9. a) Apply Prim's algorithm to find the minimum spanning tree for the following graph.



8

b) Solve the subset sum problem for the instance S={ 5, 7, 8, 10 } and d=15 6

c) Explain P and NP Problem. 6

10. a) Draw the state space tree to generate solution to 4- queens problem. 8

b) Write Kruskal's algorithm to find a minimum spanning tree. 6

c) Differentiate between back tracking and branch and bound algorithm. 6

BT* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester B.E. (CSE) (Credit System) Degree Examinations

Make up / Supplementary Examinations – July 2018

16CS402 – DESIGN AND ANALYSIS OF ALGORITHMS

Duration: 3 Hours

Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

			Marks	BT*
		Unit – I		
1.	a)	Explain the general framework for analyzing the efficiency of algorithm with an example.	10	L*2
	b)	What are the necessary steps for analyzing the efficiency of recursive algorithms? Give the example of computing n^{th} Fibonacci number.	10	L2
2.	a)	Discuss briefly any five important problem types encountered in computing.	10	L2
	b)	Give the formal definition of basic asymptotic notations used in the efficiency analysis of algorithms. Write an algorithm for checking element uniqueness in an array and answer the following question. a) What is the input size measurement? b) Which is the basic operation? c) Derive a formula for the number of times the basic operation is executed in the worst case. What is the base case?	10	L6
		Unit – II		
3.	a)	Define brute-force. Discuss the algorithms for sequential search and string matching using brute-force and analyze the efficiency .	10	L4
	b)	List the general plan in divide and conquer algorithm. Explain the Hoare partition-based quick sort algorithm and provide a complete analysis of the algorithm.	10	L4
4.	a)	Write short notes on how to apply divide and conquer technique to i. Strassen's Matrix Multiplication ii. Multiplication of largest integer	10	L3
	b)	Why does divide-and-conquer strategy work for binary trees? How do you apply the strategy for computing the height of a binary tree? How do you analyze the running time of this algorithm?	10	L5
		Unit – III		
5	a)	With suitable examples explain the major differences between depth-first and breadth-first-search traversals.	10	L5
	b)	What is a heap? Write the bottom-up heap algorithm and show the heap construction process for the array: A = { 15, 19, 10, 7, 17, 6 }.	10	L4
6	a)	Explain with examples the types of decrease and conquer technique. Describe with an example a decrease and conquer technique for topological sorting problem.	10	L3
	b)	Define AVL-tree. What is a rotation in AVL-tree? Discuss various types of rotations in AVL tree with examples.	10	L2

P.T.O.

Unit – IV

7 a) Write short note on memory function technique. Apply the memory function technique to the following instance of the knapsack problem, showing each step in your solution. Capacity W= 5. 10

Item #	Weight (Kg)	Value (Rs.)
1	2	3
2	3	4
3	4	5
4	5	6

b) Distinguish between hashing, hash function and hash address. Explain open hashing and its collision resolution mechanism with an example. 10

8 a) Write Floyd's algorithm for all pair shortest path algorithm. Apply the algorithm to the graph in Figure 8.a

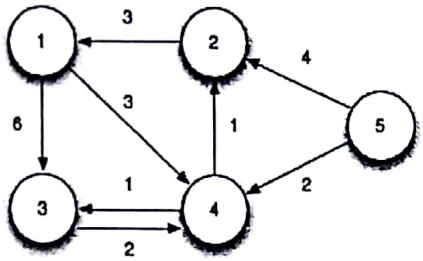

Figure: 8.a

b) List the steps in Horspool's string matching algorithm. Write the algorithm along with the procedure for computing the shift table entries and provide an analysis of the algorithm. 10

Unit – V

9 a) What is greedy technique? How this technique is used in Kruskal's algorithm? Write the algorithm and show its application to the f graph in Figure 9.a 10

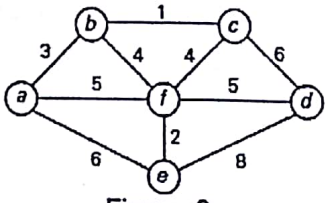

Figure :9.a

b) What is the principal idea behind backtracking technique? Discuss in detail how 4-queens problem can be solved with backtracking. 10

10 a) Write the steps to build Huffman Tree. Construct the Huffman's tree for the following data and obtain its Huffman's Code. 10

character	a	b	c	d	e
Frequency	20	15	5	15	45

b) state subset- sum problem. Write and explain backtracking algorithm for the subset-sum problem and provide an analysis of the algorithm. 10

BT* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

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Fourth Semester B.E. (CSE) (Credit System) Degree Examinations

April – May 2018

16CS402 – DESIGN AND ANALYSIS OF ALGORITHMS

Duration: 3 Hours

Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

			Marks	BT*
		Unit – I		
1.	a)	Explain Theta Θ notation for analyzing an algorithm. Show that $5n^2-6n=\Theta(n^2)$.	6	L*3
	b)	Write an algorithm to search an element in an array using sequential search Analyze best, worst and average case efficiencies of this algorithm.	6	L4
	c)	Find the efficiencies of the following recurrences and represent using standard asymptotic notations: i) $T(n)=3T\left(\frac{n}{2}\right)+n\log n$ ii) $T(n)=2T\left(\frac{n}{4}\right)+n$	8	L3
2.	a)	Explain big-oh notation for analyzing an algorithm. Show that $8n^3+n^2=O(n^3)$	6	L3

	b)	Estimate the running time of the following code segment and represent in terms of big-oh notation
		Algorithm Loop4(n)
		{
		p =1
		for i = 1 to n do
		for j = 1 to n − i do
		p = p * i;
		return p;
		}
			6	L4

	c)	Discuss briefly any four important problem types encountered in computing	8	L2
		Unit – II		
3.	a)	Explain the quick sort algorithm to sort n numbers. What is the worst case running time? Analyse the average case running time of quick sort algorithm.	8	L3
	b)	Explain a divide and conquer algorithm for multiplying 2 square matrices. Estimate the time complexity of your algorithm.	6	L2
	c)	Explain the Brute force method for string matching.	6	L2
4.	a)	Explain merge sort algorithm in detail. Prove that the merge sort algorithm runs in Θ (n log n) time for sorting n numbers.	8	L4
	b)	Explain the Strassons method for matrix multiplication. Analyze the time complexity of this method.	6	L2
	c)	Explain a non recursive procedure for binary search. Derive the time complexity of Binary search procedure.	6	L2
		Unit – III		
5.	a)	Explain the topological sort algorithm. Obtain the topological ordering for the following graph. (Fig. 5 (a))	10	L3

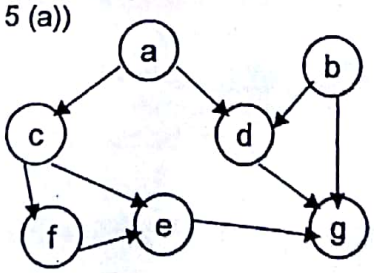

Fig. 5 (a)

P.T.O.

b) Explain the construction of max-heap from an initial unordered array and hence explain Heap Sort algorithm. 6 L3

c) Illustrate the heap sort technique on the array <10, 8, 12, 4, 7, 2, 16, 9> 4 L3

6. a) Explain the algorithm for DFS (Depth First Search) traversal. Obtain the DFS tree/forest for the following graph.

