



## Department of Cyber Security

### Previous Exam Questions Papers

Q.P Code: CY3102PC

Hall Ticket No.:

#### NARSIMHAREDDY ENGINEERING COLLEGE (UGC AUTONOMOUS)

III B.Tech I Semester (NR21) Regular Examination, December 2023 / January 2024

#### DESIGN AND ANALYSIS OF ALGORITHMS

(Computer Science and Engineering (Cyber Security))

Time : 3 hours

Maximum marks: 70

Note: • This question paper contains two parts, A and B  
 • Part A is compulsory which carries 20 marks (10 sub questions are two from each unit carry 2 Marks). Answer all questions in Part A  
 • Part B Consists of 5 Units. Answer one question from each unit. Each question carries 10 Marks and may have a, b sub questions

#### Part-A (20 Marks) Answer all questions

Q.No	Question	M	CO	BL
1)	a. State the best, average and worst case analysis for binary search.	2	CO2	L1
	b. Compute the average case time complexity of quick sort	2	CO3	L2
	c. Differentiate Graph and Tree.	2	CO2	L2
	d. What is disjoint set? Write different types of disjoint set operation.	2	CO1	L1
	e. Illustrate Prim's algorithm	2	CO1	L2
	f. Explain 0/1 knapsack problem.	2	CO2	L2
	g. What is single source shortest path?	2	CO1	L1
	h. What is time complexity of spanning tree?	2	CO1	L2
	i. Define Cook's theorem?	2	CO1	L1
	j. Explain optimization problem -	2	CO3	L2

#### Part-B (50 Marks) Answer all the Units All Questions carry equal Marks

Q.No	Question	M	CO	BL
<b>UNIT-I</b>				
2)	a. Define time and space complexity. Explain with examples.	5	CO1	L2
	b. Explain about Asymptotic Notations in detail.	5	CO1	L3
<b>OR</b>				
3)	Illustrate Merge sort algorithm and discuss its time complexity.	10	CO2	L4
<b>UNIT-II</b>				
4)	How 8-Queen's problem can be solved using back tracking and explain with an example	10	CO3	L4
<b>OR</b>				
5)	a. Discuss union and find algorithms in detail with an example.	5	CO2	L2
	b. Explain about sum of subset problem with example of $S = \{4, 2, 3, 5\}$ & $M=7$ .	5	CO1	L3

<b>UNIT-III</b>			
6)	Explain how solution will be provided for all pairs shortest path problem using dynamic programming.	10	CO2
<b>OR</b>			
7)	Let $n=4$ and $(a_1, a_2, a_3, a_4) = (do, if, int, while)$ , $p(1 : 4) = (3, 3, 1, 1)$ $q(0 : 4) = (2, 3, 1, 1, 1)$	10	CO3
<b>UNIT-IV</b>			
8)	Derive time complexity of job sequencing with deadlines. Obtain the optimal solution when $n=5$ , $(p_1, p_2, \dots) = (20, 15, 10, 5, 1)$ and $(d_1, d_2, \dots) = (2, 2, 1, 3, 3)$ .	10	CO3
<b>OR</b>			
9)	Define Greedy knapsack. Find the optimal solution of the Knapsack instance $n=7$ , $M=15$ , $(p_1, p_2, \dots, p_7) = (10, 5, 15, 7, 6, 18, 3)$ and $(w_1, w_2, \dots, w_7) = (2, 3, 5, 7, 1, 4, 1)$ .	10	CO3
<b>UNIT-V</b>			
10)	Discuss in detail about the class P, NP, NP-hard and NP complete problems. Give examples for each class.	10	CO3
<b>OR</b>			
11)	Describe Travelling Salesperson Problem (TSP) using Branch and Bound.	10	CO2

