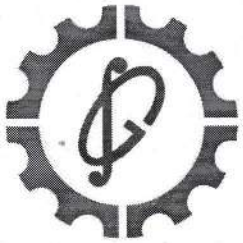
Saintgits College of Applied Sciences (SCAS),



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Course File

ON

Design and Analysis of Algorithms

CS4CRT09

[SEMESTER(S4) Computer Applications]

COURSE FILE

BY

Arun Padmanabhan - Asst. Prof.

NAME OF STAFF	Arun Padmanabhan
COURSE NAME	Design and Analysis of Algorithms
COURSE CODE	CS4CRT09
TEACHING SCHEME	
CREDITS	4
COURSE SYLLABUS CODE	DAA
SEMESTER	S4
BRANCH	Computer Applications
STREAM	
BATCH	2022 - 2025
ACADEMIC YEAR	2023 - 2024

Course File Index

S/N	ITEMS
1	Student's List
2	Timetable
3	Syllabus
4	COs of the Subject
5	Attendance
6	Course Plan
7	Subject Coverage
8	First Internal Examination a. Question Paper b. Answer Scheme c. Sample Papers d. Analysis CO
9	Second Internal Examination a. Question Paper b. Answer Scheme c. Sample Papers d. Analysis CO
10	Assignment / Seminar a. Sample b. Analysis of CO
11	Module Test a. Sample Paper
12	CO Evaluation Sheet
13	Resources

Student's List

Roll No	University Reg. No	Student Name
01	220021086575	A ADINATH
02	220021086576	AADHIL S
03	220021086577	AARON K JIJO
04	220021086578	ABHINAND M A
05	220021086579	ABHINAV GOPAN
06	220021086580	ABHIRAM SREEKUMAR
07	220021086581	ABIN ABRAHAM KOTTANIPRAL
08	220021086582	ABRAHAM J ALAMPALLIL
09	220021086583	ADITHRAJ N
10	220021086584	AKHIL VARGHESE
12	220021086585	ALBIN SIBY
14	220021086587	ALVIN BAIJU
15	220021086588	ALWIN JOSE
16	220021086589	AMAL JAYAKUMAR
17	220021086590	AMITH K SAJI
18	220021086592	ANAGHA LAKSHMI B
19	220021086593	ANFAS P HANISH
20	220021086594	ANJANA SAJIKUMAR
21	220021086595	ANTOS BIJU
22	220021086596	ARCHANA S NAIR
23	220021086597	ARPITHA ASOKAN
24	220021086598	ARTHANA PRADEEP
25	220021086599	ATHIRA P S
26	220021086600	ATHUL S. KRISHNA
27	220021086601	ATHULYA ANIL
28	220021086602	B SREELAKSHMI
29	220021086603	BILEENA VARUGHESE
30	220021086604	CHERIAN T THAYIL
31	220021086605	DEVANANDHA S
32	220021086606	DIANA REEBA BENJAMIN
33	220021086607	EMIL SUNNY
34	220021086608	FARHAN SIYAD
35	220021086609	GAYATHRI MANOJ
36	220021086610	GEETHIKA A
37	220021086611	GEORGE RIGIN JAMES
38	220021086612	JESWIN SEBASTIAN
39	220021086613	JOE THOMAS
40	220021086614	JOHIN JOHN
41	220021086615	JOSHILY MARY JOSE
42	22140623	JUSTIN JOY
43	220021086616	KARTHIK P NAIR
44	220021086617	KARTHIK SUDARSANAN
45	220021086618	KRISHNA MURALI
46	220021086619	LEVIN MATHEW ABRAHAM
48	220021086621	MUHAMMED AMEEN
49	220021086622	NANDANA ANIL
50	220021086623	NANDHANA K MANOJ
51	220021086624	NEERAJA RAJESH
52	220021086625	NILA CHANDANA T S
53	220021086626	NIRAJ P NITIN
54	220021086627	NIYA ANN JACOB
55	220021086628	OHMDHIRDHE
56	220021086629	PRAJUL TOM
57	220021086630	RAHUL M
58	220021086631	RAICHEL KARUKANCHERIL THOMAS
59	220021086632	RAKESH
60	220021086633	RICHARD CHRISTY PINSON
61	220021086634	SAJU P VARGHESE
62	220021086635	SIVARAM.D.KUMAR
63	220021086636	SREEHARI CS
64	220021086637	SREELAKSHMI N J

Roll No	University Reg. No	Student Name
65	220021086638	STEPHEN MATHEW K M
66	220021086639	SUMI SUSAN JOSE
67	220021086640	VARSHA S
68	220021086641	VYSHNAVI P T
69	220021089078	AKSA ABI
70		ROHAN GEO PHILIPS

Batch Timetable

Day/Hour	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8	Hour 9	Hour 10
11-03-2024 Monday	-	-	-	-	-	-	-	-	-	-
12-03-2024 Tuesday	-	-	-	-	(1:50 PM - 2:50 PM) Arun Padmanabhan	(3:00 PM - 4:00 PM) Arun Padmanabhan	-	-	-	-
13-03-2024 Wednesday	-	-	(11:10 AM - 12:00 PM) Arun Padmanabhan	-	-	-	-	-	-	-
14-03-2024 Thursday	-	-	-	(12:00 PM - 12:50 PM) Arun Padmanabhan	-	-	-	-	-	-
15-03-)24 Friday	-	-	(11:10 AM - 12:00 PM) Arun Padmanabhan	-	-	-	-	-	-	-
16-03-2024 Saturday	-	-	-	-	-	-	-	-	-	-
17-03-2024 Sunday	-	-	-	-	-	-	-	-	-	-

Course Timetable

BCA-2022										
Hour	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8	Hour 9	Hour 10
Monday 11-03-2024	CS4CRT10	MM4CMT03	CA4CRT03	CS4CRT10	CA4CRT03	CS4CRT11				
Tuesday 12-03-2024	CS4CRP04	CS4CRP04	CS4CRP04	CS4CRT11	CS4CRT09	CS4CRT09				
Wednesday 13-03-2024	CS4CRP04	CS4CRP04	CS4CRT09	CS4CRT10	CA4CRT03					
Thursday 14-03-2024	MM4CMT03	CRT	MM4CMT03	CS4CRT09	CS4CRT10					
Friday 15-03-2024	MM4CMT03	CRT	CS4CRT09	CS4CRT10	CA4CRT03					
Saturday 16-03-2024										
Sunday 17-03-2024										

Syllabus

CA4CRT10 - Design and Analysis of Algorithms (Core)

Theory:4 hrs. per week

Credits:4

Unit 1: (12 hrs.)

Introduction, Definition of Algorithm, Algorithm design techniques, Algorithm Analysis, performance analysis - space complexity, time complexity, Best, Worst, And average case complexity.

Unit 2 (14 hrs.)

Divide and Conquer General method, Binary search, finding the maximum and minimum, merge sort, quick sort, performance measurement of quick sort, Selection, Strassen%u2019s matrix multiplication.

Unit 3 (18 hrs.)

Greedy Algorithm General Characteristics of greedy algorithms, Problem solving using Greedy Algorithm - Knapsack problem, Minimum Spanning trees (Kruskal%u2019s algorithm, Prim%u2019s algorithm).

Unit 4: (16 hrs.)

Dynamic programming The general method, multistage graphs, all-pairs shortest path, Single source shortest path, 0/1 Knapsack problem, Traveling Sales person problem.

Unit 5: (12 hrs)

Basic traversal and search techniques - BFS and traversal, DFS and traversal, Bi-connected components and DFS, Backtracking General method, 8-queens problem, Sum of subsets problem, Graph colouring, Hamiltonian cycles.

Book of study:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekharan, Computer algorithms/C ,Second Edition, Universities Press.

References:

1. Anany Levitin- Introduction to design and analysis of algorithms, Third Edition, Addison Wesley Low price edition.
2. Richard Neapolitan & Kumarss Naimipour, Foundation of Algorithms using C Pseudocode, Third edition, Jones And Bartlett Publishers

Course Outcome

Upon completion of this course, students will be able to do the following

CO 1 : Demonstrate algorithm design techniques
CO 2 : Summarize the recursive methods of divide and conquer strategy
CO 3 : Practice Greedy approach for problem solving
CO 4 : Use dynamic programming
CO 5 : Identify applications of backtracking

Attendance

Roll No	Student Name	Attendance	University Reg. No
01	A ADINATH	88.89	220021086575
02	AADHIL S	80.00	220021086576
03	AARON K JIJO	77.78	220021086577
04	ABHINAND M A	77.78	220021086578
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06	ABHIRAM SREEKUMAR	77.78	220021086580
07	ABIN ABRAHAM KOTTANIPRAL	100.00	220021086581
08	ABRAHAM J ALAMPALLIL	86.67	220021086582
09	ADITHRAJ N	100.00	220021086583
10	AKHIL VARGHESE	68.89	220021086584
12	ALBIN SIBY	97.78	220021086585
14	ALVIN BAIJU	84.44	220021086587
15	ALWIN JOSE	93.33	220021086588
16	AMAL JAYAKUMAR	77.78	220021086589
17	AMITH K SAJI	86.67	220021086590
18	ANAGHA LAKSHMI B	88.89	220021086592
19	ANFAS P HANISH	64.44	220021086593
20	ANJANA SAJIKUMAR	88.89	220021086594
21	ANTOS BIJU	88.89	220021086595
22	ARCHANA S NAIR	93.33	220021086596
23	ARPITHA ASOKAN	86.67	220021086597
24	ARTHANA PRADEEP	77.78	220021086598
25	ATHIRA P S	97.78	220021086599
26	ATHUL S. KRISHNA	82.22	220021086600
27	ATHULYA ANIL	97.78	220021086601
28	B SREELAKSHMI	84.44	220021086602
29	BILEENA VARUGHESE	77.78	220021086603
30	CHERIAN T THAYIL	93.33	220021086604
31	DEVANANDHA S	84.44	220021086605
32	DIANA REEBA BENJAMIN	100.00	220021086606
33	EMIL SUNNY	95.56	220021086607
34	FARHAN SIYAD	62.22	220021086608
35	GAYATHRI MANOJ	88.89	220021086609
36	GEETHIKA A	86.67	220021086610
37	GEORGE RIGIN JAMES	88.89	220021086611
38	JESWIN SEBASTIAN	86.67	220021086612
39	JOE THOMAS	88.89	220021086613
40	JOHIN JOHN	84.44	220021086614
41	JOSHILY MARY JOSE	93.33	220021086615
42	JUSTIN JOY	84.44	22140623
43	KARTHIK P NAIR	91.11	220021086616
44	KARTHIK SUDARSANAN	91.11	220021086617
45	KRISHNA MURALI	86.67	220021086618
46	LEVIN MATHEW ABRAHAM	93.33	220021086619
48	MUHAMMED AMEEN	71.11	220021086621
49	NANDANA ANIL	91.11	220021086622
50	NANDHANA K MANOJ	93.33	220021086623
51	NEERAJA RAJESH	95.56	220021086624
52	NILA CHANDANA T S	95.56	220021086625
53	NIRAJ P NITIN	86.67	220021086626
54	NIYA ANN JACOB	93.33	220021086627
55	OHMDHIRDHE	86.67	220021086628
56	PRAJUL TOM	95.56	220021086629
57	RAHUL M	95.56	220021086630
58	RAICHEL KARUKANCHERIL THOMAS	84.44	220021086631
59	RAKESH	93.33	220021086632
60	RICHARD CHRISTY PINSON	73.33	220021086633
61	SAJU P VARGHESE	91.11	220021086634
62	SIVARAM.D.KUMAR	73.33	220021086635
63	SREEHARI CS	84.44	220021086636
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66	SUMI SUSAN JOSE	91.11	220021086639
67	VARSHA S	93.33	220021086640
68	VYSHNAVI P T	95.56	220021086641
69	AKSA ABI	95.56	220021089078
70	ROHAN GEO PHILIPS	22.22	

Course Plan

Sl.no	Date	Hour	Module	Topic Name	Topic Description
1	04-12-2023	4	1	Introduction to algorithms	Intro to algorithms
2	05-12-2023	5	1	Algorithm Definition	Definition of algorithm
3	07-12-2023	4	1	Performance analysis	Performance Analysis
4	07-12-2023	6	1	Complexities	Space Complexity Intro
5	08-12-2023	1	1	Space complexity	Space complexity
6	08-12-2023	6	1	Complexity	Time Complexity
7	11-12-2023	4	1	Space Complexity	Space Complexity
8	12-12-2023	5	1	Time complexity	Time complecity
9	14-12-2023	4	1	Asymptotic notation	Asymptotic notation
10	15-12-2023	6	1	Big Oh, Big Theta, Big Omega	Notations in Detail
11	18-12-2023	4	1	Asymptotic notaion	Asymptotic notation
12	19-12-2023	5	1	ASSIGNMENT 1 & Little Oh, Lil Theta, Lil Omega	ASSIGNMENT 1 & Little Notations
13	20-12-2023	3	2	Divide and conquer	Divide and conquer
14	05-01-2024	5	2	Finding the maximum and minimum	Finding the maximum and minimum
15	06-01-2024	1	2	Merge sort	Merge sort
16	08-01-2024	2	2	Quick sort	Quick sort
17	08-01-2024	4	2	Selection sort	Selection sort
18	12-01-2024	1	2	Strassens Matrix Multiplication	Strassens Matrix Multiplocation
19	15-01-2024	4	2	Problem on Matrix Multiplication	Detailed example
20	17-01-2024	6	3	Knapsack Problem	Knapsack problem
21	19-01-2024	1	3	Prims algorithm	Prims algorithm.
22	22-01-2024	1	3	Kruskal Algorithm	Kruskal Algorithm
23	23-01-2024	5	4	Multistage graphs	Multistage graphs
24	30-01-2024	5	4	ASSIGNMENT 2 & All pairs shortest paths	ASSIGNMENT 2 & All pairs shortest paths
25	02-02-2024	1	4	Single source shortest paths	Single source shortest paths
26	05-02-2024	4	4	ASSIGNMENT 3 & O/1 Knapsack problem	ASSIGNMENT 3 & 0/1 Knapsack problem
27	06-02-2024	5	4	TSP	TSP
28	08-02-2024	4	5	BFS & DFS	Bfs and dfs
29	12-02-2024	4	5	Bi connected component and dfs	Bi connected components
30	16-02-2024	1	5	Queens problem & graph coloring	8 queens and graph coloring
31	16-02-2024	6	5	Hamiltonian cycle	Hamiltonian cycle
32	27-02-2024	5	5	ASSIGNMENT 4 & Backtracking	ASSIGNMENT 4 & General method
33	29-02-2024	4	5	Backtracking	Introduction to backtracking
34	01-03-2024	1	5	Sum of subset	Algorithm of sum of subset
35	12-03-2024	5	5	Sum of subsets	Algorithm of sum of subsets
36	12-03-2024	6	5	8 queens problem	Algorithm of 8 queens problem
37	13-03-2024	3	5	8 queens problem	Algorithm of 8 queens problem
38	14-03-2024	4	5	Graph coloring	Algorithm of graph coloring
39	15-03-2024	3	5	Graph coloring	Algorithm of graph coloring
40	18-03-2024	4	5	Hamiltoniaan cycle	Algorithm of Hamiltonian cycles
41	19-03-2024	5	5	ASSIGNMENT 5 & Advanced Concepts	ASSIGNMENT 5 & Advanced Concepts
42	19-03-2024	5	5	Backtracking Examples	Examples on Backtracking
43	19-03-2024	6	5	Backtracking Examples	More examples on backtracking