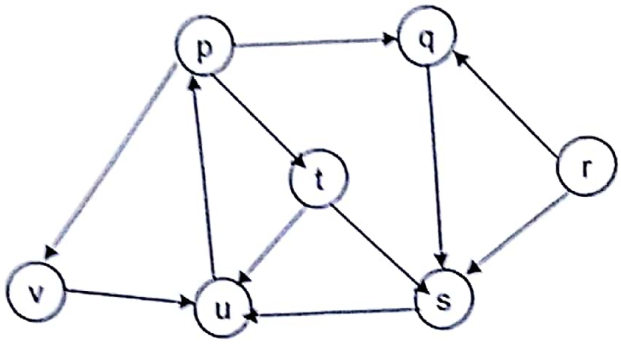

Fig. 6 (a) 8 L3

b) Explain the breadth first search (BFS) traversal. Obtain the DFS tree for the undirected version of the graph in Fig. 6a. 8 L3

c) What is an AVL tree? Explain. 4 L2

Unit – IV

7. a) Differentiate between divide and conquer and Dynamic programming techniques for solving problems. 6 L4

b) Give a dynamic programming algorithm for computing the binomial coefficients. 6 L2

c) Distinguish between hashing, hash function and hash address. Explain open hashing and its collision resolution mechanism with an example. 8 L2

8. a) Explain 0-1 knapsack problem. Explain the dynamic programing algorithm for 0-1 Knapsack. 6 L2

b) Illustrate algorithm 8(a) for the following data.
Value = {60, 100, 120};
Weight = {10, 20, 30};
Capacity = 50 8 L5

c) Explain the Floyd algorithm for finding all pair shortest path. 6 L2

Unit – V

9. a) Explain the minimum spanning tree (MST) problem. 4 L2

b) Explain Prims algorithm for computing MST. 8 L2

c) What is subset sum problem? Solve subset sum for the following instance.
set= {3, 34, 4, 12, 5, 2}, sum = 9 8 L3

10. a) Explain Class P, NP and NP-complete problems. 6 L2

b) Explain the Kruskals algorithm to compute minimum spanning tree. 6 L2

c) Explain the algorithm for Huffman code. Illustrate with an example. 8 L3

BT* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

IV Sem B.E. (CSE) Mid Semester Examinations - II, March 2018

16CS402 – DESIGN AND ANALYSIS OF ALGORITHMS

ration: 1 Hour

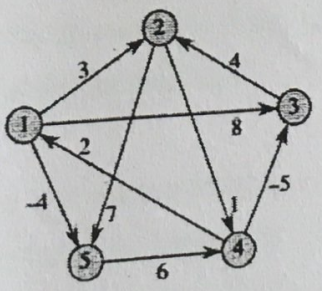
Max. Marks: 20

*Note: Answer any **One** full question from **each Unit.***

Unit – I

		Marks	BT*
a)	Describe the Johnson Trotter algorithm for generating permutations. Generate permutations of {5,7,9} using Johnson Trotter algorithm.	06	L*3
b)	Construct an AVL tree for the list 14, 17, 11, 7, 53, 4, 13 by successive insertion.	04	L3
a)	What is a heap? Apply the bottom-up approach to sort the given list using heapsort. H = {21, 15, 25, 3, 5, 12 , 7}	06	L5
b)	Explain the difference between DFS and BFS.	04	L3

Unit – II

a)	Write and explain the algorithm for computing a binomial coefficient. Provide an analysis of the algorithm.	06	L6
b)	Write an algorithm for Comparison Counting Sort and analyze its efficiency. Sort the following array using comparison count 62 31 84 96 19 47.	04	L4
a)	Apply Floyd's method to solve the following all pairs shortest path problem. 	06	L4
b)	Apply Boyers-Moore algorithm to search for the pattern BAAB in the text AABAACAADAABAABA	04	L5

* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

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Fourth Semester B.E. (CSE) (Credit System) Degree Examinations

April – May 2018

16CS402 – DESIGN AND ANALYSIS OF ALGORITHMS

ation: 3 Hours Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

		Marks	BT*
	Unit – I		
a)	Explain Theta Θ notation for analyzing an algorithm. Show that $5n^2-6n=\Theta(n^2)$.	6	L*3
b)	Write an algorithm to search an element in an array using sequential search Analyze best, worst and average case efficiencies of this algorithm.	6	L4
c)	Find the efficiencies of the following recurrences and represent using standard asymptotic notations: i) $T(n)=3T\left(\frac{n}{2}\right)+n\log n$ ii) $T(n)=2T\left(\frac{n}{4}\right)+n$	8	L3
a)	Explain big-oh notation for analyzing an algorithm. Show that $8n^3+n^2=O(n^3)$	6	L3

b)	Estimate the running time of the following code segment and represent in terms of big-oh notation
	Algorithm Loop4(n)
	{
	p =1
	for i = 1 to n do
	for j = 1 to n − i do
	p = p * i;
	return p;
	}
		6	L4

c)	Discuss briefly any four important problem types encountered in computing	8	L2
	Unit – II		
a)	Explain the quick sort algorithm to sort n numbers. What is the worst case running time? Analyse the average case running time of quick sort algorithm.	8	L3
b)	Explain a divide and conquer algorithm for multiplying 2 square matrices. Estimate the time complexity of your algorithm.	6	L2
c)	Explain the Brute force method for string matching.	6	L2
a)	Explain merge sort algorithm in detail. Prove that the merge sort algorithm runs in Θ (n log n) time for sorting n numbers.	8	L4
b)	Explain the Strassons method for matrix multiplication. Analyze the time complexity of this method.	6	L2
c)	Explain a non recursive procedure for binary search. Derive the time complexity of Binary search procedure.	6	L2
	Unit – III		
a)	Explain the topological sort algorithm. Obtain the topological ordering for the following graph. (Fig. 5 (a))	10	L3

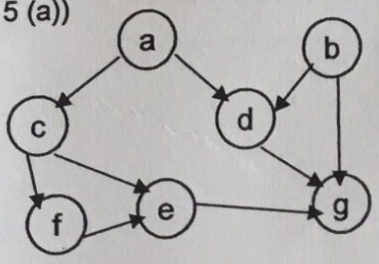

Fig. 5 (a)

P.T.O.

b) Explain the construction of max-heap from an initial unordered array and hence explain Heap Sort algorithm. 6 L3

c) Illustrate the heap sort technique on the array <10, 8, 12, 4, 7, 2, 16, 9> 4 L3

6. a) Explain the algorithm for DFS (Depth First Search) traversal. Obtain the DFS tree/forest for the following graph.