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**R09**

**Code No: 09A40505**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD**

**B.Tech II Year II Semester Examinations, June-2014**

**DESIGN AND ANALYSIS OF ALGORITHMS**

**(Common to CSE, IT)**

**Time: 3 hours**

**Max. Marks: 75**

**Answer any five questions  
All questions carry equal marks**

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- 1.a) Explain the asymptotic notations used in algorithm analysis.
- 1.b) What is big "oh" notation? Show that if  $f(n) = a_m n^m + \dots + a_1 n + a_0$  then  $f(n) = O(n^m)$ .
- 2.a) What is weighting rule for Union(i, j)? How it improves the performance of union operation? Explain with example.
- 2.b) What is biconnected graph? How to determine biconnected components of graph?
- 3.a) Apply divide and conquer strategy to the following input values for searching 112 and -14 by showing the values of low, mid, high for each search.  
-15, -6, 0, 7, 9, 23, 54, 82, 101, 112, 125, 131, 142, 151
- 3.b) Why Strassen's matrix multiplication method is efficient? Explain with suitable example.
- 4.a) What is job sequencing with deadlines problem? Let  $n = 5$ ,  $(p_1, p_2, \dots, p_5) = (10, 3, 33, 11, 40)$  and  $(d_1, d_2, \dots, d_5) = (3, 1, 1, 2, 2)$ . Find the optimal solution using greedy algorithm.
- 4.b) Write and explain the control abstraction for Divide and conquer.
- 5.a) How reliability design problem can be solved with dynamic programming? Give example.
- 5.b) Discuss about all pairs shortest path problem with suitable example.
- 6.a) What is Hamiltonian cycle? Discuss a backtracking algorithm that finds all the Hamiltonian cycles in a graph.
- 6.b) Write a recursive backtracking algorithm for sum of subsets problem.
- 7.a) Illustrate LCBB solution to solve the knapsack problem.
- 7.b) What do you mean by bounding? Explain how these bound are useful in branch and bound methods?
- 8.a) Explain the classes of NP-Hard and NP-Complete.
- 8.b) Discuss about deterministic and non-deterministic algorithms.

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**R09**

**Code No: 54016**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD**

**B.Tech II Year II Semester Examinations, December-2014/January-2015**

**DESIGN AND ANALYSIS OF ALGORITHMS**

**(Common to CSE, IT)**

**Time: 3 hours**

**Max. Marks: 75**

**Answer any five questions**

**All questions carry equal marks**

- 1.a) What is amortized analysis? Explain with example.  
b) What is meant by asymptotic notation? Why it is used? Explain.
- 2.a) Explain the representations of disjoint set union with example.  
b) What is biconnected graph? How to determine biconnected components of graph?
- 3.a) Apply merge sort and show the file after each splitting and then merging for the following input: 30, 12, 75, 35, 85, 70, 35, 59.  
b) What is binary search? How it can be implemented by Divide and conquer strategy? Explain with example.
- 4.a) What is job sequencing with deadlines problem? Let  $n = 5$ ,  $(p_1, p_2, \dots, p_5) = (1, 3, 6, 9, 5)$  and  $(d_1, d_2, \dots, d_5) = (3, 1, 1, 2, 2)$ . Find the optimal solution using greedy algorithm.  
b) Can we solve 0/1 knapsack problem with greedy method? Discuss with example.
- 5.a) Discuss about all pairs shortest path problem with suitable example.  
b) Find the minimum no of operations required for the following chain matrix multiplication using dynamic programming.  
$$A(20,30) * B(30,10) * C(10,5) * D(5,15)$$
- 6.a) Write a recursive backtracking algorithm for sum of subsets problem.  
b) Draw and explain the portion of the tree for 4-queens problem that is generated during backtracking.
- 7.a) What do you mean by bounding? Explain how these bound are useful in branch and bound methods?  
b) Explain the principles of:  
i) FIFO branch and Bound  
ii) LC Branch and Bound.
- 8.a) Discuss about cook's theorem.  
b) Explain the classes of NP-Hard and NP-Complete.

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**R18**

**Code No: 156AN**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**B. Tech III Year II Semester Examinations, August/September - 2021**

**DESIGN AND ANALYSIS OF ALGORITHMS**

**(Computer Science and Engineering)**

**Time: 3 Hours**

**Max. Marks: 75**

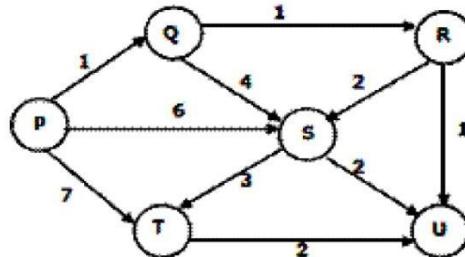
**Answer any five questions  
All questions carry equal marks**