Subject Coverage

Sl.no	Date	Hour	Topic Name	Topic Description	Mode of Instruction
1	2023-12-04	4	Introduction to algorithms	Intro to algorithms	Lecture
2	2023-12-05	5	Algorithm Definition	Definition of algorithm	Lecture
3	2023-12-07	4	Performance analysis	Performance Analysis	Lecture
4	2023-12-07	6	Complexities	Space Complexity Intro	Lecture
5	2023-12-08	1	Space complexity	Space complexity	Lecture
6	2023-12-08	6	Complexity	Time Complexity	Lecture
7	2023-12-11	4	Space Complexity	Space Complexity	Lecture
8	2023-12-12	5	Time complexity	Time complecity	Lecture
9	2023-12-14	4	Asymptotic notation	Asymptotic notation	Lecture
10	2023-12-15	6	Big Oh, Big Theta, Big Omega	Notations in Detail	Lecture
11	2023-12-18	4	Asymptotic notaion	Asymptotic notation	Lecture
12	2023-12-19	5	Little Oh, Lil Theta, Lil Omega	Little Notations	Lecture
13	2023-12-20	3	Divide and conquer	Divide and conquer	Lecture
14	2024-01-05	5	Finding the maximum and minimum	Finding the maximum and minimum	Lecture
15	2024-01-06	1	Merge sort	Merge sort	Lecture
16	2024-01-08	2	Quick sort	Quick sort	Lecture
17	2024-01-08	4	Selection sort	Selection sort	Lecture
18	2024-01-12	1	Strassens Matrix Multiplication	Strassens Matrix Multiplocation	Lecture
19	2024-01-15	4	Problem on Matrix Multiplication	Detailed example	Lecture
20	2024-01-17	6	Knapsack Problem	Knapsack problem	Lecture
21	2024-01-19	1	Prims algorithm	Prims algorithm.	Lecture
22	2024-01-22	1	Kruskal Algorithm	Kruskal Algorithm	Lecture
23	2024-01-23	5	Multistage graphs	Multistage graphs	Lecture
24	2024-01-30	5	All pairs shortest paths	All pairs shortest paths	Lecture
25	2024-02-02	1	Single source shortest paths	Single source shortest paths	Lecture
26	2024-02-05	4	O/1 Knapsack problem	0/1 Knapsack problem	Lecture
27	2024-02-06	5	TSP	TSP	Lecture
28	2024-02-08	4	BFS & DFS	Bfs and dfs	Lecture
29	2024-02-12	4	Bi connected component and dfs	Bi connected components	Lecture
30	2024-02-16	1	Queens problem & graph coloring	8 queens and graph coloring	Lecture
31	2024-02-16	6	Hamiltonian cycle	Hamiltonian cycle	Lecture
32	2024-02-27	5	Backtracking	General method	Lecture
33	2024-02-29	4	Backtracking	Introduction to backtracking	Lecture
34	2024-03-01	1	Sum of subset	Algorithm of sum of subset	Lecture
35	2024-03-12	5	Sum of subsets	Algorithm of sum of subsets	Lecture
36	2024-03-12	6	8 queens problem	Algorithm of 8 queens problem	Lecture
37	2024-03-13	3	8 queens problem	Algorithm of 8 queens problem	Lecture
38	2024-03-14	4	Graph coloring	Algorithm of graph coloring	Lecture
39	2024-03-15	3	Graph coloring	Algorithm of graph coloring	Lecture
40	2024-03-18	4	Hamiltoniaan cycle	Algorithm of Hamiltonian cycles	Lecture
41	2024-03-19	5	Backtracking Examples	Examples on Backtracking	Lecture
42	2024-03-19	5	Advanced	Backtracking advanced	Lecture
43	2024-03-19	6	Backtracking Examples	More examples on backtracking	Lecture

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SAINTGITS COLLEGE OF APPLIED SCIENCES
KOTTAYAM, KERALA
Model Examination, February 2024

PG Department of Computer Applications & AI, Semester 4

Design & Analysis of Algorithms
CSCRT09

Total: 80 marks **Time: 3 hours**

Section A

Answer any 10 questions. Each question carries 2 marks.

1. Define algorithm.
2. What is best case complexity?
3. What is knapsack problem?
4. State Principle of Optimality
5. Define TSP.
6. Explain the method of Kruskal's algorithm.
7. What is spanning tree? Give an example.
8. What are the features of dynamic programming?
9. Describe binary search method.
10. What is space complexity?
11. Discuss the part of partitioning algorithm in quick sort.
12. What is recursion?

(10 x 2 =20 Marks)

Section B

Answer any 6 questions. Each question carries 5 marks.

13. Explain the characteristics of an algorithm.
14. Explain time complexity and space complexity.
15. Briefly explain different algorithm design techniques.
16. What is single source shortest path? Explain with an algorithm.

17. Discuss with justification that Strassen's matrix multiplication brings the improvement over the ordinary matrix multiplication method.

18. Explain all pairs shortest path with an algorithm.

19. Compare linear search with binary search using suitable examples.

20. State greedy knapsack algorithm.

21. Explain the role of various data structures in algorithm.

(6 x 5 = 30 Marks)

Section C

Answer any 2 questions. Each question carries 15 marks

22. What is minimum cost spanning tree? Explain prim's algorithm with suitable example.

23. Given the list of numbers {14, 24, 27, 34, 36, 46, and 56}. Use Binary search algorithm to check whether the number 46 present or not.

24. Explain BFS and DFS with suitable examples.

25. Define backtracking. Write any one algorithm of backtracking.

(2 X 15 = 30 Marks)

[Scan QR code for Answer Key]

SAINTGITS COLLEGE OF APPLIED SCIENCES
KOTTAYAM, KERALA
Model Examination, February 2024

PG Department of Computer Applications & AI, Semester 4

Design & Analysis of Algorithms – ANSWER KEY
CSCRT09

Total: 80 marks **Time: 3 hours**

Section A

Answer any 10 questions. Each question carries 2 marks.

1. Algorithm: A step-by-step procedure or set of rules to solve a problem or perform a task.
2. Best case complexity: The minimum amount of time or space required by an algorithm when provided with the most favorable input.
3. Knapsack problem: A combinatorial optimization problem that involves selecting items to maximize the total value within a limited capacity.
4. Principle of Optimality: In dynamic programming, it states that an optimal solution to a problem contains optimal solutions to its subproblems.
5. TSP (Traveling Salesman Problem): A classic optimization problem where the goal is to find the shortest possible route that visits each city exactly once and returns to the original city.
6. Kruskal's algorithm: A greedy algorithm for finding the minimum spanning tree of a connected, weighted graph by iteratively adding the shortest edge that does not form a cycle.
7. Spanning tree: A subgraph of a connected, undirected graph that is a tree and includes all the vertices of the original graph. Example: Consider a graph with vertices A, B, C, and edges AB, AC, BC. A spanning tree could be AB, AC.
8. Features of dynamic programming: Optimal substructure, overlapping subproblems, and memoization or tabulation.
9. Binary search: A search algorithm that finds the position of a target value within a sorted array by repeatedly dividing the search interval in half.
10. Space complexity: The amount of memory required by an algorithm to execute as a function of the input size.
11. Quick sort partitioning: It involves selecting a pivot element and rearranging the array such that all elements less than the pivot are placed before it, and all elements greater than the pivot are placed after it.
12. Recursion: A programming technique where a function calls itself in order to solve smaller instances of the same problem.

Section B:

13. Characteristics of an algorithm: Finiteness, definiteness, input, output, effectiveness, and generality.
14. Time complexity: Measure of the amount of time an algorithm takes to complete as a function of the input size. Space complexity: Measure of the amount of memory an algorithm uses as a function of the input size.
15. Algorithm design techniques: Divide and conquer, dynamic programming, greedy algorithms, backtracking, and brute force.
16. Single source shortest path: The shortest path from a source vertex to all other vertices in a graph. Example algorithm: Dijkstra's algorithm.

17. Strassen's matrix multiplication: Improves over ordinary matrix multiplication by reducing the number of scalar multiplications.
18. All pairs shortest path: Finding the shortest path between all pairs of vertices in a graph. Example algorithm: Floyd-Warshall algorithm.
19. Comparison of linear search and binary search: Linear search scans sequentially, while binary search halves the search space at each step. Example: Searching for a number in an ordered list.
20. Greedy knapsack algorithm: A method for solving the knapsack problem by selecting items based on their ratio of value to weight until the knapsack is full.
21. Role of data structures in algorithms: They facilitate efficient storage and manipulation of data, impacting the algorithm's performance.

Section C:

22. Minimum cost spanning tree: A spanning tree of a weighted graph with the minimum possible total edge weight. Prim's algorithm constructs this tree by adding edges of minimum weight.
23. Binary search algorithm: Given a sorted list, it repeatedly halves the search interval until the target element is found or the interval is empty.
24. BFS (Breadth-First Search) and DFS (Depth-First Search): Graph traversal algorithms. BFS explores neighbor nodes before moving to the next level, while DFS explores as far as possible along each branch before backtracking.
25. Backtracking: A technique for systematically exploring all possible solutions to a problem by incrementally building candidates and abandoning partial solutions that cannot fulfill the conditions. Example algorithm: N-Queens problem.

(2 X 15 = 30 Marks)

[Scan QR code for Answer Key]

SAINTGITS COLLEGE OF APPLIED SCIENCES

ANSWER BOOK FOR UG / PG PROGRAMME

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Date of Examination : 20-02-2024 Class : BCA - C4

Name of Examination / Programme MODEL EXAMINATIONS February 2024
(exactly as given in the question paper)

Stream : B.C.A Semester : 04

Course Title & Code: Design and Analysis of Algorithms Total No. of Page written 26

Q. No.	Mark	Grade	Wt. Gr. Point
1	2		
2	2		
3	2		
4	2	20	
5			
6	2		
7	2		
8	2		
9	2		
10	1		
11	2		
12	2		
13	5		
14	5		
15	5	20	
16			
17	5		
18			
19	5		
20	5		

Q. No.	Mark	Grade	Wt. Gr. Point
21			
22			
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24	15		
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Teachers Feedback
Excellent !

Total Marks: Total WGP: 80
Total Weight:
GPA (WGP/ Total Wt.):

Date of Examination : 20-02-2024 Class : BCA - C4

Room No. DB-201 Register No. (in figures): 2 3 4 6

(in words): Two Three four Six

(See instructions to the candidates overleaf)

Student Name Nandhana k manoj

Class Roll No. 50

Invigilator Code & Signature AAU 20/02/24

SECTION-A

1. Algorithm is a set of finite number of instructions which followed, it will complete a particular task. It's main properties are input, output, finite, definite, effectiveness

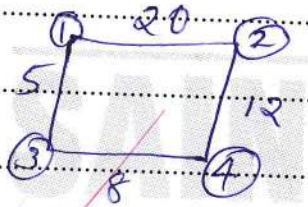
2. Best case complexity is when the minimum amount of work is taken for ~~solutt~~ solving a problem.
eg: Taking the shortest path to a destination with the least amount of time.

3. Knapsack problem is when there are various available amount of ~~time~~ different items and we need to choose a fixed amount of items in total irrespective of which items we choose.
eg: If we need to pay 40 rupees to a shopkeep we can make it various combinations such as 20+20, 20+10+10, 10+10+10+10, 20+10+5+5 etc

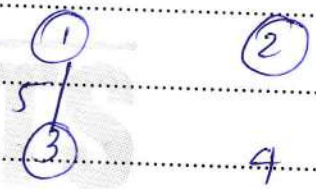
4. Principle of Optimality means reducing the enumeration by reducing enumeration steps for dicision making statements it reduces the optimality of a solution. Dynamic Programming uses principle of optimality whereas Greedy method don't

6. Kruskal's algorithm is an algorithm for developing a minimum spanning tree for a graph. In Kruskal algorithm, the shortest path among the graph is identified in the increasing order join them together.

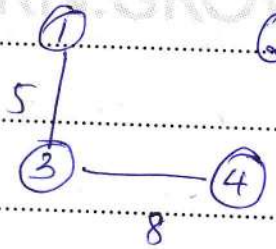
Eg:



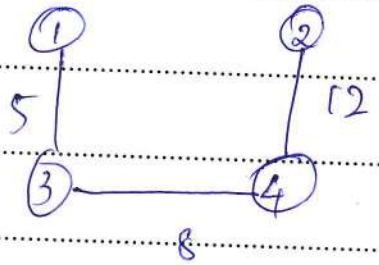
Step 1:



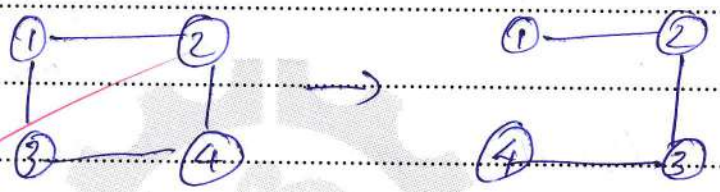
Step 2:



Step 3:



7. Spanning tree is a tree derived from a tree or graph where it contains all the nodes or vertices but not all edges present in the original one. Spanning tree doesnot form a closed path.