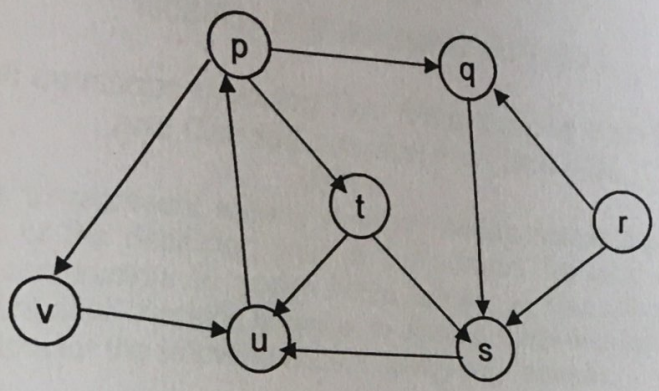

Fig. 6 (a) 8 L3

b) Explain the breadth first search (BFS) traversal. Obtain the DFS tree for the undirected version of the graph in Fig. 6a. 8 L3

c) What is an AVL tree? Explain. 4 L2

Unit – IV

7. a) Differentiate between divide and conquer and Dynamic programming techniques for solving problems. 6 L4

b) Give a dynamic programming algorithm for computing the binomial coefficients. 6 L2

c) Distinguish between hashing, hash function and hash address. Explain open hashing and its collision resolution mechanism with an example. 8 L2

8. a) Explain 0-1 knapsack problem. Explain the dynamic programing algorithm for 0-1 Knapsack. 6 L2

b) Illustrate algorithm 8(a) for the following data.
Value = {60, 100, 120}; 8 L5
Weight = {10, 20, 30}; 6 L2
Capacity = 50

c) Explain the Floyd algorithm for finding all pair shortest path. 4 L2

Unit – V

9. a) Explain the minimum spanning tree (MST) problem. 8 L2

b) Explain Prims algorithm for computing MST. 8 L3

c) What is subset sum problem? Solve subset sum for the following instance. 6 L2
set= {3, 34, 4, 12, 5, 2}, sum = 9 6 L2

10. a) Explain Class P, NP and NP-complete problems. 8 L3

b) Explain the Kruskals algorithm to compute minimum spanning tree.

c) Explain the algorithm for Huffman code. Illustrate with an example.

BT* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester B.E. (CSE) (Credit System) Degree Examinations

Make up / Supplementary Examinations – July 2018

16CS402 – DESIGN AND ANALYSIS OF ALGORITHMS

Duration: 3 Hours Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

		Marks	BT*
	Unit – I		
a)	Explain the general framework for analyzing the efficiency of algorithm with an example.	10	L*2
b)	What are the necessary steps for analyzing the efficiency of recursive algorithms? Give the example of computing n^{th} Fibonacci number.	10	L2
a)	Discuss briefly any five important problem types encountered in computing.	10	L2
b)	Give the formal definition of basic asymptotic notations used in the efficiency analysis of algorithms. Write an algorithm for checking element uniqueness in an array and answer the following question. a) What is the input size measurement? b) Which is the basic operation? c) Derive a formula for the number of times the basic operation is executed in the worst case. What is the base case?	10	L6
	Unit – II		
a)	Define brute-force. Discuss the algorithms for sequential search and string matching using brute-force and analyze the efficiency .	10	L4
b)	List the general plan in divide and conquer algorithm. Explain the Hoare partition-based quick sort algorithm and provide a complete analysis of the algorithm.	10	L4
a)	Write short notes on how to apply divide and conquer technique to i. Strassen's Matrix Multiplication ii. Multiplication of largest integer	10	L3
b)	Why does divide-and-conquer strategy work for binary trees? How do you apply the strategy for computing the height of a binary tree? How do you analyze the running time of this algorithm?	10	L5
	Unit – III		
a)	With suitable examples explain the major differences between depth-first and breadth-first-search traversals.	10	L5
b)	What is a heap? Write the bottom-up heap algorithm and show the heap construction process for the array: A = { 15, 19, 10, 7, 17, 6 }.	10	L4
a)	Explain with examples the types of decrease and conquer technique. Describe with an example a decrease and conquer technique for topological sorting problem.	10	L3
b)	Define AVL-tree. What is a rotation in AVL-tree? Discuss various types of rotations in AVL tree with examples.	10	L2

P.T.O.

Unit – IV

7 a) Write short note on memory function technique. Apply the memory function technique to the following instance of the knapsack problem, showing each step in your solution. Capacity W= 5. 10 L4

Item #	Weight (Kg)	Value (Rs.)
1	2	3
2	3	4
3	4	5
4	5	6

b) Distinguish between hashing, hash function and hash address. Explain open hashing and its collision resolution mechanism with an example. 10 L2

8 a) Write Floyd's algorithm for all pair shortest path algorithm. Apply the algorithm to the graph in Figure 8.a 10 L4

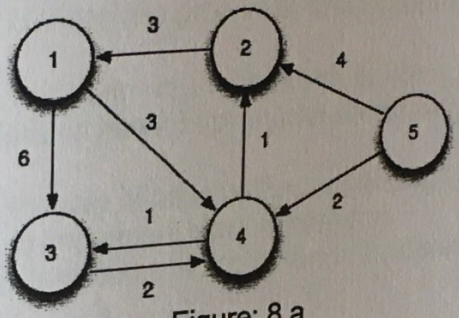

Figure: 8.a

b) List the steps in Horspool's string matching algorithm. Write the algorithm along with the procedure for computing the shift table entries and provide an analysis of the algorithm. 10 L3

Unit – V

9 a) What is greedy technique? How this technique is used in Kruskal's algorithm? Write the algorithm and show its application to the f graph in Figure 9.a

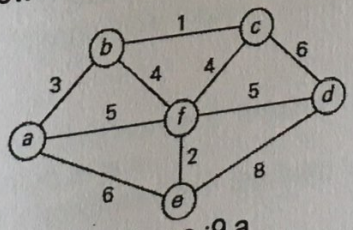

Figure :9.a 10 L4

b) What is the principal idea behind backtracking technique? Discuss in detail how 4-queens problem can be solved with backtracking. 10 L3

10 a) Write the steps to build Huffman Tree. Construct the Huffman's tree for the following data and obtain its Huffman's Code. 10 L5

character	a	b	c	d	e
Frequency	20	15	5	15	45

b) state subset- sum problem. Write and explain backtracking algorithm for the subset-sum problem and provide an analysis of the algorithm. 10 L3

T* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

IV Sem B.E. (CSE/ISE) Mid Semester Examinations - I, February 2017

15CS402/15IS402 – DESIGN AND ANALYSIS OF ALGORITHMS

Duration: 1 Hour | Max. Marks: 20

*Note: Answer any **One** full question from **each Unit.***

			Marks	BT*
		Unit – I		
1.	a)	With a neat block diagram explain the algorithm design and analysis process.	06	L*2

	b)	Set up and solve the recurrence relation for the following algorithm:
		Algorithm S(n)
		if n=1 return 1
		else
		return S(n-1)+n*n*n;
			04	L5

2.	a)	Give formal definitions of the Asymptotic notations. Give one example for each.	06	L2
	b)	Solve the following recurrence relation: x(n) = x(n/3)+1 for n>1; x(1)=1	04	L5
		Unit – II		
3.	a)	Give the brute force algorithm for selection sort and bubble sort. Compare their efficiencies.	06	L3
	b)	Explain the Divide and Conquer algorithm design technique in detail. How does this technique helps in parallel programming? Justify your answer.	04	L4
4.	a)	Apply Quick Sort algorithm on the following characters: M, E, R, G, E, S, O, R, T Show the split positions clearly using the tree structure.	06	L5
	b)	Define Exhaustive Search technique. How this technique is used to solve Knapsack problem? Explain with an example.	04	L2

BT* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

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IV Sem B.E. (CSE/ISE) Mid Semester Examinations - II, March 2017

15CS402/15IS402 – DESIGN AND ANALYSIS OF ALGORITHMS

Duration: 1 Hour | Max. Marks: 20

*Note: Answer any **One** full question from **each Unit.***

		Marks	BT*
	Unit – I		
1. a)	Sort the given list by heapsort 3, 2, 4, 1, 6, 5 using bottom up heapification.	06	L*3
b)	Describe the Johnson Trotter algorithm for generating permutations. Generate permutations of {3,5,7} using Johnson Trotter algorithm.	04	L3
2. a)	What is an AVL tree? Construct an AVL tree for the list 10,20,30,25,27,7,4 by successive insertion.	06	L5
b)	Explain the difference between DFS and BFS.	04	L2
	Unit – II		
3. a)	Write an algorithm for Comparison Counting Sort and analyze its efficiency. Sort the following array using comaprison count 62 31 84 96 19 47.	06	L4
b)	Apply Warshall's algorithm to find the transitive closure of the graph defined by the adjacency matrix $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$	04	L3
4. a)	Apply Floyd's method to solve the following all pairs shortest path problem.	06	L5

	a	b	c	d
a	0	∞	3	∞
b	2	0	∞	∞
c	∞	7	0	1
d	6	∞	∞	0

b)	Apply Boyers-Moore algorithm to search for the pattern AT_THAT in the text WHICH_FINALLY_HALTS_AT_THAT.	04	L3

BT* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester B.E. (CSE / ISE) (Credit System) Degree Examinations

April – May 2017

15CS402 / 15IS402 – DESIGN AND ANALYSIS OF ALGORITHMS

Duration: 3 Hours

Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

			Marks	BT*
		Unit – I		
1.	a)	Define the basic asymptotic notations.Give example for each.	8	L*2
	b)	Write an algorithm to check whether all the elements in a given array are distinct and analyze its complexity.	6	L4
	c)	Write the general plan for analyzing the efficiency of recursive algorithm.	6	L2
2.	a)	Write a recursive algorithm to compute the n^{th} fibonacci number and analyze its complexity.	8	L4
	b)	Solve the following recurrence relation: $x(n) = x(n/3)+1$ for $n>1$; $x(1)=1$	6	L3
	c)	Write Middle School Procedure algorithm to find GCD of two numbers.	6	L2
		Unit – II		
3.	a)	Apply Quick Sort algorithm on the following characters: M, E, R, G, E, S, O, R, T.Show the split positions clearly using the tree structure.	8	L3
	b)	Explain Strassen's matrix multplication method to multipy two matrices with an example.	6	L3
	c)	Write brute force algorithm for string matching.	6	L2
4.	a)	Write a brute algorithm for bubble sort and analyze its efficiency.	8	L4
	b)	Define Exhaustive Search technique. How this technique is used to solve Knapsack problem? Explain with an example.	6	L3
	c)	Write a short note on various tree traversals.	6	L2
		Unit – III		
5.	a)	Solve topological sorting problem using DFS algorithm, with an example.	8	L3
	b)	Sort the following array using insertion sort. 25, 3, 17, 26, 15, 7, 6.	6	L3
	c)	Explain the different variations of decrease and conquer technique.	6	L2
6.	a)	What is an AVL tree?Explain the various rotations of AVL tree with an example.	8	L2
	b)	Describe the Johnson Trotter algorithm for generating permutations. Generate all permutations of {3, 5, 7} using Johnson Trotter algorithm.	6	L3
	c)	Construct a heap for the list 1, 8, 6, 5, 3, 7, 4 by the bottom-up algorithm.	6	L3

P.T.O.

Unit – IV

SEE – April – May 2017

7. a) 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

b) Write Horspool's algorithm for string matching. Apply Horspool algorithm to search for the pattern BAOBAB in the text BESS_KNEW_ABOUT_BAOBABS — 10 L3

8. a) Use Floyd's method to solve the following all pairs shortest path problem. — 10 L3

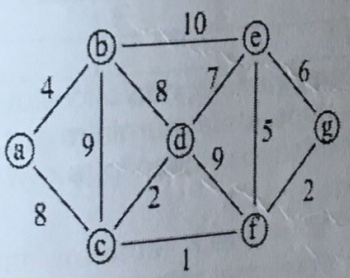
	a	b	c	d
a	0	∞	3	∞
b	2	0	∞	∞
c	∞	7	0	1
d	6	∞	∞	0

b) Write an algoritm for distribution counting. — 8 L3

c) Write Warshall's algorithm to find the transitive closure. — 6 L2

Unit – V

9. a) Apply Prim's algorithm to find the minimum spanning tree for the following graph.



— 6 L3

b) Solve the subset sum problem for the instance S={ 5, 7, 8, 10 } and d=15 — 6 L2

c) Explain P and NP Problem. — 8 L3

10. a) Draw the state space tree to generate solution to 4- queens problem. — 6 L2

b) Write Kruskal's algorithm to find a minimum spanning tree. — 6 L4

c) Differentiate between back tracking and branch and bound algorithm.

* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester B.E. (CSE/ISE) (Credit System) Degree Examinations

Make up / Supplementary Examinations – July 2017

15CS402 / 15IS402 – DESIGN AND ANALYSIS OF ALGORITHMS

ation: 3 Hours — Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

		Marks	BT*
	Unit – I		
a)	Write sequential search algorithm. Derive the best, worst and average case efficiency for sequential search algorithm.	6 9	L*4 L2
b)	Describe in detail O, Ω, Θ notations, with suitable examples.	5	L5
c)	If $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ then prove that $t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$	9	L5
a)	Using limits compare the order of growth for the following: i) $\frac{1}{2} n(n-1)$ and n^2 ii) $\log_2 n$ and $\sqrt{n}$ iii) n! and 2^n	6	L6
b)	Arrange the following functions according to their order of decay from highest to lowest: log n, $2n^4+4$, $8n^2$, n log n, n!, 6n	5	L5
c)	Setup and solve a recurrence relationship for the Towers of Hanoi puzzle.		
	Unit – II		
a)	Solve the following instance of knapsack problem using exhaustive search approach: n=4, capacity M=10	6	L5

Item	Weight	Profit
1	7	$42
2	3	$12
3	4	$40
4	5	$25

b)	Write Master theorem. Using the same solve the following recurrences: i) $T(n)= 2T(n/2) + n$ ii) $T(n)= 2T(n/2) + n^2$ iii) $T(n)= 2T(n/2) + 1$	9 5	L5 L2
c)	Describe brute force string matching algorithm with a suitable example.	4	L2
a)	Describe divide-and-conquer algorithm design technique.	8	L4
b)	Sort the following input in ascending order using quick sort algorithm: 5,3,1,9,8,2,4,7. Also derive the best and worst case efficiency of quick sort algorithm.	8	L4
c)	Sort the list E,X,A,M,P,L,E in alphabetical order using bubble sort technique. Also represent the efficiency of bubble sort algorithm.	6 6	L4 L3
	Unit – III		
a)	Differentiate between DFS and BFS graph traversal techniques.	8	L3
b)	Write Johnson Trotter algorithm. Also generate permutations for n = 3.		
c)	Define AVL tree. Construct an AVL tree for the input: 5,6,8,3,2,4,7 by successive insertions.	6	L3
a)	Define a Heap. Construct a heap for the input 2,9,7,6,5,8 using bottom-up approach.		

Write insertion sort algorithm. Sort the following input using the same: 89,45,68,90,29,34,17. Also derive the worst case efficiency.	10	L4
Explain topological sorting problem using suitable example.	4	L2

Unit – IV

Sort the following input using distribution counting method: 13,11,12,13,12,12.	6	L3
Apply Horspool string matching algorithm on the input text: JIM_SAW_ME_IN_A_ BARBERSHOP and pattern: BARBER	8	L4
Write dynamic programing technique based binomial coefficient computing algorithm. Also derive the efficiency.	6	L4

Compute transitive closure for the following input using Warshall's algorithm.

0 1 0 0
0 0 0 1
0 0 0 0
1 0 1 0

	5	L3
Write Floyd's algorithm for all pair shortest paths algorithm and derive its efficiency.	6	L2

Explain dynamic programming approach of solving problems. Also solve the following instance of knapsack problem using the dynamic programming approach.

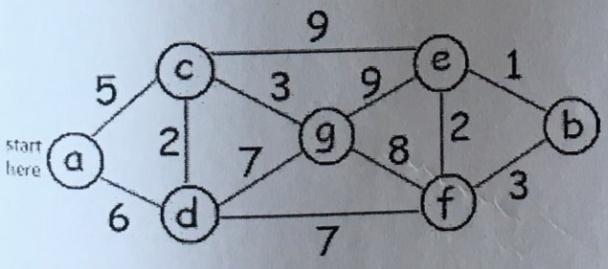
N=4, W=5. Also compute the items selected.

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

9 L5

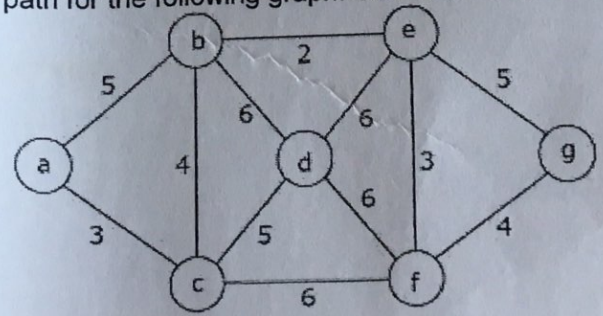
Unit – V

Explain Prim's Algorithm in detail. Apply Prim's algorithm to find minimum cost spanning tree for the following graph.



10 L5

Explain Dijkstra's Algorithm in detail. Apply Dijkstra's algorithm to find single source shortest path for the following graph. Use node 'a' as source.



10 L5

a) Construct Huffman's coding tree for the following input table. Also encode the following: i) DAD ii) BAD_AD

	characters				
probability	A	B	C	D	_
	0.35	0.1	0.2	0.2	0.15

8 L6

b) Describe n queens problem for n=4. 4 L2

c) Using branch and bound approach solve the following assignment problem.

	Job 1	Job 2	Job 3	Job 4
Person a	9	2	7	8
Person b	6	4	3	7
Person c	5	8	1	8
Person d	7	6	9	4

8 L5

* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

IV Sem B.E. (CSE) Mid Semester Examinations - II, March 2018

16CS402 – DESIGN AND ANALYSIS OF ALGORITHMS

ration: 1 Hour

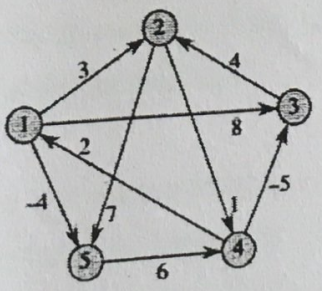
Max. Marks: 20

*Note: Answer any **One** full question from **each Unit.***

Unit – I

		Marks	BT*
a)	Describe the Johnson Trotter algorithm for generating permutations. Generate permutations of {5,7,9} using Johnson Trotter algorithm.	06	L*3
b)	Construct an AVL tree for the list 14, 17, 11, 7, 53, 4, 13 by successive insertion.	04	L3
a)	What is a heap? Apply the bottom-up approach to sort the given list using heapsort. H = {21, 15, 25, 3, 5, 12 , 7}	06	L5
b)	Explain the difference between DFS and BFS.	04	L3

Unit – II

a)	Write and explain the algorithm for computing a binomial coefficient. Provide an analysis of the algorithm.	06	L6
b)	Write an algorithm for Comparison Counting Sort and analyze its efficiency. Sort the following array using comparison count 62 31 84 96 19 47.	04	L4
a)	Apply Floyd's method to solve the following all pairs shortest path problem. 	06	L4
b)	Apply Boyers-Moore algorithm to search for the pattern BAAB in the text AABAACAADAABAABA	04	L5

* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester B.E. (CSE) (Credit System) Degree Examinations

