

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
 Department of Computer Science and Engineering
END SEMESTER EXAMINATION, Jan-June 2024

B.Tech (CSE): Semester-IV
Course Name: Operations Research
Maximum Time: 3 hours

Course Code: CS44146
Max. Marks: 60

Instruction:

1. Attempt all questions.
2. The Marks, CO (Course Outcome) and BL (Bloom's Level) related to questions are mentioned on the right-hand side margin.

		Marks	POs	BL																				
1.	<p>Explain the concept of modeling in operations research and brief about characteristics of good models.</p> <p style="text-align: center;">OR</p> <p>Solve Graphically the LPP: $\text{Maximize } z = 2x_1 + 3x_2$ subject to the $x_1 + x_2 \leq 30, x_1 - x_2 \geq 0, x_2 \geq 3, 0 \leq x_1 \leq 20$, and $0 \leq x_2 \leq 12$</p>	5	PO1, PO2, PO3	Remember Understand and Apply																				
2.	<p>Explain Queuing theory. Elaborate the components of Queue system in detail.</p> <p style="text-align: center;">OR</p> <p>Use dual simplex method to solve the following LPP.</p> <p>$\text{Minimize } z = 3x_1 + x_2$ subject to the constraints $x_1 + x_2 \geq 1, 2x_1 + 3x_2 \geq 2, x_1, x_2 \geq 0$</p>	5	PO1, PO3, PO5	Remember Analyze and Apply																				
3.	<p>The marketing department of a company has collected information on the problem of advertising for its productions. This relates to the advertising media available, the number of families expected to be reached with each alternative, cost per advertisement, the maximum availability of each medium. The information is given as under:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Advertising media</th> <th>No. of families to cover</th> <th>Cost/ad(Rs.)</th> <th>Max Availability</th> </tr> </thead> <tbody> <tr> <td>T.V (30 Sec)</td> <td>3,000</td> <td>8,000</td> <td>8</td> </tr> <tr> <td>Radio(15 Sec)</td> <td>7,000</td> <td>3,000</td> <td>30</td> </tr> <tr> <td>Newspaper(1/4 Page)</td> <td>5,000</td> <td>4,000</td> <td>4</td> </tr> <tr> <td>Magazine(1 page)</td> <td>2,000</td> <td>3,000</td> <td>2</td> </tr> </tbody> </table> <p>a. The average budget is Rs.70,000 b. At least 40,000 families should be covered. c. At least 2 insertions be given in newspaper but no more than 4 advertisements should be given on the T.V</p> <p>Formulate this as a linear programming problem to maximize the expected exposure.</p>	Advertising media	No. of families to cover	Cost/ad(Rs.)	Max Availability	T.V (30 Sec)	3,000	8,000	8	Radio(15 Sec)	7,000	3,000	30	Newspaper(1/4 Page)	5,000	4,000	4	Magazine(1 page)	2,000	3,000	2	5	PO1, PO3, PO5	Analyze and Evaluate
Advertising media	No. of families to cover	Cost/ad(Rs.)	Max Availability																					
T.V (30 Sec)	3,000	8,000	8																					
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Magazine(1 page)	2,000	3,000	2																					
4.	<p>A company has factories F1, F2, and F3 which supply warehouses as W1, W2, and W3. Weekly factory capacities are 200, 160, and 90 units respectively. Weekly warehouse requirements are 180, 120 and 150 units respectively. Unit shipping costs (in rupees) are as follows :</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Factory</th> <th colspan="3">Warehouse</th> </tr> <tr> <th>W1</th> <th>W2</th> <th>W3</th> </tr> </thead> <tbody> <tr> <td>F1</td> <td>16</td> <td>20</td> <td>12</td> </tr> <tr> <td>F2</td> <td>14</td> <td>8</td> <td>18</td> </tr> <tr> <td>F3</td> <td>26</td> <td>24</td> <td>16</td> </tr> </tbody> </table> <p>⇒ Determine the optimum distribution for this company to minimize shipping cost.</p>	Factory	Warehouse			W1	W2	W3	F1	16	20	12	F2	14	8	18	F3	26	24	16	10	PO1, PO3, PO5	Analyze and Understand Apply	
Factory	Warehouse																							
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NATIONAL INSTITUTE OF TECHNOLOGY PATNA
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
END-SEMESTER EXAMINATION - MAY, 2024
B. Tech (Computer Science & Engineering) IVth Semester (SECTION - A, B, and C)
 Course: Design and Analysis of Algorithms Max. Marks:60 Max. Time: 3 Hrs.
 Course Code: CS44115 (for B.Tech-CSE and DD-CSE-CS & DS) / CS47101 (for DD-MA-MCT)