Eg 

8. Dynamic Programming is a computer programming technique where a program is divided into small partitions and each partition is solved for optimisation. It works under the principle of optimality. It reduces space complexity and having low time complexity.

9. Binary Search Method is a Divide and Conquer Method which is used to search an element in an array or any other data structure where elements are sorted in a sorted order. It is a fast searching method as it doesnot search

each element in the array.

10. Space complexity is the total space used by an algorithm to complete its task. Space complexity are of two types.

Fixed Space complexity :- For fixed variab constants, etc.

Variable Space complexity :- reference variabl and stack space

11. Partitioning algorithm in quick sort is used to partitioned the large array into smal ones.

```
int Partition( int a[], p, q)
{
  int m = a[p], i = p, j = q+1;
  do
  { do i++;
    a[i] < v; // checking next is letter or
    do j--;
    a[j] > v // checking right el is greater or
  if (i < j)
  Interchange(a, i, j)
  // Interchange or Su
```

```
        a[v] = a[j]
        a[j] = m;
    } while (i<j);
}
```

12. Recussion is a procen of calling a functio within itself. So the procen will be continue for a long way by Repeated calling of a function

SECTION-B

13. Charact

Algorithm is a finite set of instructions when followed it can complete a particul task. Algorithm is the helps us to understan even a complicated program.

Characteristics of Algorithm

- Input
- Output
- finite
- Definite
- effectiveness

* Input:

An algorithm may or may not have an Input. It completely depends solely on the type of problem which we are solving. Some problems might need some input to futher operations.

* Output

An algorithm gives a sets of instruction to solve a problem So it always gives an Output. We are using an algorithm to get an output.

* Finite

An algorithm is quite a short form of the problem which only explains the main operations occur in it. An algorithm consists of finite sets of code. Thus is less number of code line in Algorithm.

* Definite

An algorithm is definite : Each

Instruction in an algorithm is clear, which won't raise a doubt.

Eg: $c = a+b$

It is clear to do what, that is add a and b

$c = a+b*/a-b$ (This won't be a step in an algorithm as steps in an algorithm clearly suggest what to do.

* Effectiveness

An algorithm is effective since it does not need any knowledge in programming. Even a person who doesn't know programming can create an algorithm. We only need a logical thinking to construct an algorithm. Anyone can create an algorithm.

14. Time complexity

Time complexity is the total amount o time taken for the completion of an algorithm. It is measure by two meth

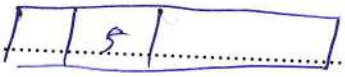
i) Step - count method
ii) Asymptotic method

In step-count method, each steps of the code is calculated. For comments, thu is no time is taken, for initialization and operation it is executed only one time. In decision making statements, only the statements which is true gets executed. For looping Statement it will get executed for a maxim of n+1 times. Asymptotic method uses Big-Oh notation, Big-Ω notation, Big-Θ omega - notation where Big-Oh gives upper bound of time whereas big Ω gives the lower bound of time.

Time complexities are of several types:

I) Constant Time complexity.

This type doesnot depends on the input size.

Eg: 

II) Linear Time Complexity

This type of complexity depends on the input size of the program and will get executed that many times

Eg: Looping over an array

III) Exponential Time Complexity:

This type of complexity is directly proportional to the double of the input size

Eg: looping over an another loop

IV) Logarithmic Time complexity

This complexity is directly proportional to logarithmically to the input size.

Space complexity

Space complexity is the total amount of storage space taken to complete the execution of an algorithm. It is of two types:

i) Fixed
ii) Variable

Fixed Space Complexity

Here the value of space complexity is fixed, Example: normal variables, constants, functions etc.

Variable Space Complexity

Here the value of space complexity varies according to program to program. Reference variables, stack space etc shows variable space complexity.

15. ALGORITHM DESIGNING TECHNIQUE

There are 4 major algorithm designing technique. If one can masters these technique can easily construct an algorithm.

i) Divide and Conquer
ii) Greedy
iii) Dynamic Programming
iv) Backtracking

a) Divide and Conquer Method:

In this method, we are dividing a program into small sections and each of them is solved.

i) Divide :- Dividing the whole program into partitions.
ii) Conquer :- Solving each portions recursively.
iii) Combine :- Combining all portions into one whole program.

Advantages: Reduces time complexity.
Faster since we use recursion.
Fewer line of code.

(ii) Greedy Method

Greedy method are used for optimisation problems where we need to do either maximisation or minimisation. It gives an optimal solution for such problems.

Advantages:- Less Space complexity

Only best solution is taken

Disadvantages:- Can be used only for problems having greedy property

(iii) Dynamic Programming

Dynamic Programming is the computer programming technique. It divides a whole programs into smaller portions and solve them to optimality. Dynamic Programming uses Principle of Optimality. It uses more decision statement whereas in Greedy method only one decision is made.

Advantages: Reduces time complexity.

Uses Less Space complexity.

Disadvantages: Since it uses recursion, it can lead to recursion vigorously

iv) Backtracking

Backtracking is one of the algorithm designing technique used when we have multiple directions or path to get solution to the problems. We will quit the direction or path when we find out that it cannot lead us to the solution.

Advantages :- It can be used for any type of problem.

Disadvantages :- Takes up too much space

17. Normal Matrix Multiplication

Let A and B be two nxn matrices and C is the product of A & B which is also a nxn matrix.

$$A = \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix} \quad B = \begin{bmatrix} B_{11} & B_{12} \\ B_{21} & B_{22} \end{bmatrix} \quad C = \begin{bmatrix} C_{11} & C_{12} \\ C_{21} & C_{22} \end{bmatrix}$$

$$C_{11} = A_{11}B_{11} + A_{12}B_{21}$$

$$C_{12} = A_{11}B_{12} + A_{12}B_{22}$$

$$C_{21} = A_{21}B_{11} + A_{22}B_{21}$$

$$C_{22} = A_{21}B_{12} + A_{22}B_{22}$$

Strassen's Matrix Multiplication

$$P = (A_{11} + A_{22})(B_{11} + B_{22})$$
$$Q = B_{11}(A_{21} + A_{22})$$
$$R = A_{11}(B_{12} - B_{22})$$
$$S = A_{21}(B_{21} - B_{11})$$
$$T = B_{22}(A_{11} + A_{12})$$
$$U = (A_{21} - A_{11})(B_{11} + B_{12})$$
$$V = (A_{12} - A_{22})(B_{21} + B_{22})$$

$$C_{11} = P + S - T + V$$
$$C_{12} = R + T$$
$$C_{21} = Q + S$$
$$C_{22} = P + R - Q + U$$

In normal multiplication, we need to do multiplication 8 times but in Strassen's Matrix multiplication there is only 7 multiplication steps. In programming, not only multiplication is a expensive procedure, it also takes more time than normal addition and subtraction. Therefore Strassen's matrix multiplication brings more

Improvement over an ordinary matrix multiplication method as it takes less effort, less expensive and takes less time and space.

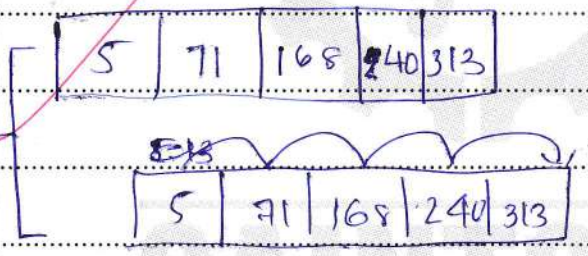
19)

Linear Search	Binary Search

for(i=0; i<n; i++)
Eg: if (x == a[i]
{
found i;
}
if (i==n)
{
Not found
}
	Eg: int mid = (low+high)/2
	if (x == a[mid]
	{
	found
	}
	else if (x < a[mid]
	high = mid-1
	else
	low = mid+1;

• Linear Search is a Searching method where we checking element in a linear manner.	• Binary Search is a Divide and Conquer method where we divide the array into portions and search.
• Checks each element of the array	• Does not check every element, check only the random ones.
• Less Faster	• More Faster
• Less efficient	• More efficient

• Elements should not be in Sorted	• Should be in Sorted format
• If there are 100 elements we need to check a 100 times thus increasing the time complexity of the problem	• If there are 100 elements may or may not be element can be found within a 10 seaches thus reducing the time complexity comparatively



Linear Search

To search 13

Checks every element

Binary Search

int mid = 313

168 = 313 // Not

low = mid+1

240=313 // No

313 = 313 // Yes

Linear Search takes 5 whereas Binary Search takes 3 steps only

20. Greedy Knapsack Problem:

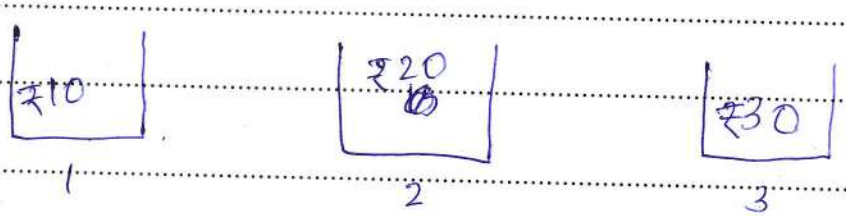
Greedy Knapsack Problem is a problem when there are various available amount of different items present to choose from and we need to choose a the items in such a way that the total does not succeed a given amount

Eg: If we need to pay 40 rupees to shopkeper. We can give him by making various combinations such as 20+20

10+10+10+10

20+10+10

20+10+5+5 etc



We have 3 items namely 1, 2, 3 having a cost of 10, 20, 30 respectively, we have to choose a the items but not exceeding 40.

```
void Greedyknapsack (int x[], int w[n], v,n)
{
    // x contains the items
       w contains the price.
       v is the maximum amount
    for (i=0; i<=n; i++)
        {   x[i] = 0.0;
    }
for (i=0; i<=n; i++) {
if ( w[i] > v)
    {       break; }
    x[i] = 1;
    v- = w[i];      }
if ( w[i] > v)
    {
    w[i] = v ;
           w[i]
    }
}
```

Trace

for (i=0

i=0 x = 0

i=1 x = 0

i=2 x = 0

if (w[0] > v) // False (10 > 40)

x[0] = 1

v = 40 - 10 = 30 // v = 30

if (w[1] > v) (20 > 30)

x[1] = 1

v = 30 - 20 = 10 // v = 10

if (w[2] > v) (30 > 10)

break

if (10 > 10)

w[2] = 10/30 = 1/3

SECTION - C

23) Binary Search is a divide and conquer method used to search an element in an ~~array~~ sorted array.

	1	2	3	4	5	6	7
a	14	24	27	34	36	46	56

```
int BinSrch ( Type a[], int l, int h, Type x)
{
    int low = l, high = h;
    while ( low <= high)
    {
        int mid = (low+high)/2
        if ( x < a[mid])
            high = mid - 1;
        else if (x > a[mid])
            low = mid + 1;
        else
            return (mid);
    }
    return 0;
}
```

Eg: `int BinSrch ( a[ ], 1, 7, 46)`

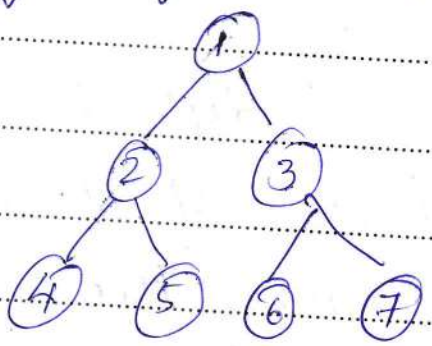
```
{
    low = 1 , high = 7
    while ( 1 <= 7)
    {
        mid = (1+7)/2 = 4
    if ( 46 < 34)   // false
    else if ( 46 > 34)  // true
```

low = 4+1 = 5

while (5 <= 7)
{
mid = (5+7)/2 = 6
if (46 < 46) // false
else if (46 > 46) // false
else
return 6.

24) BFS

Breadth First ~~Spanning~~ Search Tree is the technique taking each vertices of a spanning tree. A spanning tree is tree which consists of all the vertices of the tree but not all edges of the tree



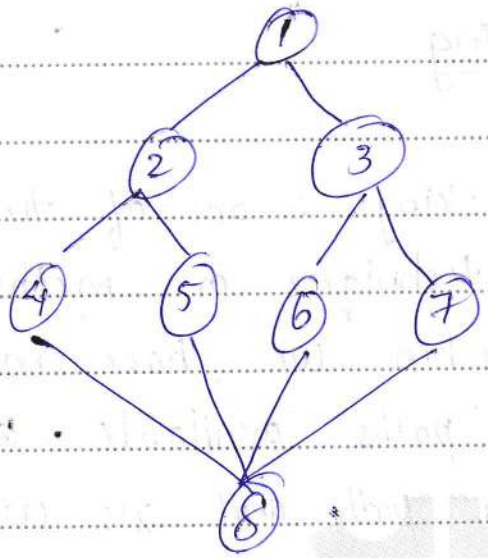
4, 5, 2, 6, 7, 3, 1

DFS BFS

```
Void BFS (int v)
{ int Queue q[size];
// take the all vertices
   adjacent to v.
   v = { 2, 3 }
if( visited[v] = 1;
if (visited[v] == 0)
{ visited[v] = 1;
   q.AddQ(u);
}
if ( q.Empty())
                return 0;
else q.delete(u);
}
```

DFS

DFS means depth first search tree is the technique of taking each vertices of the spanning tree considering the depth-first manner.