April – May 2018

16CS402 – DESIGN AND ANALYSIS OF ALGORITHMS

ation: 3 Hours Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

		Marks	BT*
	Unit – I		
a)	Explain Theta Θ notation for analyzing an algorithm. Show that $5n^2-6n=\Theta(n^2)$.	6	L*3
b)	Write an algorithm to search an element in an array using sequential search Analyze best, worst and average case efficiencies of this algorithm.	6	L4
c)	Find the efficiencies of the following recurrences and represent using standard asymptotic notations: i) $T(n)=3T\left(\frac{n}{2}\right)+n\log n$ ii) $T(n)=2T\left(\frac{n}{4}\right)+n$	8	L3
a)	Explain big-oh notation for analyzing an algorithm. Show that $8n^3+n^2=O(n^3)$	6	L3

b)	Estimate the running time of the following code segment and represent in terms of big-oh notation
	Algorithm Loop4(n)
	{
	p =1
	for i = 1 to n do
	for j = 1 to n − i do
	p = p * i;
	return p;
	}
		6	L4

c)	Discuss briefly any four important problem types encountered in computing	8	L2
	Unit – II		
a)	Explain the quick sort algorithm to sort n numbers. What is the worst case running time? Analyse the average case running time of quick sort algorithm.	8	L3
b)	Explain a divide and conquer algorithm for multiplying 2 square matrices. Estimate the time complexity of your algorithm.	6	L2
c)	Explain the Brute force method for string matching.	6	L2
a)	Explain merge sort algorithm in detail. Prove that the merge sort algorithm runs in Θ (n log n) time for sorting n numbers.	8	L4
b)	Explain the Strassons method for matrix multiplication. Analyze the time complexity of this method.	6	L2
c)	Explain a non recursive procedure for binary search. Derive the time complexity of Binary search procedure.	6	L2
	Unit – III		
a)	Explain the topological sort algorithm. Obtain the topological ordering for the following graph. (Fig. 5 (a))	10	L3

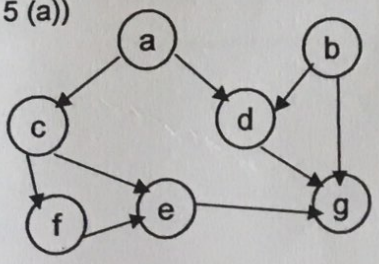

Fig. 5 (a)

P.T.O.

b) Explain the construction of max-heap from an initial unordered array and hence explain Heap Sort algorithm. 6 L3

c) Illustrate the heap sort technique on the array <10, 8, 12, 4, 7, 2, 16, 9> 4 L3

6. a) Explain the algorithm for DFS (Depth First Search) traversal. Obtain the DFS tree/forest for the following graph.

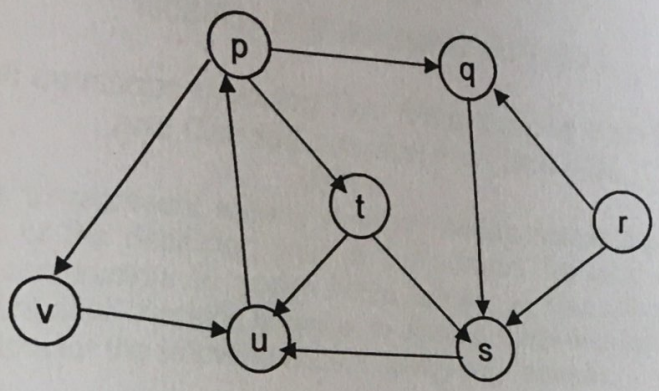

Fig. 6 (a) 8 L3

b) Explain the breadth first search (BFS) traversal. Obtain the DFS tree for the undirected version of the graph in Fig. 6a. 8 L3

c) What is an AVL tree? Explain. 4 L2

Unit – IV

7. a) Differentiate between divide and conquer and Dynamic programming techniques for solving problems. 6 L4

b) Give a dynamic programming algorithm for computing the binomial coefficients. 6 L2

c) Distinguish between hashing, hash function and hash address. Explain open hashing and its collision resolution mechanism with an example. 8 L2

8. a) Explain 0-1 knapsack problem. Explain the dynamic programing algorithm for 0-1 Knapsack. 6 L2

b) Illustrate algorithm 8(a) for the following data.
Value = {60, 100, 120}; 8 L5
Weight = {10, 20, 30}; 6 L2
Capacity = 50

c) Explain the Floyd algorithm for finding all pair shortest path. 4 L2

Unit – V

9. a) Explain the minimum spanning tree (MST) problem. 8 L2

b) Explain Prims algorithm for computing MST. 8 L3

c) What is subset sum problem? Solve subset sum for the following instance. 6 L2
set= {3, 34, 4, 12, 5, 2}, sum = 9 6 L2

10. a) Explain Class P, NP and NP-complete problems. 8 L3

b) Explain the Kruskals algorithm to compute minimum spanning tree.

c) Explain the algorithm for Huffman code. Illustrate with an example.

BT* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester B.E. (CSE) (Credit System) Degree Examinations

Make up / Supplementary Examinations – July 2018

16CS402 – DESIGN AND ANALYSIS OF ALGORITHMS

Duration: 3 Hours Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

		Marks	BT*
	Unit – I		
a)	Explain the general framework for analyzing the efficiency of algorithm with an example.	10	L*2
b)	What are the necessary steps for analyzing the efficiency of recursive algorithms? Give the example of computing n^{th} Fibonacci number.	10	L2
a)	Discuss briefly any five important problem types encountered in computing.	10	L2
b)	Give the formal definition of basic asymptotic notations used in the efficiency analysis of algorithms. Write an algorithm for checking element uniqueness in an array and answer the following question. a) What is the input size measurement? b) Which is the basic operation? c) Derive a formula for the number of times the basic operation is executed in the worst case. What is the base case?	10	L6
	Unit – II		
a)	Define brute-force. Discuss the algorithms for sequential search and string matching using brute-force and analyze the efficiency .	10	L4
b)	List the general plan in divide and conquer algorithm. Explain the Hoare partition-based quick sort algorithm and provide a complete analysis of the algorithm.	10	L4
a)	Write short notes on how to apply divide and conquer technique to i. Strassen's Matrix Multiplication ii. Multiplication of largest integer	10	L3
b)	Why does divide-and-conquer strategy work for binary trees? How do you apply the strategy for computing the height of a binary tree? How do you analyze the running time of this algorithm?	10	L5
	Unit – III		
a)	With suitable examples explain the major differences between depth-first and breadth-first-search traversals.	10	L5
b)	What is a heap? Write the bottom-up heap algorithm and show the heap construction process for the array: A = { 15, 19, 10, 7, 17, 6 }.	10	L4
a)	Explain with examples the types of decrease and conquer technique. Describe with an example a decrease and conquer technique for topological sorting problem.	10	L3
b)	Define AVL-tree. What is a rotation in AVL-tree? Discuss various types of rotations in AVL tree with examples.	10	L2

P.T.O.