Instruction:

1. Answer all questions.
2. The Marks, CO (Course Outcome) and BL (Bloom's Level) related to questions are mentioned on the right-hand side margin.

Q. No	Question	Marks	CO	BL										
1	<p>a. What is the complexity of the below program:</p> <pre>void function(int n) { int i, j, k, count = 0; for(i=n/2; i<=n; i++) for(j=1; j + n/2 <=n; j++) for(k=1; k <=n; k = k * 2) count++; }</pre> <p>b. Suppose we're using quick sort to process data that we're receiving from a connection in a networked system. We want to cover our system from the possibility of being "sabotaged" by hostile connections—we could receive data that is specifically crafted to cause quick sort to have its worstcase performance and thus make our system consume excessive resources and time. Assuming that quick sort simply chooses the first element as the pivot, what is the arrangement of data that produces the worst-case performance in quick sort?</p>	5M	CO1	Analyze										
2	<p>a. For the graph given below, find a Minimum Spanning Tree through Prim's algorithm by taking '1' as the starting node. Show all the stages in the diagrammatic form only.</p> <p>b. Show the timing analysis of Kruskal's & Prim's Algorithms.</p>	5M	CO1 & CO2	Understand Apply Evaluate										
3	<p>a. Solve the below 0/1 knapsack problem using the Least Cost Branch and Bound method. The knapsack capacity is 15. Show the complete state space tree to solve this problem and mention which items are loaded to maximize the profit.</p> <table border="1"> <tr> <td>Profit</td> <td>10</td> <td>10</td> <td>12</td> <td>18</td> </tr> <tr> <td>Weight</td> <td>2</td> <td>4</td> <td>6</td> <td>9</td> </tr> </table> <p>b. What is the main purpose of studying NP-Completeness? What is the difference between NP Hard and NP-Complete problem? Proof that Clique Decision Problem (CDP) is a NP Hard Problem.</p>	Profit	10	10	12	18	Weight	2	4	6	9	6M	CO4	Understand Apply Evaluate
Profit	10	10	12	18										
Weight	2	4	6	9										
		4M	CO1	Analyze										
		5M	CO5	Understand Apply Evaluate										
		5M	CO5	Understand Create										



NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Department of Computer Science and Engineering

END SEMESTER EXAMINATION – May, 2024

B. Tech (Computer Science and Engineering) 4th Semester (Section 1, 2, and 3)
Course: Automata Theory and Compiler Design (CS44114)