1, 2, 4, 8, 5, 2, 3, 6, 7

DFS algorithm

```
void DFS (int v)
{
    visited[v];
    for each w
    // take the adjacent vertices w from v.
    if (! visited[w])
        visited[w] = 1
        DFS (w);
}
```

25. Backtracking

Backtracking is one of the algorithm designing technique or method which is used when we have multiple directions or paths available. We go through directions or path and we will reject the direction or path when we find out that it cannot lead us to the solution to the problem. This method can be used for any type of method, it does not have any specialisation.

Advantages:

- It can be used for any type of problem we need to solve

Disadvantages

- Since it goes to the wrong ~~and~~ route and comeback and start another

path. It takes more time to complete the solution.

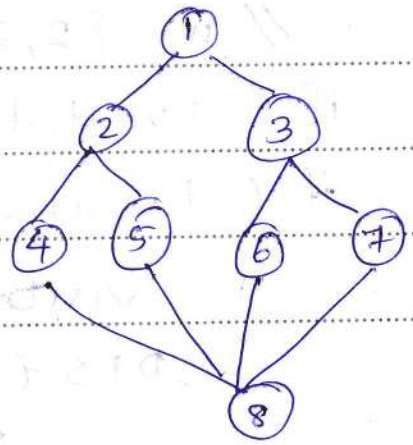
It takes up more space.

Both BFS and DFS takes the application of backtracking. Queens Problem is also use it.

DFS Algorithm

```
void DFS (int v)
{
    // visits the 1st vertinode
    visited [v];
    // take all the adgacent vertices w from
       u
    if ( ! visited [w])
            visited [w] = 1;
            DFS (w);
]
```

Eg:



path. It takes more time to complete the solution.

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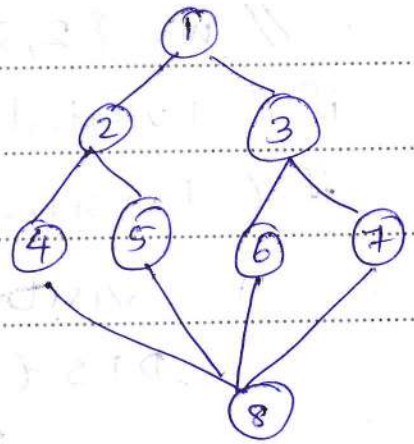
DFS Algorithm

```
void DFS (int v)
{
    // visits the 1st vertinode
    visited [v];
    // take all the adgacent vertices w from
       u
    if ( ! visited [w])
            visited [w] = 1;
            DFS (w);
]
```

Eg:



```
void DFS (int 1)
{
    visited [1];                    // 1
    // w = { 2, 3}
    if (! visited [2]) // true
        visited [2] = 1
        DFS (2)                     // 1, 2

void DFS (int 2)
{
    visited [2];
    // w = { 1, 4, 5}
    if (! visited [1]) // false
    if (! visited [4]) // true
        visited [4] = 1             // 1, 2, 4
        DFS [4]

void DFS (int 4)
{
    visited [4];
    // w = { 2, 8}
    if ( ! visited [2]) // false
    if ( ! visited [8]) // true
        visited [8];                // 1, 2, 4, 8
        DFS (8);
```

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Name of Examination / Programme model examination febauary 2024
(exactly as given in the question paper)

Stream : BCA Semester : 4

Course Title & Code: Design & Analysis of Algorithms Total No. of Page written 5

Q. No.	Mark	Grade	Wt. Gr. Point
1			
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Q. No.	Mark	Grade	Wt. Gr. Point
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40			

Teachers Feedback

Total Marks:	Total WGP: Total Weight: GPA (WGP/ Total Wt.):

Date of Examination : 20/2/2024 Class : BCA S4

Room No. PB 207 Register No. (in figures):

2	3	5	8

(in words):

two	three	five	EIGHT

(See instructions to the candidates overleaf)

Student Name Sivaram D Kumar

Class Roll No. 62

Invigilator Code & Signature DN

23) void main

{

if $A == 1$) main min (a-1)

else

i = x - 1

{

if a[] < a(i) maxi : main }

else

24) Backtracking is a method that is used for the fus some poublems so we can find the solution to the previus or same back's step of that equation. It is mainly seen in the face method so it is simple to find the answer of that.

Prim's Algorithm

A greedy method to obtain in a minimum cost spanning tree that builds ~~the~~ an extra tree edge by one the next edge include is chosen wisely though the optimisation criterion. The Simples criterion is used to choose such edges so far included 2 case @1 because the set of the edge (u,v) is included in a ~~tree~~ edge the A is the minimum cost the selects the minimum edge that is. ~~be~~ the A in the property is called the minimum profit that get

7) Spanning tree is a graph that represents the child, father, mother and the other ~~relations~~ nodes. It is mainly used to identify the one to other connection from a single look up. It is also ~~used~~ mainly used in multinational companies to know the growth.

An Algorithm is the simplest way to do or solve a problem at the present times.

Internal Exam Marks

Roll No	University Register Number	Name of student	MODEL EXAMINATION[80]
01	220021086575	A ADINATH	60
02	220021086576	AADHIL S	13
03	220021086577	AARON K JIJO	18
04	220021086578	ABHINAND M A	25
05	220021086579	ABHINAV GOPAN	44
06	220021086580	ABHIRAM SREEKUMAR	24
07	220021086581	ABIN ABRAHAM KOTTANIPRAL	59
08	220021086582	ABRAHAM J ALAMPALLIL	35
09	220021086583	ADITHRAJ N	70
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12	220021086585	ALBIN SIBY	33
14	220021086587	ALVIN BAIJU	15
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26	220021086600	ATHUL S. KRISHNA	56
27	220021086601	ATHULYA ANIL	58
28	220021086602	B SREELAKSHMI	28
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31	220021086605	DEVANANDHA S	65
32	220021086606	DIANA REEBA BENJAMIN	73
33	220021086607	EMIL SUNNY	51
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40	220021086614	JOHIN JOHN	10
41	220021086615	JOSHILY MARY JOSE	72
42	22140623	JUSTIN JOY	44
43	220021086616	KARTHIK P NAIR	45
44	220021086617	KARTHIK SUDARSANAN	63
45	220021086618	KRISHNA MURALI	A
46	220021086619	LEVIN MATHEW ABRAHAM	15
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59	220021086632	RAKESH	50
60	220021086633	RICHARD CHRISTY PINSON	44
61	220021086634	SAJU P VARGHESE	30
62	220021086635	SIVARAM.D.KUMAR	1
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64	220021086637	SREELAKSHMI N J	80

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65	220021086638	STEPHEN MATHEW K M	60
66	220021086639	SUMI SUSAN JOSE	61
67	220021086640	VARSHA S	68
68	220021086641	VYSHNAVI P T	71
69	220021089078	AKSA ABI	52
70		ROHAN GEO PHILIPS	A

Model Examination Marks

Semester : IV

Subject with Code: CS4CRT09 Design & Analysis of Algor

Programme: BCA

Faculty: Arun Padmanabhan [AP]

Roll No	Register No	Name	Q No	Course Outcomes (COs)				
			Max Marks	CO 1	CO 2	CO 3	CO 4	CO 5
			C O	Maximum Marks				
			Total Marks	21	17	26	32	22
1	220021086575	A ADINATH	60	11	9	13	16	11
2	220021086576	AADHIL S	13	3	2	3	4	3
3	220021086577	AARON K JIJO	18	4	3	4	6	4
4	220021086578	ABHINAND M A	25	6	5	6	9	6
5	220021086579	ABHINAV GOPAN	44	10	8	10	15	10
6	220021086580	ABHIRAM SREEKUMAR	24	5	4	5	8	5
7	220021086581	ABIN ABRAHAM KOTTANIPR	59	13	11	13	20	14
8	220021086582	ABRAHAM J ALAMPALLIL	35	7	6	8	11	7
9	220021086583	ADITHRAJ N	70	15	12	15	23	16
10	220021086584	AKHIL VARGHESE	31	6	5	7	9	6
11	220021086585	ALBIN SIBY	33	7	6	7	11	8
12	220021086587	ALVIN BAIJU	3	1	1	1	1	1
13	220021086588	ALWIN JOSE	37	9	7	8	14	9
14	220021086589	AMAL JAYAKUMAR	59	12	10	13	19	13
15	220021086590	AMITH K SAJI	3	1	0	1	1	1
16	220021086592	ANAGHA LAKSHMI B	63	15	12	14	23	16
17	220021086593	ANFAS P HANISH	9	2	1	2	3	2
18	220021086594	ANJANA SAJIKUMAR	75	18	14	17	27	19
19	220021086595	ANTOS BIJU	62	12	9	14	18	12
20	220021086596	ARCHANA S NAIR	43	9	7	9	13	9
21	220021086597	ARPITHA ASOKAN	31	7	5	7	10	7
22	220021086598	ARTHANA PRADEEP	56	12	10	12	19	13
23	220021086599	ATHIRA P S	58	12	9	13	18	12
24	220021086600	ATHUL S. KRISHNA	28	6	5	6	9	6
25	220021086601	ATHULYA ANIL	40	9	7	9	14	9
26	220021086602	B SREELAKSHMI	63	13	11	14	20	14
27	220021086603	BILEENA VARUGHESE	40	8	6	9	12	8
28	220021086604	CHERIAN T THAYIL	63	13	11	14	21	14
29	220021086605	DEVANANDHA S	65	13	10	14	20	13
30	220021086606	DIANA REEBA BENJAMIN	73	15	12	16	22	15
31	220021086607	EMIL SUNNY	51	10	8	11	15	10
32	220021086608	FARHAN SIYAD	30	6	5	7	9	7
33	220021086609	GAYATHRI MANOJ	66	15	12	15	22	15
34	220021086610	GEETHIKA A	42	8	7	9	12	9
35	220021086611	GEORGE RIGIN JAMES	28	6	5	6	9	6
36	220021086612	JESWIN SEBASTIAN	18	4	3	4	6	4
37	220021086613	JOE THOMAS	28	6	5	6	10	7
38	220021086614	JOHIN JOHN	10	2	2	2	3	2
39	220021086615	JOSHILY MARY JOSE	72	17	14	16	26	18
40	220021086616	KARTHIK P NAIR	45	8	7	10	13	9
41	220021086617	KARTHIK SUDARSANAN	63	13	11	14	20	14
42	220021086618	KRISHNA MURALI	0	0	0	0	0	0
43	220021086619	LEVIN MATHEW ABRAHAM	15	4	3	3	6	4
44	220021086621	MUHAMMED AMEEN	32	7	6	7	11	8
45	220021086622	NANDANA ANIL	80	17	14	18	26	18
46	220021086623	NANDHANA K MANOJ	80	15	12	18	23	16
47	220021086624	NEERAJA RAJESH	75	14	12	17	22	15
48	220021086625	NILA CHANDANA T S	66	13	10	15	20	13
49	220021086626	NIRAJ P NITIN	15	3	2	3	5	3
50	220021086627	NIYA ANN JACOB	43	10	8	9	15	10
51	220021086628	OHMDHIRDHE	77	16	13	17	24	17
52	220021086629	PRAJUL TOM	55	10	8	12	16	11

Model Examination Marks

Semester : IV

Subject with Code: CS4CRT09 Design & Analysis of Algo

Programme: BCA

Faculty: Arun Padmanabhan [AP]

Roll No	Register No	Name	Q No	Course Outcomes (COs)				
			Max Marks	CO 1	CO 2	CO 3	CO 4	CO 5
			C O	Maximum Marks				
			Total Marks	21	17	26	32	22
1	220021086575	A ADINATH	60	11	9	13	16	11
2	220021086576	AADHIL S	13	3	2	3	4	3
3	220021086577	AARON K JIJO	18	4	3	4	6	4
4	220021086578	ABHINAND M A	25	6	5	6	9	6
5	220021086579	ABHINAV GOPAN	44	10	8	10	15	10
6	220021086580	ABHIRAM SREEKUMAR	24	5	4	5	8	5
7	220021086581	ABIN ABRAHAM KOTTANIPR	59	13	11	13	20	14
8	220021086582	ABRAHAM J ALAMPALLIL	35	7	6	8	11	7
9	220021086583	ADITHRAJ N	70	15	12	15	23	16
10	220021086584	AKHIL VARGHESE	31	6	5	7	9	6
11	220021086585	ALBIN SIBY	33	7	6	7	11	8
12	220021086587	ALVIN BAIJU	3	1	1	1	1	1
13	220021086588	ALWIN JOSE	37	9	7	8	14	9
14	220021086589	AMAL JAYAKUMAR	59	12	10	13	19	13
15	220021086590	AMITH K SAJI	3	1	0	1	1	1
16	220021086592	ANAGHA LAKSHMI B	63	15	12	14	23	16
17	220021086593	ANFAS P HANISH	9	2	1	2	3	2
18	220021086594	ANJANA SAJIKUMAR	75	18	14	17	27	19
19	220021086595	ANTOS BIJU	62	12	9	14	18	12
20	220021086596	ARCHANA S NAIR	43	9	7	9	13	9
21	220021086597	ARPITHA ASOKAN	31	7	5	7	10	7
22	220021086598	ARTHANA PRADEEP	56	12	10	12	19	13
23	220021086599	ATHIRA P S	58	12	9	13	18	12
24	220021086600	ATHUL S. KRISHNA	28	6	5	6	9	6
25	220021086601	ATHULYA ANIL	40	9	7	9	14	9
26	220021086602	B SREELAKSHMI	63	13	11	14	20	14
27	220021086603	BILEENA VARUGHESE	40	8	6	9	12	8
28	220021086604	CHERIAN T THAYIL	63	13	11	14	21	14
29	220021086605	DEVANANDHA S	65	13	10	14	20	13
30	220021086606	DIANA REEBA BENJAMIN	73	15	12	16	22	15
31	220021086607	EMIL SUNNY	51	10	8	11	15	10
32	220021086608	FARHAN SIYAD	30	6	5	7	9	7
33	220021086609	GAYATHRI MANOJ	66	15	12	15	22	15
34	220021086610	GEETHIKA A	42	8	7	9	12	9
35	220021086611	GEORGE RIGIN JAMES	28	6	5	6	9	6
36	220021086612	JESWIN SEBASTIAN	18	4	3	4	6	4
37	220021086613	JOE THOMAS	28	6	5	6	10	7
38	220021086614	JOHIN JOHN	10	2	2	2	3	2
39	220021086615	JOSHILY MARY JOSE	72	17	14	16	26	18
40	220021086616	KARTHIK P NAIR	45	8	7	10	13	9
41	220021086617	KARTHIK SUDARSANAN	63	13	11	14	20	14
42	220021086618	KRISHNA MURALI	0	0	0	0	0	0
43	220021086619	LEVIN MATHEW ABRAHAM	15	4	3	3	6	4
44	220021086621	MUHAMMED AMEEN	32	7	6	7	11	8
45	220021086622	NANDANA ANIL	80	17	14	18	26	18
46	220021086623	NANDHANA K MANOJ	80	15	12	18	23	16
47	220021086624	NEERAJA RAJESH	75	14	12	17	22	15
48	220021086625	NILA CHANDANA T S	66	13	10	15	20	13
49	220021086626	NIRAJ P NITIN	15	3	2	3	5	3
50	220021086627	NIYA ANN JACOB	43	10	8	9	15	10
51	220021086628	OHMDHIRDHE	77	16	13	17	24	17
52	220021086629	PRAJUL TOM	55	10	8	12	16	11