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- 1.a) Write and explain randomized quick sort algorithm.  
b) Discuss about Big oh O, Omega  $\Omega$  and Theta  $\theta$  notations with examples. [8+7]
- 2.a) Using Merge sort, sort the following elements:  
310, 285, 179, 652, 351, 423, 861, 254, 450, 520  
b) Analyze the computing time complexity of binary search algorithm. [7+8]
- 3.a) Show that depth first search can be used to find the connected components of an undirected graph.  
b) Write an algorithm of n-queen's problem and explain. [8+7]
4. Suppose we start with  $n$  sets, each containing a distinct element.
  - a) Show that if  $u$  unions are performed, then no set contains more than  $u+1$  elements.
  - b) Show that at most  $n - 1$  unions can be performed before the number of sets becomes 1.
  - c) Show that if fewer than  $(n/2)$  unions are performed, then at least one set with a single element in it remains. [5+5+5]
- 5.a) Solve the following 0/1 Knapsack Problem using dynamic programming  
 $n=4$ ,  $m=30$ ,  $(w_1, w_2, w_3, w_4) = (10, 15, 6, 9)$  and  $(p_1, p_2, p_3, p_4) = (2, 5, 8, 1)$ .  
b) Explain the concept of the traveling salesperson problem. [7+8]
6. Use the function OBST to compute  $w(i,j)$ ,  $r(i,j)$ , and  $c(i,j)$ ,  $0 \leq i < j \leq 4$ , for the identifier set  $(a_1, a_2, a_3, a_4) = (\text{do}, \text{if}, \text{int}, \text{while})$  with  $p(1 : 4) = (3, 3, 1, 1)$  and  $q(0:4) = (2, 3, 1, 1, 1)$ . Using the  $r(i,j)$ 's construct the optimal binary search tree. [15]
- 7.a) Explain the general method of Greedy method.  
b) Write and explain the Kruskal's algorithm with an illustrative example. [7+8]
- 8.a) Explain with respect to branch and bound 0/1 knapsack problem.  
b) Discuss in detail about the classes of NP-hard and NP-complete. [7+8]

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1. Design an algorithm to sort the given list of elements using Quick Sort incorporating divide and conquer technique. Sort the following list using the same and compute its best case time efficiency: 4, 2, 0, 8, 7, 1, 3, 6. [15]
2. Consider the following recurrence  
 $T(n)=3T(n/3)+ n$   
Obtain asymptotic bound using substitution method. [15]
3. Using disjoint-sets find the connected components in the undirected graph  $G = (V, E)$ , where the vertices  $V = \{a, b, c, d, e, f, g, h, i, j\}$  and edges  $E = \{(a, c), (a, b), (e, f), (h, i), (e, g), (a, d), (e, d), (b, d), (c, a), (h, j)\}$ . The edges are processed in the order given. List the vertices in each connected component after each step. [15]
4. Find a solution to the 8-Queens problem using backtracking strategy. Draw the solution space using necessary bounding function. [15]
5. Suppose we run Dijkstra's single source shortest-path algorithm on the following edge weighted directed graph with vertex P as the source (figure 1). In what order do the nodes get included into the set of vertices for which the shortest path distances are finalized? [15]

**Figure 1**

6. A thief enters a house for robbing it. He can carry a maximal weight of 60 kg into his bag. There are 5 items in the house with the following weights and values. What items should thief take if he can even take the fraction of any item with him?  $(w_1, w_2, w_3, w_4, w_5) = (5, 10, 15, 22, 25)$ ,  $(b_1, b_2, b_3, b_4, b_5) = (30, 40, 45, 77, 90)$ . [15]

7. Given a set of cities and distance between every pair of cities, the problem is to find the shortest possible route that visits every city exactly once and returns to the starting point. (figure 2) [15]

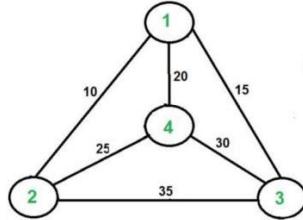


Figure 2

8. Given a set of 4 items, each with weight {2,2,4,5} and benefit {3,7,2,9}, Using LC branch and Bound determine the items to include in the knapsack so that the total weight is less than or equal to a given weight limit and the total benefit is maximized. The weight limit for this knapsack is 10? [15]

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