Unit – IV

7 a) Write short note on memory function technique. Apply the memory function technique to the following instance of the knapsack problem, showing each step in your solution. Capacity W= 5. 10 L4

Item #	Weight (Kg)	Value (Rs.)
1	2	3
2	3	4
3	4	5
4	5	6

b) Distinguish between hashing, hash function and hash address. Explain open hashing and its collision resolution mechanism with an example. 10 L2

8 a) Write Floyd's algorithm for all pair shortest path algorithm. Apply the algorithm to the graph in Figure 8.a 10 L4

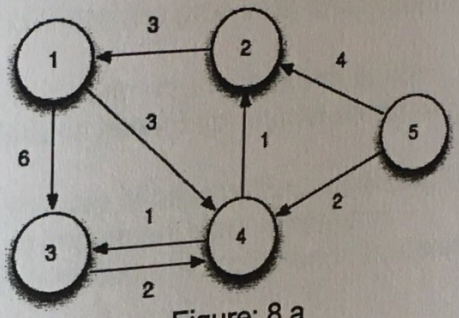

Figure: 8.a

b) List the steps in Horspool's string matching algorithm. Write the algorithm along with the procedure for computing the shift table entries and provide an analysis of the algorithm. 10 L3

Unit – V

9 a) What is greedy technique? How this technique is used in Kruskal's algorithm? Write the algorithm and show its application to the f graph in Figure 9.a

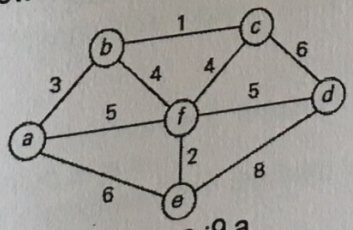

Figure :9.a 10 L4

b) What is the principal idea behind backtracking technique? Discuss in detail how 4-queens problem can be solved with backtracking. 10 L3

10 a) Write the steps to build Huffman Tree. Construct the Huffman's tree for the following data and obtain its Huffman's Code. 10 L5

character	a	b	c	d	e
Frequency	20	15	5	15	45

b) state subset- sum problem. Write and explain backtracking algorithm for the subset-sum problem and provide an analysis of the algorithm. 10 L3

T* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

IV Sem B.E. (CSE/ISE) Mid Semester Examinations - I, February 2017

15CS402/15IS402 – DESIGN AND ANALYSIS OF ALGORITHMS

Duration: 1 Hour | Max. Marks: 20

*Note: Answer any **One** full question from **each Unit.***

			Marks	BT*
		Unit – I		
1.	a)	With a neat block diagram explain the algorithm design and analysis process.	06	L*2

	b)	Set up and solve the recurrence relation for the following algorithm:
		Algorithm S(n)
		if n=1 return 1
		else
		return S(n-1)+n*n*n;
			04	L5

2.	a)	Give formal definitions of the Asymptotic notations. Give one example for each.	06	L2
	b)	Solve the following recurrence relation: x(n) = x(n/3)+1 for n>1; x(1)=1	04	L5
		Unit – II		
3.	a)	Give the brute force algorithm for selection sort and bubble sort. Compare their efficiencies.	06	L3
	b)	Explain the Divide and Conquer algorithm design technique in detail. How does this technique helps in parallel programming? Justify your answer.	04	L4
4.	a)	Apply Quick Sort algorithm on the following characters: M, E, R, G, E, S, O, R, T Show the split positions clearly using the tree structure.	06	L5
	b)	Define Exhaustive Search technique. How this technique is used to solve Knapsack problem? Explain with an example.	04	L2

BT* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

IV Sem B.E. (CSE/ISE) Mid Semester Examinations - II, March 2017

15CS402/15IS402 – DESIGN AND ANALYSIS OF ALGORITHMS

Duration: 1 Hour | Max. Marks: 20

*Note: Answer any **One** full question from **each Unit.***

		Marks	BT*
	Unit – I		
1. a)	Sort the given list by heapsort 3, 2, 4, 1, 6, 5 using bottom up heapification.	06	L*3
b)	Describe the Johnson Trotter algorithm for generating permutations. Generate permutations of {3,5,7} using Johnson Trotter algorithm.	04	L3
2. a)	What is an AVL tree? Construct an AVL tree for the list 10,20,30,25,27,7,4 by successive insertion.	06	L5
b)	Explain the difference between DFS and BFS.	04	L2
	Unit – II		
3. a)	Write an algorithm for Comparison Counting Sort and analyze its efficiency. Sort the following array using comaprison count 62 31 84 96 19 47.	06	L4
b)	Apply Warshall's algorithm to find the transitive closure of the graph defined by the adjacency matrix $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$	04	L3
4. a)	Apply Floyd's method to solve the following all pairs shortest path problem.	06	L5

	a	b	c	d
a	0	∞	3	∞
b	2	0	∞	∞
c	∞	7	0	1
d	6	∞	∞	0

b)	Apply Boyers-Moore algorithm to search for the pattern AT_THAT in the text WHICH_FINALLY_HALTS_AT_THAT.	04	L3

BT* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

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Fourth Semester B.E. (CSE / ISE) (Credit System) Degree Examinations

April – May 2017

15CS402 / 15IS402 – DESIGN AND ANALYSIS OF ALGORITHMS

Duration: 3 Hours

Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

			Marks	BT*
		Unit – I		
1.	a)	Define the basic asymptotic notations.Give example for each.	8	L*2
	b)	Write an algorithm to check whether all the elements in a given array are distinct and analyze its complexity.	6	L4
	c)	Write the general plan for analyzing the efficiency of recursive algorithm.	6	L2
2.	a)	Write a recursive algorithm to compute the n^{th} fibonacci number and analyze its complexity.	8	L4
	b)	Solve the following recurrence relation: $x(n) = x(n/3)+1$ for $n>1$; $x(1)=1$	6	L3
	c)	Write Middle School Procedure algorithm to find GCD of two numbers.	6	L2
		Unit – II		
3.	a)	Apply Quick Sort algorithm on the following characters: M, E, R, G, E, S, O, R, T.Show the split positions clearly using the tree structure.	8	L3
	b)	Explain Strassen's matrix multplication method to multipy two matrices with an example.	6	L3
	c)	Write brute force algorithm for string matching.	6	L2
4.	a)	Write a brute algorithm for bubble sort and analyze its efficiency.	8	L4
	b)	Define Exhaustive Search technique. How this technique is used to solve Knapsack problem? Explain with an example.	6	L3
	c)	Write a short note on various tree traversals.	6	L2
		Unit – III		
5.	a)	Solve topological sorting problem using DFS algorithm, with an example.	8	L3
	b)	Sort the following array using insertion sort. 25, 3, 17, 26, 15, 7, 6.	6	L3
	c)	Explain the different variations of decrease and conquer technique.	6	L2
6.	a)	What is an AVL tree?Explain the various rotations of AVL tree with an example.	8	L2
	b)	Describe the Johnson Trotter algorithm for generating permutations. Generate all permutations of {3, 5, 7} using Johnson Trotter algorithm.	6	L3
	c)	Construct a heap for the list 1, 8, 6, 5, 3, 7, 4 by the bottom-up algorithm.	6	L3

P.T.O.