53	220021086630	RAHUL M	40	8	7	9	13	9
54	220021086631	RAICHEL KARUKANCHERIL	79	17	14	17	26	18
55	220021086632	RAKESH	50	9	8	11	14	10
56	220021086633	RICHARD CHRISTY PINSON	44	9	7	10	14	10
57	220021086634	SAJU P VARGHESE	30	6	5	7	10	7
58	220021086635	SIVARAM.D.KUMAR	1	0	0	0	0	0
59	220021086636	SREEHARI CS	50	12	10	11	19	13
60	220021086637	SREELAKSHMI N J	80	16	13	18	24	17
61	220021086638	STEPHEN MATHEW K M	60	11	9	13	17	12
62	220021086639	SUMI SUSAN JOSE	61	12	10	13	19	13
63	220021086640	VARSHA S	68	14	11	15	21	14
64	220021086641	VYSHNAVI P T	71	14	11	16	21	15
65	220021086642	JUSTIN JOY	52	10	8	11	16	11
66	220021089078	AKSA ABI ABRAHAM	0	0	0	0	0	0

SAINTGITS COLLEGE OF APPLIED SCIENCES

Kottukulam Hills, Pathamuttom P.O., Kottayam - 686 532

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B.Com / BCA / BBA/ B.A. Corp. Eco./
B.Sc. Psychology /M.Com / M.Sc.

RECORD OF ASSIGNMENTS

Name : ARPITHA ASOKAN

Course : DESIGN & ANALYSIS OF ALGORITHMS

SAINTGITS COLLEGE OF APPLIED SCIENCES

Kottukulam Hills, Pathamuttom P.O., Kottayam - 686 532

NAAC Re- Accredited with A Grade

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RECORD OF ASSIGNMENTS

Certified that this is a bonafide assignments done by

Name :..... ARPITHA ASOKAN .....

Reg. No :.....Academic Year..... 2022 - 25 .....

Programme..... BCA .....

Course..... DESIGN & ANALYSIS OF ALGORITHM .....

Faculty in Charge..... Asst. Prof. ARUN PADMANABHAN .....

Head of the Department..... Dr. AMBILI MERLIN KURUVILA .....

CONTENTS

SL.NO.	DATE	TITLE OF ASSIGNMENTS	TOTAL MARKS/ GRADE	MARKS AWARDED/ GRADE	REMARKS
1	19/12	Assignment 1	5	5	A
2	30/1	Assignment 2	5	5	A
3	5/2	Assignment 3	5	5	A
4	27/2	Assignment 4	5	5	A
5	19/3	Assignment 5	5	5	A

ASSIGNMENT-1

RECURSIVE BINARY SEARCH

```
int BinSrch (Type a[], int i, int l, Type x)
{
  if (l==i)
  {
    if (x==a[i])
      {
        return i; }
    else
      {
        return 0; }
  else
  {
    int mid = (i+l)/2;
    if (x==a[mid])
    {
      return mid; }
    else if (x < a[mid])
      {
        return BinSrch (a, i, mid-1, x); }
    else
      {
        return BinSrch (a, mid+1, l, x); }
    }
}
```

ASSIGNMENT - 2

GREEDY ALGORITHM

```
SetType Greedy (Type a[], int n)
{
    for(initialize; i<=n; i++)
    {
        Type x = Select(a);
        if Feasible (solution, x)
        {
            solution = Union (solution, x);
        }
    }
    return solution;
}
```

ASSIGNMENT-3

DYNAMIC PROGRAMMING

```
void FGraph (graph G, int k, int n, int p[])
{
    float cost[MAXSIZE];
    int d[MAXSIZE], r;
    cost[n] = 0.0;
    for (int j = k; j >= 1; j--)
    {
        cost[j] = c[j][r] + cost[r];
        d[j] = r;
    }
    p[1] = 1;
    p[k] = n;
    for (j = 2; j <= k-1; j++)
    {
        p[j] = d[p[j-1]];
    }
}
```

ASSIGNMENT - 4

ALL PAIR SHORTEST PATH

```
void AllPaths (float cost[][SIZE], float A[][SIZE], int n)
{
for (int i=1; i<=n; i++)
  {
   for (int j=1 ; j<=n; j++)
    {
      A[i][j] = cost [i][j]; }
   }
  for (int k= 1; k<=n; k++)
    {
     for (int i=1 ; i<=n; i++)
      {
       for (int j =1 ; j<=n; j++)
        {
          A[i][j] = min (A[i][j], A[i][k] + A[k][j]);
        }
      }
    }
}
```

ASSIGNMENT-5

BFS & DFS

BFS :-

```
void BFS (int v)
{
  int u = v;
  Queue q[SIZE];
  visited[v] = 1;
  do{
     for all vertices w adjacent from u {
        if (visited[w] == 0)
        {
           q.AddQ(w);
           visited[w] = 1;
        }
     }
     if (q.QEmpty())
     {
        return; }
     q.DeleteQ(u);
  } while(1);
}

void BFT (struct treenode G[], int n)
{
  int i;
  boolean visited[SIZE];
```

```
for (i=1; i<=n; i++)
{
    visited[i]=0; }
for (i=1; i<=n; i++)
{
   if (!visited[i])
     {
        BFS(i); }
}}
```

DFS :-

```
    void DFS (int v)
    {
       visited[v]=1;
       for each vertex w adjacent from v
        {
          if (!visited[w])
            { DFS(w); }
        }
    }
```

Marks For Assignments

Roll No	Student ID	Name of student	Assignment 1 [5.00]	Assignment 2 [5.00]	Assignment 3 [5.00]	Assignment 4 [5.00]	Assignment 5 [5.00]
01	adinath.bca2225@saintgits.org	A ADINATH	5	5	5	5	5
02	aadhils.bca2225@saintgits.org	AADHIL S	5	5	5	5	5
03	aaronkj.bca2225@saintgits.org	AARON K JIJO	5	5	5	5	5
04	abhinand.bca2225@saintgits.org	ABHINAND M A	5	5	5	5	5
05	abhinavg.bca2225@saintgits.org	ABHINAV GOPAN	5	5	5	5	5
06	abhirams.bca2225@saintgits.org	ABHIRAM SREEKUMAR	5	5	5	5	5
07	abinak.bca2225@saintgits.org	ABIN ABRAHAM KOTTANIPRAL	5	5	5	5	5
08	abrahamj.bca2225@saintgits.org	ABRAHAM J ALAMPALLIL	5	5	5	5	5
09	adithraj.bca2225@saintgits.org	ADITHRAJ N	5	5	5	5	5
10	akhilv.bca2225@saintgits.org	AKHIL VARGHESE	5	5	5	5	5
12	albins.bca2225@saintgits.org	ALBIN SIBY	5	5	5	5	5
14	alvinb.bca2225@saintgits.org	ALVIN BAIJU	5	5	5	5	5
15	alwinj.bca2225@saintgits.org	ALWIN JOSE	5	5	5	5	5
16	amalj.bca2225@saintgits.org	AMAL JAYAKUMAR	5	5	5	5	5
17	amithks.bca2225@saintgits.org	AMITH K SAJI	5	5	5	5	5
18	anaghalb.bca2225@saintgits.org	ANAGHA LAKSHMI B	5	5	5	5	5
19	anfas.bca2225@saintgits.org	ANFAS P HANISH	5	5	5	5	5
20	anjanas.bca2225@saintgits.org	ANJANA SAJIKUMAR	5	5	5	5	5
21	antos.bca2225@saintgits.org	ANTOS BIJU	5	5	5	5	5
22	archanas.bca2225@saintgits.org	ARCHANA S NAIR	5	5	5	5	5
23	arpithaa.bca2225@saintgits.org	ARPITHA ASOKAN	5	5	5	5	5
24	arthanap.bca2225@saintgits.org	ARTHANA PRADEEP	5	5	5	5	5
25	athiraps.bca2225@saintgits.org	ATHIRA P S	5	5	5	5	5
26	athulsk.bca2225@saintgits.org	ATHUL S. KRISHNA	5	5	5	5	5
27	athulyaa.bca2225@saintgits.org	ATHULYA ANIL	5	5	5	5	5
28	sb.bca2225@saintgits.org	B SREELAKSHMI	5	5	5	5	5
29	bileenav.bca2225@saintgits.org	BILEENA VARUGHESE	5	5	5	5	5
30	cheriant.bca2225@saintgits.org	CHERIAN T THAYIL	5	5	5	5	5
31	ds.bca2225@saintgits.org	DEVANANDHA S	5	5	5	5	5
32	dianarb.bca2225@saintgits.org	DIANA REEBA BENJAMIN	5	5	5	5	5
33	emils.bca2225@saintgits.org	EMIL SUNNY	5	5	5	5	5
34	farhans.bca2225@saintgits.org	FARHAN SIYAD	5	5	5	5	5
35	gayathri.bca2225@saintgits.org	GAYATHRI MANOJ	5	5	5	5	5
36	geethika.bca2225@saintgits.org	GEETHIKA A	5	5	5	5	5
37	georgerj.bca2225@saintgits.org	GEORGE RIGIN JAMES	5	5	5	5	5
38	jeswins.bca2225@saintgits.org	JESWIN SEBASTIAN	5	5	5	5	5
39	joet.bca2225@saintgits.org	JOE THOMAS	5	5	5	5	5
40	johinj.bca2225@saintgits.org	JOHIN JOHN	5	5	5	5	5
41	joshily.bca2225@saintgits.org	JOSHILY MARY JOSE	5	5	5	5	5
42	justinj.bca2225@saintgits.org	JUSTIN JOY	5	5	5	5	5
43	karthik.bca2225@saintgits.org	KARTHIK P NAIR	5	5	5	5	5
44	karthiks.bca2225@saintgits.org	KARTHIK SUDARSANAN	5	5	5	5	5
45	krishnam.bca2225@saintgits.org	KRISHNA MURALI	5	5	5	5	5
46	levinma.bca2225@saintgits.org	LEVIN MATHEW ABRAHAM	5	5	5	5	5
48	muhammed.bca2225@saintgits.org	MUHAMMED AMEEN	5	5	5	5	5
49	nandana.bca2225@saintgits.org	NANDANA ANIL	5	5	5	5	5
50	nandhana.bca2225@saintgits.org	NANDHANA K MANOJ	5	5	5	5	5

Roll No	Student ID	Name of student	Assignment 1 [5.00]	Assignment 2 [5.00]	Assignment 3 [5.00]	Assignment 4 [5.00]	Assignment 5 [5.00]
51	neeraja.bca2225@saintgits.org	NEERAJA RAJESH	5	5	5	5	5
52	nilacts.bca2225@saintgits.org	NILA CHANDANA T S	5	5	5	5	5
53	nirajpn.bca2225@saintgits.org	NIRAJ P NITIN	5	5	5	5	5
54	niyaaj.bca2225@saintgits.org	NIYA ANN JACOB	5	5	5	5	5
55	ohm.bca2225@saintgits.org	OHMDHIRDHE	5	5	5	5	5
56	prajult.bca2225@saintgits.org	PRAJUL TOM	5	5	5	5	5
57	rahulm.bca2225@saintgits.org	RAHUL M	5	5	5	5	5
58	raichel.bca2225@saintgits.org	RAICHEL KARUKANCHERIL THOMAS	5	5	5	5	5
59	rakesh.bca2225@saintgits.org	RAKESH	5	5	5	5	5
60	richard.bca2225@saintgits.org	RICHARD CHRISTY PINSON	5	5	5	5	5
61	sajupv.bca2225@saintgits.org	SAJU P VARGHESE	5	5	5	5	5
62	sivaram.bca2225@saintgits.org	SIVARAM.D.KUMAR	5	5	5	5	5
63	sreehari.bca2225@saintgits.org	SREEHARI CS	5	5	5	5	5
64	snj.bca2225@saintgits.org	SREELAKSHMI N J	5	5	5	5	5
65	stephen.bca2225@saintgits.org	STEPHEN MATHEW K M	5	5	5	5	5
66	sumisj.bca2225@saintgits.org	SUMI SUSAN JOSE	5	5	5	5	5
7	varshas.bca2225@saintgits.org	VARSHA S	5	5	5	5	5
68	vyshnavi.bca2225@saintgits.org	VYSHNAVI P T	5	5	5	5	5
69	aksa.bca2225@saintgits.org	AKSA ABI	5	5	5	5	5
70	rohangp.bca2225@saintgits.org	ROHAN GEO PHILIPS	5	5	5	5	5

Assignment Marks

Semester : IV **Programme: BCA**

Subject with Code: CS4CRT09 Design & Analysis of Algorithms **Faculty:** Arun Padmanabhan [AP]