Full marks:60 Time: 3 hours

Answer all questions

Question

Q.no	Question	Marks	CO	BL
1	<p>a) Design Deterministic PDA for the language $L_1 = \{a^m b^n c^{m+n}, m > n \text{ and } n \geq 1\}$</p> <p>b) Define and explain with an example about the synthesized attributes and inherited attributes.</p>	06M 06M	C04 C06	Application Remembering & Understanding
2	<p>Consider the following grammar:</p> $S \rightarrow Aa bAc Bc bBa$ $A \rightarrow d$ $B \rightarrow d$ <p>Compute the sets of LR(0) items and show them using the LR(0) automaton (goto graph). Construct the corresponding SLR parsing table and verify whether the given grammar is SLR(1) or not.</p>	12M	C03	Understanding & Application
3	<p>Design the SDD to convert the given infix expression into postfix expression using the following grammar:</p> $E \rightarrow E + T \mid T$ $T \rightarrow T * F \mid F$ $F \rightarrow (E) \mid id$ <p>Also construct the annotated parse tree for the string $id + id * id$.</p>	12M	C06	Creation
4	<p>a) Generate the three-address codes for the following program segments and also construct the basic blocks.</p> $\text{int } k = 1; \text{ int } a[5];$ $\text{while } (k \leq 5)$ $\{ a[k] = 0; k++; \}$ <p>b) Generate the three-address codes for the following program segment and represent the code in Quadruple and Triples.</p> $\text{for}(i=1; i \leq 10; i++) \{ a[i] = x * 5; \}$	06M 06M	C07 C07	Understanding & Analyze Understanding & Analyze
5	<p>(a) Translate the expression $(a * b / c) * (d + e + f)$ into three address codes. Write the code (target language instructions using assembly language) by using the three address codes generated above. Also, show the register descriptor list, address descriptor list after each and every instruction generated and the cost of each instruction and total cost of the code.</p> <p style="text-align: center;">(or)</p> <p>(b.i) Construct the basic blocks and the corresponding flow graph for the following program fragment:</p> $x=1;$ $\text{for } (n=1; n \leq 3; n++)$ $x=x^2;$ <p>(b.ii) Design a Turing Machine for the following language:</p> $L = \{WW^R \mid W \in \{0,1\}^*\}$	12M (6+6)	C07 C07 C08	Application Application Creation

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
Department of Computer Science and Engineering
END SEMESTER EXAMINATION, Jan-June 2024

B Tech: Semester-IV

Course Name: Computer Networks
Maximum Time: 3 hours

Course Code: CS44113
Max. Marks: 60

Instructions:

1. Attempt all questions.
2. Assume any suitable data, if necessary. (Any other instruction need to provide by the concern faculty)
3. The marks, Course Outcome (CO) and Bloom's Level (BL) related to questions are mentioned on the right-hand side margin.

		Marks	CO	BL
1	Develop an algorithm for CSMA/CD method with suitable flow diagram/example? How it can be differ from Pure ALOHA protocol. One hundred stations on a slotted ALOHA network share a 1-Mbps channel. If frames are 1000 bits long, determine the throughput if each station is sending 10 frames per second.	3+3+4 = 10	CO-3	Applying and Evaluating
2	List the difference (at least five) between IPv4 and IPv6 protocol with suitable diagram? An ISP is granted a block of addresses starting with 120.60.4.0/20. The ISP wants to distribute these blocks to 100 organizations with each organization receiving 8 addresses only. Design the sub blocks and give the slash notation for each sub-block. Find out how many addresses are still available after these allocations.	5+5 = 10	CO-4	Remembering and Creating
3	Discuss the algorithmic steps for link state routing algorithm with suitable diagram/example? How does it differ (at least five) from distance vector routing algorithm? Consider the network shown below (Fig-1) and assume that each node initially knows the costs to each of its neighbors. Consider the link state routing algorithm and create the distance table entries at node X (Source node).	3+2+5 = 10	CO-4	Applying
	Figure 1: The Network			
4	Compare and contrast TCP segment with UDP datagram in detail along with flow and congestion control mechanism for TCP? The following is a dump of a TCP header in hexadecimal format: (05320017 00000001 00000000 500207FF 00000000) ₁₆ . Determine the following: a) Destination port number, b) Sequence number, c) Length of the header, d) Type of the segment, and e) Window size	5+5 = 10	CO-5	Understanding and Evaluating
5	Write an effective note on any four with suitable diagram (s)	20 (5 marks each)	CO-2- CO-6	Creating
	<ol style="list-style-type: none"> Traffic shaping algorithms Hypertext transfer protocol Error detection techniques Stop & wait ARQ protocol Time division multiplexing OSI reference model 			