Unit – IV

SEE – April – May 2017

7. a) 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

b) Write Horspool's algorithm for string matching. Apply Horspool algorithm to search for the pattern BAOBAB in the text BESS_KNEW_ABOUT_BAOBABS — 10 L3

8. a) Use Floyd's method to solve the following all pairs shortest path problem. — 10 L3

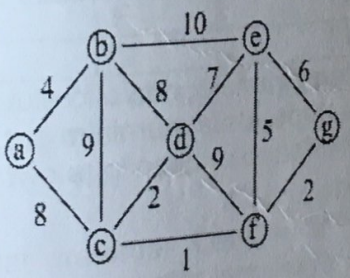
	a	b	c	d
a	0	∞	3	∞
b	2	0	∞	∞
c	∞	7	0	1
d	6	∞	∞	0

b) Write an algoritm for distribution counting. — 8 L3

c) Write Warshall's algorithm to find the transitive closure. — 6 L2

Unit – V

9. a) Apply Prim's algorithm to find the minimum spanning tree for the following graph.



— 6 L3

b) Solve the subset sum problem for the instance S={ 5, 7, 8, 10 } and d=15 — 6 L2

c) Explain P and NP Problem. — 8 L3

10. a) Draw the state space tree to generate solution to 4- queens problem. — 6 L2

b) Write Kruskal's algorithm to find a minimum spanning tree. — 6 L4

c) Differentiate between back tracking and branch and bound algorithm.

* Bloom's Taxonomy, L* Level

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester B.E. (CSE/ISE) (Credit System) Degree Examinations

Make up / Supplementary Examinations – July 2017

15CS402 / 15IS402 – DESIGN AND ANALYSIS OF ALGORITHMS

ation: 3 Hours — Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from **each Unit.***

		Marks	BT*
	Unit – I		
a)	Write sequential search algorithm. Derive the best, worst and average case efficiency for sequential search algorithm.	6 9	L*4 L2
b)	Describe in detail O, Ω, Θ notations, with suitable examples.	5	L5
c)	If $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$ then prove that $t_1(n) + t_2(n) \in O(\max\{g_1(n), g_2(n)\})$	9	L5
a)	Using limits compare the order of growth for the following: i) $\frac{1}{2} n(n-1)$ and n^2 ii) $\log_2 n$ and $\sqrt{n}$ iii) n! and 2^n	6	L6
b)	Arrange the following functions according to their order of decay from highest to lowest: log n, $2n^4+4$, $8n^2$, n log n, n!, 6n	5	L5
c)	Setup and solve a recurrence relationship for the Towers of Hanoi puzzle.		
	Unit – II		
a)	Solve the following instance of knapsack problem using exhaustive search approach: n=4, capacity M=10	6	L5

Item	Weight	Profit
1	7	$42
2	3	$12
3	4	$40
4	5	$25

b)	Write Master theorem. Using the same solve the following recurrences: i) $T(n)= 2T(n/2) + n$ ii) $T(n)= 2T(n/2) + n^2$ iii) $T(n)= 2T(n/2) + 1$	9 5	L5 L2
c)	Describe brute force string matching algorithm with a suitable example.	4	L2
a)	Describe divide-and-conquer algorithm design technique.	8	L4
b)	Sort the following input in ascending order using quick sort algorithm: 5,3,1,9,8,2,4,7. Also derive the best and worst case efficiency of quick sort algorithm.	8	L4
c)	Sort the list E,X,A,M,P,L,E in alphabetical order using bubble sort technique. Also represent the efficiency of bubble sort algorithm.	6 6	L4 L3
	Unit – III		
a)	Differentiate between DFS and BFS graph traversal techniques.	8	L3
b)	Write Johnson Trotter algorithm. Also generate permutations for n = 3.		
c)	Define AVL tree. Construct an AVL tree for the input: 5,6,8,3,2,4,7 by successive insertions.	6	L3
a)	Define a Heap. Construct a heap for the input 2,9,7,6,5,8 using bottom-up approach.		

Write insertion sort algorithm. Sort the following input using the same: 89,45,68,90,29,34,17. Also derive the worst case efficiency.	10	L4
Explain topological sorting problem using suitable example.	4	L2

Unit – IV

Sort the following input using distribution counting method: 13,11,12,13,12,12.	6	L3
Apply Horspool string matching algorithm on the input text: JIM_SAW_ME_IN_A_ BARBERSHOP and pattern: BARBER	8	L4
Write dynamic programing technique based binomial coefficient computing algorithm. Also derive the efficiency.	6	L4

Compute transitive closure for the following input using Warshall's algorithm.

0 1 0 0
0 0 0 1
0 0 0 0
1 0 1 0

	5	L3
Write Floyd's algorithm for all pair shortest paths algorithm and derive its efficiency.	6	L2

Explain dynamic programming approach of solving problems. Also solve the following instance of knapsack problem using the dynamic programming approach.

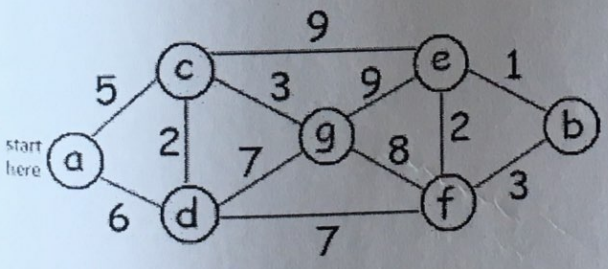
N=4, W=5. Also compute the items selected.

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

9 L5

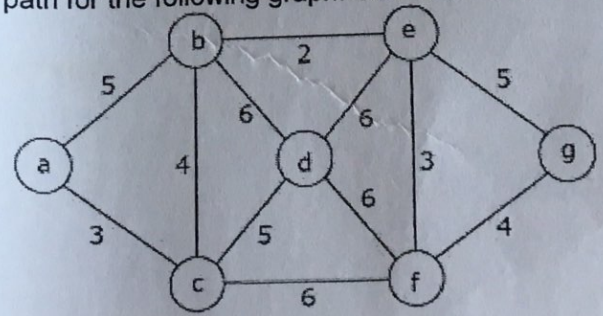
Unit – V

Explain Prim's Algorithm in detail. Apply Prim's algorithm to find minimum cost spanning tree for the following graph.



10 L5

Explain Dijkstra's Algorithm in detail. Apply Dijkstra's algorithm to find single source shortest path for the following graph. Use node 'a' as source.



10 L5

a) Construct Huffman's coding tree for the following input table. Also encode the following: i) DAD ii) BAD_AD

	characters				
probability	A	B	C	D	_
	0.35	0.1	0.2	0.2	0.15

8 L6

b) Describe n queens problem for n=4. 4 L2

c) Using branch and bound approach solve the following assignment problem.

	Job 1	Job 2	Job 3	Job 4
Person a	9	2	7	8
Person b	6	4	3	7
Person c	5	8	1	8
Person d	7	6	9	4

8 L5

* Bloom's Taxonomy, L* Level

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