Roll No	Register No	Name	Assignment					Average
			1	2	3	4	5	
Course Outcome			CO 2	CO 5	CO 3	CO 4	CO 5	
			Maximum Marks					
			5	5	5	5	5	
1	220021086575	A ADINATH	5	5	4	5	5	4.80
2	220021086576	AADHIL S	5	5	4	5	5	4.80
3	220021086577	AARON K JIJO	5	5	5	5	5	5.00
4	220021086578	ABHINAND M A	5	5	4	5	5	4.80
5	220021086579	ABHINAV GOPAN	5	5	5	5	5	5.00
6	220021086580	ABHIRAM SREEKUMAR	5	5	5	5	5	5.00
7	220021086581	ABIN ABRAHAM KOTTANIPRAL	5	5	5	5	5	5.00
8	220021086582	ABRAHAM J ALAMPALLIL	5	5	5	5	5	5.00
9	220021086583	ADITHRAJ N	5	5	5	5	5	5.00
10	220021086584	AKHIL VARGHESE	5	5	4	5	5	4.80
11	220021086585	ALBIN SIBY	5	5	5	5	5	5.00
12	220021086587	ALVIN BAIJU	5	5	4	5	5	4.80
13	220021086588	ALWIN JOSE	5	5	5	5	5	5.00
14	220021086589	AMAL JAYAKUMAR	5	5	5	5	5	5.00
15	220021086590	AMITH K SAJI	5	5	4	5	5	4.80
16	220021086592	ANAGHA LAKSHMI B	5	5	5	5	5	5.00
17	220021086593	ANFAS P HANISH	5	5	5	5	5	5.00
18	220021086594	ANJANA SAJIKUMAR	5	5	5	5	5	5.00
19	220021086595	ANTOS BIJU	5	5	5	5	5	5.00
20	220021086596	ARCHANA S NAIR	5	5	5	5	5	5.00
21	220021086597	ARPITHA ASOKAN	5	5	3	5	5	4.60
22	220021086598	ARTHANA PRADEEP	5	5	5	5	5	5.00
23	220021086599	ATHIRA P S	5	5	4	5	5	4.80
24	220021086600	ATHUL S. KRISHNA	5	5	5	5	5	5.00
25	220021086601	ATHULYA ANIL	5	5	5	5	5	5.00
26	220021086602	B SREELAKSHMI	5	5	4	5	5	4.80
27	220021086603	BILEENA VARUGHESE	5	5	5	5	5	5.00
28	220021086604	CHERIAN T THAYIL	5	5	5	5	5	5.00
29	220021086605	DEVANANDHA S	5	5	4	5	5	4.80
30	220021086606	DIANA REEBA BENJAMIN	5	5	5	5	5	5.00
31	220021086607	EMIL SUNNY	5	5	5	5	5	5.00

32	220021086608	FARHAN SIYAD	5	5	5	5	5	5.00
33	220021086609	GAYATHRI MANOJ	5	5	5	5	5	5.00
34	220021086610	GEETHIKA A	5	5	5	5	5	5.00
35	220021086611	GEORGE RIGIN JAMES	5	5	5	5	5	5.00
36	220021086612	JESWIN SEBASTIAN	5	5	5	5	5	5.00
37	220021086613	JOE THOMAS	5	5	5	5	5	5.00
38	220021086614	JOHIN JOHN	5	5	5	5	5	5.00
39	220021086615	JOSHILY MARY JOSE	5	5	5	5	5	5.00
40	220021086616	KARTHIK P NAIR	5	5	5	5	5	5.00
41	220021086617	KARTHIK SUDARSANAN	5	5	5	5	5	5.00
42	220021086618	KRISHNA MURALI	5	5	5	5	5	5.00
43	220021086619	LEVIN MATHEW ABRAHAM	5	5	5	5	5	5.00
44	220021086621	MUHAMMED AMEEN	5	5	5	5	5	5.00
45	220021086622	NANDANA ANIL	5	5	5	5	5	5.00
46	220021086623	NANDHANA K MANOJ	5	5	5	5	5	5.00
47	220021086624	NEERAJA RAJESH	5	5	5	5	5	5.00
48	220021086625	NILA CHANDANA T S	5	5	5	5	5	5.00
49	220021086626	NIRAJ P NITIN	5	5	5	5	5	5.00
50	220021086627	NIYA ANN JACOB	5	5	5	5	5	5.00
51	220021086628	OHMDHIRDHE	5	5	5	5	5	5.00
52	220021086629	PRAJUL TOM	5	5	5	5	5	5.00
53	220021086630	RAHUL M	5	5	5	5	5	5.00
54	220021086631	RAICHEL KARUKANCHERIL THOMAS	5	5	5	5	5	5.00
55	220021086632	RAKESH	5	5	5	5	5	5.00
56	220021086633	RICHARD CHRISTY PINSON	5	5	5	5	5	5.00
57	220021086634	SAJU P VARGHESE	5	5	5	5	5	5.00
58	220021086635	SIVARAM.D.KUMAR	5	5	5	5	5	5.00
59	220021086636	SREEHARI CS	5	5	5	5	5	5.00
60	220021086637	SREELAKSHMI N J	5	5	5	5	5	5.00
61	220021086638	STEPHEN MATHEW K M	5	5	5	5	5	5.00
62	220021086639	SUMI SUSAN JOSE	5	5	5	5	5	5.00
63	220021086640	VARSHA S	5	5	5	5	5	5.00
64	220021086641	VYSHNAVI P T	5	5	5	5	5	5.00
65	220021086642	JUSTIN JOY	5	5	5	5	5	5.00
66	220021089078	AKSA ABI ABRAHAM	5	5	5	5	5	5.00

SAINTGITS
COLLEGE OF APPLIED SCIENCES

KOTTUKULAM HILLS, PATHAMUTTOM P.O., KOTTAYAM - 686 532

NAAC Re- Accredited with A Grade

SAINTGITS
LEARN.GROW.EXCEL

B.Com / BCA / BBA/ B.A. Corp. Eco./ B.Sc. Psychology / M.Com / M.Sc.

TEST PAPER BOOK

TEST	DATE	FACULTY	Marks awarded	Total marks
TEST 1	12/03	AP	9	10
TEST 2	13/03	AP	10	10
TEST 3	13/03	AP	8	10
TEST 4	19/03	AP	10	10
TEST 5	19/03	AP	10	10
TEST 6				

Name : Aapitha Askar

Course : Design & Analysis of Algorithm

Class:

Write the eqns of Strassen's Matrix Multiplication. Also prove the same for the matrix

$$A = \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix}$$

Eqns

$$A = \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix} \qquad B = \begin{bmatrix} B_{11} & B_{12} \\ B_{21} & B_{22} \end{bmatrix}$$

$$A * B = C \begin{bmatrix} C_{11} & C_{12} \\ C_{21} & C_{22} \end{bmatrix}$$

$P = (A_{11} + A_{22})(B_{11} + B_{22})$

$Q = (A_{21} + A_{22}) B_{11}$

$R = A_{11} (B_{12} - B_{22})$

$S = A_{22} (B_{21} - B_{11})$

$T = (A_{12} + A_{11}) B_{22}$

$U = (A_{21} - A_{11})(B_{12} + B_{11})$

$V = (A_{12} - A_{22})(B_{21} + B_{22})$

$C_{11} = P + S - T + V$

$C_{12} = R + T$

$C_{21} = Q + S$

$C_{22} = P + R - Q + U$

By Strassen's method:-

$$A = \begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix} \qquad B = \begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix}$$

$P = (A_{11} + A_{22})(B_{11} + B_{22}) = (1+2)(2+1) = 3 \times 3 = 9$

$Q = (A_{21} + A_{22}) B_{11} = (1+2)2 = 3 \times 2 = 6$

$R = A_{11}(B_{12} - B_{22}) = 1(1-1) = 0$

$S = A_{22}(B_{21} - B_{11}) = 2(1-2) = 2(-1) = -2$

$T = (B_{12} + B_{11})(A_{12} + A_{11}) B_{22} = (1+1)1 = 2$

~~$U = (A_{21} - A_{22})$~~

$U = (A_{21} - A_{11})(B_{11} + B_{12}) = (1-1)(2+1) = 0 \times 3 = 0$

$V = (A_{12} - A_{22})(B_{22} + B_{21}) = (1-2)(1+1) = (-1)(2) = -2$

$C_{11} = P + S - T + V = 9 + (-2) - 2 + (-2) = 9 - 6 = 3$

$C_{12} = R + T = 0 + 2 = 2$

$C_{21} = Q + S = 6 + (-2) = 4$

$C_{22} = P + R - Q + U = 9 + 0 - 6 + 0 = 3$

$$C = \begin{bmatrix} 3 & 2 \\ 4 & 3 \end{bmatrix}$$

Normal method:-

$C_{11} = A_{11} B_{11} + A_{21} B_{12} = 1(2) + (1)(1) = 2 + 1 = 3$

$C_{12} = A_{11} B_{21} + A_{21} + B_{22} = 1(1) + 1(1) = 1 + 1 = 2$

$C_{22} = A_{12} B_{21} + A_{22} B_{22} = 1(1) + 2(1) = 1 + 2 = 3$

$C_{21} = A_{12} B_{11} + A_{22} B_{12} = 1(2) + 2(1) = 2 + 2 = 4$

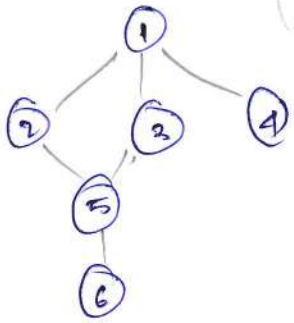
$$C = \begin{bmatrix} 3 & 2 \\ 4 & 3 \end{bmatrix}$$

Since the answer found in both methods are same Strassen's Matrix Multiplication is Proved.

9½/10

TEST PAPER-2

Q. Write the algorithm of BFS & DFS. Print the traversal of the given graph using BFS or DFS



BFS:-

```
void BFS (struct node G[], int n)
{
 int i, visited [SIZE];
 for (i=1; i<=n; i++)
  {
    visited [i]=0;
 for (i=1 ; i<=n; i++)
  { if (! visited [i])
     { BFS (i); }
  }}

void BFS (int v)
{
 int u=v , q[SIZE];
  visited [v]=1
  do {
   for all vertices w adjacent from u
    {
```

```
if (visited[w] == 0)
{
    q.AddQ(w);
    visited[w] = 1;
}
}
if (q.QEmpty())
{ return; }
q.DeleteQ(v);
} while (1);
}
```

TEST PAPER-3

Consider the instance of knapsack problem $n=3$, $m=20$, $(P_1, P_2, P_3) = (25, 24, 15)$, $(w_1, w_2, w_3) = (18, 15, 10)$

A	1	2	3	TW	TP
1	1/2	1/3	1/4	16.5	12.5 + 8 + 3.75 = 24.25
2	1/3	1/5	1	19	8.3 + 4.8 + 15 = 28.1
3	1/6	1	1/5	20	4.16 + 24 + 3 = 31.16

algorithm

$\frac{P_i}{w_i} \Rightarrow \frac{25}{18} = 1.38$

$\frac{24}{15} = 1.6$

$\frac{15}{10} = 1.5$

void greedy knapsack (20, 3)

{

for (int i = 1; i <= 3;)

x[i] = 0

i = 2

2 <= 3

x[2] = 0

i = 3; 3 <= 3

x[3] = 0

for (i = 1 ; i <= 3)

{

if (w[i] > 20) // false x[i] = 1

x[i] = 1 }

u = w[i] // u = u - w[i] = 20 - 15 // 5

cout u = m

for (i = 2 ; 2 <= 3)

{ if (w[2] > u) // 10 > 5 x[2] = 1/2

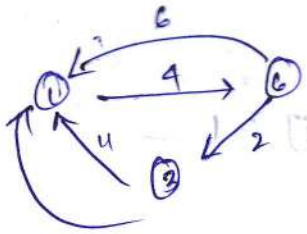
break

exit from loop :- if (2 <= 3

x[2] = 5/10 = 1/2 . x[3] = 0

Profit = 24 + 7 1/2 = 31 1/2

8/10

2. 

solve using all pairs shortest path.

```
void AllPaths(float cost[][SIZE], float A[][SIZE], int n)
{
  for (i=1; i<=3; i++)
  {
    for (j=1; j<=3; j++)
      A[i][j] = cost[i][j]; // 0
  }
  for (i=1; i<=3; i++)
  {
    for (j=2; j<=3; j++)
      A[i][2] = cost[i][2] // 9
  }
  for (i=1; i<=3; i++)
  {
    for (j=3; j<=3; j++)
      A[i][3] = cost[i][3] // 11
  }
  .
  .
  .
  A[3][3] = cost[3][3] // 0

  for (k=1; k<=3; k++)
    for (i=1; i<=3; i++)
      for (j=1; j<=3; j++)
        A[i][j] = min(A[i][j], A[i][k] + A[k][j])

  for (i=1; i<=3; i++)
  {
    for (j=2; j<=3; j++)
      A[i][2] = min(A[i][2], A[i][1] + A[1]
```

$A[3][3] = \min(A[2][3], A[3][1] + A[1][3])$

6/10

Course Evaluation Feedback

Semester : IV **Programme: BCA**

Subject with Code: CS4CRT09 Design & Analysis of Algorith **Faculty:** Arun Padmanabhan [AP]

Roll No	Register No	Name	Course Evaluation Feedback					
			1	2	3	4	5	Average
Course Outcome			CO 1	CO 2	CO 3	CO 4	CO 5	
1	220021086575	A ADINATH	5	5	5	5	5	5.00
2	220021086576	AADHIL S	4	5	3	4	4	4.00
3	220021086577	AARON K JIJO	5	3	3	5	5	4.20
4	220021086578	ABHINAND M A	4	4	4	4	4	4.00
5	220021086579	ABHINAV GOPAN	4	4	4	4	4	4.00
6	220021086580	ABHIRAM SREEKUMAR	4	4	3	4	4	3.80
7	220021086581	ABIN ABRAHAM KOTTANIPRAL	4	4	3	4	4	3.80
8	220021086582	ABRAHAM J ALAMPALLIL	4	4	3	4	4	3.80
9	220021086583	ADITHRAJ N	3	3	5	3	3	3.40
10	220021086584	AKHIL VARGHESE	5	4	4	5	5	4.60
11	220021086585	ALBIN SIBY	5	5	5	5	5	5.00
12	220021086587	ALVIN BAIJU	4	4	4	4	4	4.00
13	220021086588	ALWIN JOSE	4	4	4	4	4	4.00
14	220021086589	AMAL JAYAKUMAR	4	4	3	4	4	3.80
15	220021086590	AMITH K SAJI	5	5	5	5	5	5.00
16	220021086592	ANAGHA LAKSHMI B	5	3	5	5	5	4.60
17	220021086593	ANFAS P HANISH	4	5	5	4	4	4.40
18	220021086594	ANJANA SAJIKUMAR	5	5	3	5	5	4.60
19	220021086595	ANTOS BIJU	4	3	3	4	4	3.60
20	220021086596	ARCHANA S NAIR	4	4	4	4	4	4.00
21	220021086597	ARPITHA ASOKAN	4	4	4	4	4	4.00
22	220021086598	ARTHANA PRADEEP	4	4	3	4	4	3.80
23	220021086599	ATHIRA P S	4	4	3	4	4	3.80
24	220021086600	ATHUL S. KRISHNA	3	4	3	3	3	3.20
25	220021086601	ATHULYA ANIL	4	3	5	4	4	4.00
26	220021086602	B SREELAKSHMI	5	4	4	5	5	4.60
27	220021086603	BILEENA VARUGHESE	4	4	5	4	4	4.20
28	220021086604	CHERIAN T THAYIL	4	4	4	4	4	4.00
29	220021086605	DEVANANDHA S	4	4	5	4	4	4.20
30	220021086606	DIANA REEBA BENJAMIN	4	4	3	4	4	3.80
31	220021086607	EMIL SUNNY	5	5	5	5	5	5.00
32	220021086608	FARHAN SIYAD	5	3	5	5	5	4.60
33	220021086609	GAYATHRI MANOJ	5	5	5	5	5	5.00
34	220021086610	GEETHIKA A	5	5	5	5	5	5.00

35	220021086611	GEORGE RIGIN JAMES	5	5	5	5	5	5.00
36	220021086612	JESWIN SEBASTIAN	5	5	5	5	5	5.00
37	220021086613	JOE THOMAS	5	5	5	5	5	5.00
38	220021086614	JOHIN JOHN	5	5	5	5	5	5.00
39	220021086615	JOSHILY MARY JOSE	5	5	5	5	5	5.00
40	220021086616	KARTHIK P NAIR	5	5	5	5	5	5.00
41	220021086617	KARTHIK SUDARSANAN	5	5	5	5	5	5.00
42	220021086618	KRISHNA MURALI	5	5	5	5	5	5.00
43	220021086619	LEVIN MATHEW ABRAHAM	5	5	5	5	5	5.00
44	220021086621	MUHAMMED AMEEN	5	5	5	5	5	5.00
45	220021086622	NANDANA ANIL	5	5	5	5	5	5.00
46	220021086623	NANDHANA K MANOJ	5	5	5	5	5	5.00
47	220021086624	NEERAJA RAJESH	5	5	5	5	5	5.00
48	220021086625	NILA CHANDANA T S	5	5	5	5	5	5.00
49	220021086626	NIRAJ P NITIN	5	5	5	5	5	5.00
50	220021086627	NIYA ANN JACOB	5	5	5	5	5	5.00
51	220021086628	OHMDHIRDHE	5	5	5	5	5	5.00
52	220021086629	PRAJUL TOM	5	5	5	5	5	5.00
53	220021086630	RAHUL M	5	5	5	5	5	5.00
54	220021086631	RAICHEL KARUKANCHERIL THOMAS	5	5	5	5	5	5.00
55	220021086632	RAKESH	5	5	5	5	5	5.00
56	220021086633	RICHARD CHRISTY PINSON	5	5	5	5	5	5.00
57	220021086634	SAJU P VARGHESE	5	5	5	5	5	5.00
58	220021086635	SIVARAM.D.KUMAR	5	5	5	5	5	5.00
59	220021086636	SREEHARI CS	5	5	5	5	5	5.00
60	220021086637	SREELAKSHMI N J	5	4	4	5	5	4.60
61	220021086638	STEPHEN MATHEW K M	5	4	4	5	5	4.60
62	220021086639	SUMI SUSAN JOSE	5	4	4	5	5	4.60
63	220021086640	VARSHA S	5	4	4	5	5	4.60
64	220021086641	VYSHNAVI P T	5	4	4	5	5	4.60
65	220021086642	JUSTIN JOY	5	4	4	5	5	4.60
66	220021089078	AKSA ABI ABRAHAM	5	4	4	5	5	4.60

Consolidate Course Outcomes

Semester : IV

Subject with Code: CS4CRT09 Design & Analysis of Algorithms

Programme: BCA

Faculty: Arun Padmanabhan [AP]

Roll No	Register No	Name	Model Examination					Assignment					Course Evaluation Feedback					Final CO Evaluation (Series Exam 50% Weightage + Assignment 30% Weightage + Feedback 20%)				
			CO 1	CO 2	CO 3	CO 4	CO 5	CO 1	CO 2	CO 3	CO 4	CO 5	CO 1	CO 2	CO 3	CO 4	CO 5	CO 1	CO 2	CO 3	CO 4	CO 5
			21	17	26	32	22	5	5	5	5	5	5	5	5	5	5					
1	220021086575	A ADINATH	11	9	13	16	11	5	5	4	5	5	5	5	5	5	5	0.75	0.75	0.69	0.75	0.75
2	220021086576	AADHIL S	3	2	3	4	3	5	5	4	5	5	4	5	3	4	4	0.52	0.56	0.42	0.52	0.52
3	220021086577	AARON K JIJO	4	3	4	6	4	5	5	5	5	5	5	3	3	5	5	0.60	0.52	0.50	0.60	0.60
4	220021086578	ABHINAND M A	6	5	6	9	6	5	5	4	5	5	4	4	4	4	4	0.60	0.60	0.51	0.60	0.60
5	220021086579	ABHINAV GOPAN	10	8	10	15	10	5	5	5	5	5	4	4	4	4	4	0.69	0.69	0.65	0.69	0.69
6	220021086580	ABHIRAM SREEKUMAR	5	4	5	8	5	5	5	5	5	5	4	4	3	4	4	0.58	0.58	0.52	0.58	0.58
7	220021086581	ABIN ABRAHAM KOTTANIPRAL	13	11	13	20	14	5	5	5	5	5	4	4	3	4	4	0.78	0.78	0.67	0.78	0.78
8	220021086582	ABRAHAM J ALAMPALLIL	7	6	8	11	7	5	5	5	5	5	4	4	3	4	4	0.62	0.62	0.57	0.62	0.62
9	220021086583	ADITHRAJ N	15	12	15	23	16	5	5	5	5	5	3	3	5	3	3	0.78	0.78	0.80	0.78	0.78
10	220021086584	AKHIL VARGHESE	6	5	7	9	6	5	5	4	5	5	5	4	4	5	5	0.64	0.60	0.53	0.64	0.64
11	220021086585	ALBIN SIBY	7	6	7	11	8	5	5	5	5	5	5	5	5	5	5	0.67	0.67	0.64	0.67	0.67
12	220021086587	ALVIN BAIJU	1	1	1	1	1	5	5	4	5	5	4	4	4	4	4	0.48	0.48	0.41	0.48	0.48
13	220021086588	ALWIN JOSE	9	7	8	14	9	5	5	5	5	5	4	4	4	4	4	0.67	0.67	0.62	0.67	0.67
14	220021086589	AMAL JAYAKUMAR	12	10	13	19	13	5	5	5	5	5	4	4	3	4	4	0.76	0.76	0.67	0.76	0.76
15	220021086590	AMITH K SAJI	1	0	1	1	1	5	5	4	5	5	5	5	5	5	5	0.51	0.51	0.45	0.51	0.51
16	220021086592	ANAGHA LAKSHMI B	15	12	14	23	16	5	5	5	5	5	5	3	5	5	5	0.86	0.78	0.77	0.86	0.86
17	220021086593	ANFAS P HANISH	2	1	2	3	2	5	5	5	5	5	4	5	5	4	4	0.50	0.54	0.54	0.50	0.50
18	220021086594	ANJANA SAJIKUMAR	18	14	17	27	19	5	5	5	5	5	5	5	3	5	5	0.92	0.92	0.74	0.92	0.92
19	220021086595	ANTOS BIJU	12	9	14	18	12	5	5	5	5	5	4	3	3	4	4	0.73	0.69	0.68	0.73	0.73
20	220021086596	ARCHANA S NAIR	9	7	9	13	9	5	5	5	5	5	4	4	4	4	4	0.67	0.67	0.64	0.67	0.67
21	220021086597	ARPITHA ASOKAN	7	5	7	10	7	5	5	3	5	5	4	4	4	4	4	0.62	0.62	0.47	0.62	0.62
22	220021086598	ARTHANA PRADEEP	12	10	12	19	13	5	5	5	5	5	4	4	3	4	4	0.75	0.75	0.66	0.75	0.75
23	220021086599	ATHIRA P S	12	9	13	18	12	5	5	4	5	5	4	4	3	4	4	0.74	0.74	0.61	0.74	0.74
24	220021086600	ATHUL S. KRISHNA	6	5	6	9	6	5	5	5	5	5	3	4	3	3	3	0.55	0.59	0.54	0.55	0.55
25	220021086601	ATHULYA ANIL	9	7	9	14	9	5	5	5	5	5	4	3	5	4	4	0.67	0.63	0.67	0.67	0.67
26	220021086602	B SREELAKSHMI	13	11	14	20	14	5	5	4	5	5	5	4	4	5	5	0.82	0.78	0.67	0.82	0.82
27	220021086603	BILEENA VARUGHESE	8	6	9	12	8	5	5	5	5	5	4	4	5	4	4	0.65	0.65	0.67	0.65	0.65
28	220021086604	CHERIAN T THAYIL	13	11	14	21	14	5	5	5	5	5	4	4	4	4	4	0.78	0.78	0.73	0.78	0.78
29	220021086605	DEVANANDHA S	13	10	14	20	13	5	5	4	5	5	4	4	5	4	4	0.76	0.76	0.72	0.76	0.76
30	220021086606	DIANA REEBA BENJAMIN	15	12	16	22	15	5	5	5	5	5	4	4	3	4	4	0.81	0.81	0.73	0.81	0.81
31	220021086607	EMIL SUNNY	10	8	11	15	10	5	5	5	5	5	5	5	5	5	5	0.74	0.74	0.72	0.74	0.74
32	220021086608	FARHAN SIYAD	6	5	7	9	7	5	5	5	5	5	5	3	5	5	5	0.65	0.57	0.63	0.65	0.65
33	220021086609	GAYATHRI MANOJ	15	12	15	22	15	5	5	5	5	5	5	5	5	5	5	0.85	0.85	0.78	0.85	0.85
34	220021086610	GEETHIKA A	8	7	9	12	9	5	5	5	5	5	5	5	5	5	5	0.69	0.69	0.68	0.69	0.69
35	220021086611	GEORGE RIGIN JAMES	6	5	6	9	6	5	5	5	5	5	5	5	5	5	5	0.64	0.64	0.62	0.64	0.64
36	220021086612	JESWIN SEBASTIAN	4	3	4	6	4	5	5	5	5	5	5	5	5	5	5	0.59	0.59	0.58	0.59	0.59

37	220021086613	JOE THOMAS	6	5	6	10	7	5	5	5	5	5	5	5	5	5	5	0.65	0.65	0.62	0.65	0.65
38	220021086614	JOHIN JOHN	2	2	2	3	2	5	5	5	5	5	5	5	5	5	5	0.55	0.55	0.54	0.55	0.55
39	220021086615	JOSHILY MARY JOSE	17	14	16	26	18	5	5	5	5	5	5	5	5	5	5	0.90	0.90	0.81	0.90	0.90
40	220021086616	KARTHIK P NAIR	8	7	10	13	9	5	5	5	5	5	5	5	5	5	5	0.70	0.70	0.69	0.70	0.70
41	220021086617	KARTHIK SUDARSANAN	13	11	14	20	14	5	5	5	5	5	5	5	5	5	5	0.82	0.82	0.77	0.82	0.82
42	220021086618	KRISHNA MURALI	0	0	0	0	0	5	5	5	5	5	5	5	5	5	5	0.50	0.50	0.50	0.50	0.50
43	220021086619	LEVIN MATHEW ABRAHAM	4	3	3	6	4	5	5	5	5	5	5	5	5	5	5	0.59	0.59	0.56	0.59	0.59
44	220021086621	MUHAMMED AMEEN	7	6	7	11	8	5	5	5	5	5	5	5	5	5	5	0.67	0.67	0.64	0.67	0.67
45	220021086622	NANDANA ANIL	17	14	18	26	18	5	5	5	5	5	5	5	5	5	5	0.91	0.91	0.84	0.91	0.91
46	220021086623	NANDHANA K MANOJ	15	12	18	23	16	5	5	5	5	5	5	5	5	5	5	0.86	0.86	0.84	0.86	0.86
47	220021086624	NEERAJA RAJESH	14	12	17	22	15	5	5	5	5	5	5	5	5	5	5	0.84	0.84	0.82	0.84	0.84
48	220021086625	NILA CHANDANA T S	13	10	15	20	13	5	5	5	5	5	5	5	5	5	5	0.81	0.81	0.78	0.81	0.81
49	220021086626	NIRAJ P NITIN	3	2	3	5	3	5	5	5	5	5	5	5	5	5	5	0.57	0.57	0.56	0.57	0.57
50	220021086627	NIYA ANN JACOB	10	8	9	15	10	5	5	5	5	5	5	5	5	5	5	0.74	0.74	0.68	0.74	0.74
51	220021086628	OHMDHIRDHE	16	13	17	24	17	5	5	5	5	5	5	5	5	5	5	0.88	0.88	0.83	0.88	0.88
52	220021086629	PRAJUL TOM	10	8	12	16	11	5	5	5	5	5	5	5	5	5	5	0.75	0.75	0.73	0.75	0.75
53	220021086630	RAHUL M	8	7	9	13	9	5	5	5	5	5	5	5	5	5	5	0.70	0.70	0.67	0.70	0.70
54	220021086631	RAICHEL KARUKANCHERIL THOMAS	17	14	17	26	18	5	5	5	5	5	5	5	5	5	5	0.90	0.90	0.83	0.90	0.90
55	220021086632	RAKESH	9	8	11	14	10	5	5	5	5	5	5	5	5	5	5	0.72	0.72	0.71	0.72	0.72
56	220021086633	RICHARD CHRISTY PINSON	9	7	10	14	10	5	5	5	5	5	5	5	5	5	5	0.72	0.72	0.69	0.72	0.72
57	220021086634	SAJU P VARGHESE	6	5	7	10	7	5	5	5	5	5	5	5	5	5	5	0.65	0.65	0.63	0.65	0.65
58	220021086635	SIVARAM.D.KUMAR	0	0	0	0	0	5	5	5	5	5	5	5	5	5	5	0.51	0.51	0.50	0.51	0.51
59	220021086636	SREEHARI CS	12	10	11	19	13	5	5	5	5	5	5	5	5	5	5	0.79	0.79	0.71	0.79	0.79
60	220021086637	SREELAKSHMI N J	16	13	18	24	17	5	5	5	5	5	5	4	4	5	5	0.88	0.84	0.80	0.88	0.88
61	220021086638	STEPHEN MATHEW K M	11	9	13	17	12	5	5	5	5	5	5	4	4	5	5	0.77	0.73	0.71	0.77	0.77
62	220021086639	SUMI SUSAN JOSE	12	10	13	19	13	5	5	5	5	5	5	4	4	5	5	0.80	0.76	0.72	0.80	0.80
63	220021086640	VARSHA S	14	11	15	21	14	5	5	5	5	5	5	4	4	5	5	0.82	0.78	0.75	0.82	0.82
64	220021086641	VYSHNAVI P T	14	11	16	21	15	5	5	5	5	5	5	4	4	5	5	0.83	0.79	0.76	0.83	0.83
65	220021086642	JUSTIN JOY	10	8	11	16	11	5	5	5	5	5	5	4	4	5	5	0.74	0.70	0.68	0.74	0.74
66	220021089078	AKSA ABI ABRAHAM	0	0	0	0	0	5	5	5	5	5	5	4	4	5	5	0.50	0.46	0.46	0.50	0.50
Average			9.53	7.71	10.12	14.52	9.98	5.00	5.00	4.84	5.00	5.00	4.64	4.43	4.40	4.64	4.64	0.71	0.70	0.66	0.71	0.71

Analysis of Course Outcomes

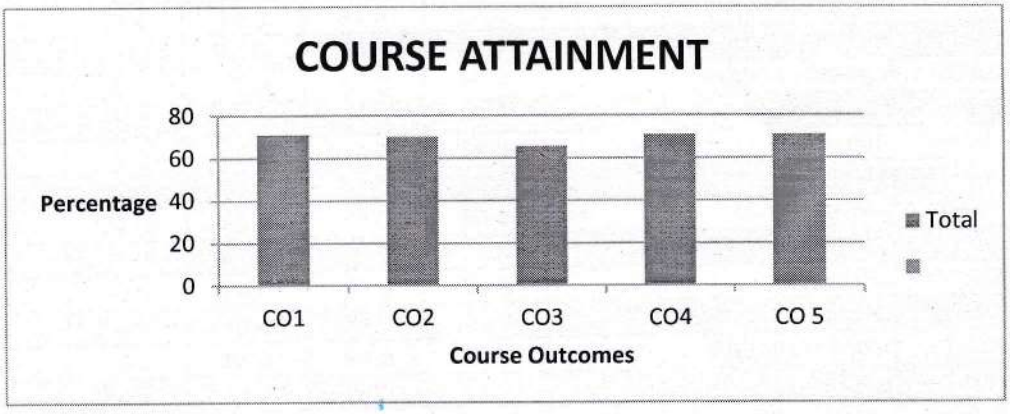
Semester : IV **Programme:** BCA

Subject with Code: CS4CRT09 Design & Analysis of Algorithm **Faculty:** Arun Padmanabhan [AP]

Roll No	Register No	Name	Final CO Evaluation (Series Exam 50% Weightage + Assignment 30% Weightage + Feedback 20%)				
			CO 1	CO 2	CO 3	CO 4	CO 5
1	220021086575	A ADINATH	0.75	0.75	0.69	0.75	0.75
2	220021086576	AADHIL S	0.52	0.56	0.42	0.52	0.52
3	220021086577	AARON K JIJO	0.60	0.52	0.50	0.60	0.60
4	220021086578	ABHINAND M A	0.60	0.60	0.51	0.60	0.60
5	220021086579	ABHINAV GOPAN	0.69	0.69	0.65	0.69	0.69
6	220021086580	ABHIRAM SREEKUMAR	0.58	0.58	0.52	0.58	0.58
7	220021086581	ABIN ABRAHAM KOTTANIPRAL	0.78	0.78	0.67	0.78	0.78
8	220021086582	ABRAHAM J ALAMPALLIL	0.62	0.62	0.57	0.62	0.62
9	220021086583	ADITHRAJ N	0.78	0.78	0.80	0.78	0.78
10	220021086584	AKHIL VARGHESE	0.64	0.60	0.53	0.64	0.64
11	220021086585	ALBIN SIBY	0.67	0.67	0.64	0.67	0.67
12	220021086587	ALVIN BAIJU	0.48	0.48	0.41	0.48	0.48
13	220021086588	ALWIN JOSE	0.67	0.67	0.62	0.67	0.67
14	220021086589	AMAL JAYAKUMAR	0.76	0.76	0.67	0.76	0.76
15	220021086590	AMITH K SAJI	0.51	0.51	0.45	0.51	0.51
16	220021086592	ANAGHA LAKSHMI B	0.86	0.78	0.77	0.86	0.86
17	220021086593	ANFAS P HANISH	0.50	0.54	0.54	0.50	0.50
18	220021086594	ANJANA SAJIKUMAR	0.92	0.92	0.74	0.92	0.92
19	220021086595	ANTOS BIJU	0.73	0.69	0.68	0.73	0.73
20	220021086596	ARCHANA S NAIR	0.67	0.67	0.64	0.67	0.67
21	220021086597	ARPITHA ASOKAN	0.62	0.62	0.47	0.62	0.62
22	220021086598	ARTHANA PRADEEP	0.75	0.75	0.66	0.75	0.75
23	220021086599	ATHIRA P S	0.74	0.74	0.61	0.74	0.74
24	220021086600	ATHUL S. KRISHNA	0.55	0.59	0.54	0.55	0.55
25	220021086601	ATHULYA ANIL	0.67	0.63	0.67	0.67	0.67
26	220021086602	B SREELAKSHMI	0.82	0.78	0.67	0.82	0.82
27	220021086603	BILEENA VARUGHESE	0.65	0.65	0.67	0.65	0.65
28	220021086604	CHERIAN T THAYIL	0.78	0.78	0.73	0.78	0.78
29	220021086605	DEVANANDHA S	0.76	0.76	0.72	0.76	0.76
30	220021086606	DIANA REEBA BENJAMIN	0.81	0.81	0.73	0.81	0.81
31	220021086607	EMIL SUNNY	0.74	0.74	0.72	0.74	0.74
32	220021086608	FARHAN SIYAD	0.65	0.57	0.63	0.65	0.65
33	220021086609	GAYATHRI MANOJ	0.85	0.85	0.78	0.85	0.85
34	220021086610	GEETHIKA A	0.69	0.69	0.68	0.69	0.69
35	220021086611	GEORGE RIGIN JAMES	0.64	0.64	0.62	0.64	0.64
36	220021086612	JESWIN SEBASTIAN	0.59	0.59	0.58	0.59	0.59
37	220021086613	JOE THOMAS	0.65	0.65	0.62	0.65	0.65
38	220021086614	JOHIN JOHN	0.55	0.55	0.54	0.55	0.55
39	220021086615	JOSHILY MARY JOSE	0.90	0.90	0.81	0.90	0.90
40	220021086616	KARTHIK P NAIR	0.70	0.70	0.69	0.70	0.70
41	220021086617	KARTHIK SUDARSANAN	0.82	0.82	0.77	0.82	0.82
42	220021086618	KRISHNA MURALI	0.50	0.50	0.50	0.50	0.50

43	220021086619	LEVIN MATHEW ABRAHAM	0.59	0.59	0.56	0.59	0.59
44	220021086621	MUHAMMED AMEEN	0.67	0.67	0.64	0.67	0.67
45	220021086622	NANDANA ANIL	0.91	0.91	0.84	0.91	0.91
46	220021086623	NANDHANA K MANOJ	0.86	0.86	0.84	0.86	0.86
47	220021086624	NEERAJA RAJESH	0.84	0.84	0.82	0.84	0.84
48	220021086625	NILA CHANDANA T S	0.81	0.81	0.78	0.81	0.81
49	220021086626	NIRAJ P NITIN	0.57	0.57	0.56	0.57	0.57
50	220021086627	NIYA ANN JACOB	0.74	0.74	0.68	0.74	0.74
51	220021086628	OHMDHIRDHE	0.88	0.88	0.83	0.88	0.88
52	220021086629	PRAJUL TOM	0.75	0.75	0.73	0.75	0.75
53	220021086630	RAHUL M	0.70	0.70	0.67	0.70	0.70
54	220021086631	RAICHEL KAROKANCHERIL THOMAS	0.90	0.90	0.83	0.90	0.90
55	220021086632	RAKESH	0.72	0.72	0.71	0.72	0.72
56	220021086633	RICHARD CHRISTY PINSON	0.72	0.72	0.69	0.72	0.72
57	220021086634	SAJU P VARGHESE	0.65	0.65	0.63	0.65	0.65
58	220021086635	SIVARAM.D.KUMAR	0.51	0.51	0.50	0.51	0.51
59	220021086636	SREEHARI CS	0.79	0.79	0.71	0.79	0.79
60	220021086637	SREELAKSHMI N J	0.88	0.84	0.80	0.88	0.88
61	220021086638	STEPHEN MATHEW K M	0.77	0.73	0.71	0.77	0.77
62	220021086639	SUMI SUSAN JOSE	0.80	0.76	0.72	0.80	0.80
63	220021086640	VARSHA S	0.82	0.78	0.75	0.82	0.82
64	220021086641	VYSHNAVI P T	0.83	0.79	0.76	0.83	0.83
65	220021086642	JUSTIN JOY	0.74	0.70	0.68	0.74	0.74
66	220021089078	AKSA ABI ABRAHAM	0.50	0.46	0.46	0.50	0.50
		Average	**0.71**	**0.70**	**0.66**	**0.71**	0.71

Course Outcomes	Direct	Indirect	Total	Attainme
CO1	0.57	0.14	70.81	H
CO2	0.56	0.14	69.96	H
CO3	0.52	0.13	65.58	H
CO4	0.57	0.14	70.81	H
CO 5	0.57	0.14	70.81	H



Teacher In-Charge

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Summary: Design Methods for Algorithms

Asst. Prof. Arun Padmanabhan

Design Methods

We have discussed examples of the following algorithm design principles:

- Dynamic Programming Paradigm
- Greedy Paradigm
- Divide-and-Conquer Paradigm

Main Question

When can one successfully use one of these algorithm design paradigms to solve a problem?

Dynamic Programming

Dynamic Programming

The development of a dynamic programming algorithm can be subdivided into the following steps:

1. Characterize the structure of an optimal solution
2. Recursively define the value of an optimal solution
3. Compute the value of an optimal solution in a bottom-up fashion
4. Construct an optimal solution from computed information

5

Key Question

- When can we apply the dynamic programming paradigm?

6

Optimal Substructure

A problem exhibits optimal substructure if and only if an optimal solution to the problem contains within it optimal solutions to subproblems.

Whenever a problem exhibits optimal substructure, it is an indication that a dynamic programming or greedy strategy might apply.

7

Overlapping Subproblems

A second indication that dynamic programming might be applicable is that the space of subproblems must be small, meaning that a recursive algorithm for the problem solves the same subproblems over and over.

Typically, the total number of distinct subproblems is a polynomial in the input size.

8

Overlapping Subproblems

When a recursive algorithm revisits the same problem over and over again, then we say that the optimization problem has overlapping subproblems.

Here two subproblems are called overlapping if and only if they really are the same subproblem that occurs as a subproblem of different problems.

9

Note

If a recursive algorithm solving the problem creates always new subproblems, then this is an indication that divide-and-conquer methods rather than dynamic programming might apply.

10

Greedy Algorithms

11

Greedy Algorithms

The development of a greedy algorithm can be separated into the following steps:

1. Cast the optimization problem as one in which we make a choice and are left with one subproblem to solve.
2. Prove that there is always an optimal solution to the original problem that makes the greedy choice, so that the greedy choice is always safe.
3. Demonstrate that, having made the greedy choice, what remains is a subproblem with the property that if we combine an optimal solution to the subproblem with the greedy choice that we have made, we arrive at an optimal solution to the original problem.

12

Greedy-Choice Property

The greedy choice property is that a globally optimal solution can be arrived at by making a locally optimal (=greedy) choice.

13

Optimal Substructure

A problem exhibits optimal substructure if and only if an optimal solution to the problem contains within it optimal solutions to subproblems.

14

Divide-and-Conquer

15

Divide-and-Conquer

A divide and conquer method can be used for problems that can be solved by recursively breaking them down into two or more sub-problems of the same (or related) type, until these become simple enough to be solved directly. The solutions to the sub-problems are then combined to give a solution to the original problem.

This approach is particularly successful when the number of subproblems remain small in each step and combining the solutions is easily done.

16