POORNIMA
COLLEGE OF ENGINEERING

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Teaching Manual

Name of faculty	**Shazia Haque**
Class- II yr	**B. Tech – III SEM**
Branch	**Information Technology**
Course Code	**3IT4-05**
Course Name	**Data Structures and Algorithms**
Session	**(2023-24)**

POORNIMA COLLEGE OF ENGINEERING

DEPARTMENT OF INFORMATION TECHNOLOGY

TIME TABLE (ODD SEMESTER 2023-24)

Faculty Name- Ms.Shazia Haque

Day/ Period	I 8:00-9:00	II 9:00-10:00	III 10:00-11:00	11:00 to 11:50	IV 11:50-12:50	V 12:50-1:50	VI 1:50-2:50
MON		7IT7-40 SEMINAR (SH,GR) 2B04 [O+E]		LUNCH	3IT4-21 DSA Lab (A1) SH 2B09C [O+E]		
TUE			3IT4-05 DSA (SH) 2B03 [O+E]		7ITPR Project(A1) SH, AS 2B05A		
WED					7IT7-30 Ind.Training (SH, NP) 2B04 [O+E]		
THU		7IT7-40 SEMINAR (SH,GR) 2B04 [O+E]			3IT4-21 DSA LAB (A3) SH 2B09C [O+E]		
FRI	3IT4-21 DSA Lab (A2) SH 2B09C [O+E]				3IT4-05 DSA (SH) 2B03 [O+E]		3IT4-05 DSA (SH) 2B03 [O+E]
SAT		3IT4-05 DSA (SH) 2B03 [O]					3IT4-05 DSA (SH) 2B03 [O]

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF INFORMATION TECHNOLOGY

Vision & Mission of Poornima College of Engineering

Vision

To create knowledge based society with scientific temper, team spirit and dignity of labor to face the global competitive challenges.

Mission

To evolve and develop skill based systems for effective delivery of knowledge so as to equip young professionals with dedication and commitment to excellence in all spheres of life.

POORNIMA COLLEGE OF ENGINEERING, JAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

VISION

To attain distinction in education to enable students for their establishment as globally competent professional and empowering them with proficiency, knowledge and research ability required to be successful in field of Information Technology.

MISSION

1. To provide state-of-the-art facilities with modern IT tools to students and faculty thereby enabling them to develop sustainable solutions for real world problems.
2. To create and propagate knowledge in field of Information Technology through research, teaching and learning for meeting societal challenges.
3. To inculcate analytical, leadership and team working skills with ethical behavior in students and provide an environment for continuous learning.

PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)

1. Graduates will perform effectively as individuals and team members of multidisciplinary projects to create innovative and sustainable solutions for societal problems, meeting with global challenges and emerging trends.
2. Graduates will possess core competence in Information Technology and allied engineering fields thereby maintaining the leading positions in industry and/ or excel in higher studies.
3. Graduates will exhibit professionalism, ethical attitude, communication ability, spirit of entrepreneurship and adapt to current advancements through research ability and lifelong learning.

Programme Specific outcomes (PSOs)

PSO-1

Analyze, design and develop efficient algorithms and software applications to deploy in secure network enabled environment meeting ever changing societal needs in economically acceptable terms.

PSO-2

Comprehend and apply knowledge of contemporary areas in Information Technology viz. Cloud based technologies, Machine Learning, Data Analytics, IOT and Network and Cyber Security to develop creative software solutions for automation of various industrial requirements.

PSO 3:

Exhibit familiarity and practical competence in modern programming languages and open source platforms so as to develop innovative projects related to business applications.

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF INFORMATION TECHNOLOGY

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF INFORMATION TECHNOLOGY

Mapping between Vision of the Institute and Vision of Department of IT

Vision of Institute	Vision of Department of IT
Knowledge based society	Distinction in education
global competitive challenges	Global competence

Mapping between Mission of the Institute and Mission of Department of IT

Mission of Institute	Mission of Department of IT
Develop skill based systems	State-of-the-art facilities, developing sustainable solutions
Effective delivery of knowledge	Teaching learning, research
Excellence in all spheres of life	Analytical, leadership and team working skills, ethical behaviour, continuous learning

Mapping between PEOs and the Mission of the Department

Mission/ PEO (keywords)	**PEO-1** Team working, Multidisciplinary project, sustainable solutions, global challenges	**PEO-2** Competence in IT field, Leading position in industry, higher education	**PEO-3** Professionalism, ethical attitude, communication skill, entrepreneurship, research & lifelong learning
Sustainable solutions for real world problems	√		
Create and propagate knowledge in IT filed		√	
Teaching learning and Research		√	√
Analytical, leadership and team working skills and Ethical behaviour	√	√	
Continuous learning		√	√

Consistency between PEOs and the Mission of the Institute

Mission / PEO (Keywords)	**PEO-1** Team working, Multidisciplinary project, sustainable solutions, global challenges	**PEO-2** Leading position in industry, higher education	**PEO-3** professionalism, ethical attitude, communication skill, entrepreneurship, research & lifelong learning
Skill based system	√		
Effective Delivery of Knowledge		√	√
Commitment to Excellence	√	√	√

Correlation between PEOs and Program Outcomes (POs)

POs **PEOs**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
PEO-1 Team working, Multidisciplinary project, sustainable solutions, global challenges		S	S	S	M	M	M	M	S		M	
PEO-2 Competence in IT field, Leading position in industry, higher education	S	S	S		M				S			S
PEO-3 Professionalism, ethical attitude, communication skill, entrepreneurship, research & lifelong learning						M	S	S		S		S

Correlation: S- Strong, M- Medium W-Weak

Correlation between PEOs and Program Specific Outcomes (PSOs)

PEOs Vs PSOs	PSO1 Development of software applications	PSO2 Emerging technologies	PSO3 Modern programming languages & open source tools
PEO-1 Team working, Multidisciplinary project, sustainable solutions, global challenges	S	M	
PEO-2 Competence in IT field, Leading position in industry, higher education	S	M	M
PEO-3 Professionalism, ethical attitude, communication skill, entrepreneurship, research & lifelong learning	S	M	M

Correlation: S- Strong, M- Medium W-Weak

POORNIMA COLLEGE OF ENGINEERING

DEPARTMENT OF INFORMATION TECHNOLOGY

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

RTU SYLLABUS

2nd Year - III Semester: B. Tech. (Information Technology)

3IT4-05: Data Structures and Algorithms

Credit- 3 **Max. Marks: 100 (IA: 30, ETE:70)**

3L+0T+0P **End Term Exam: 3 Hours**

Unit No.	Contents	Hours
I	Stacks: Basic Stack Operations, Representation of a Stack using Static Array and Dynamic Array, Multiple stack implementation using single array, Stack Applications: Reversing list, Factorial Calculation, Infix to postfix Transformation, Evaluating Arithmetic Expressions and Towers of Hanoi.	8
II	Queues: Basic Queue Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack, Application of Queues- Round Robin Algorithm. Circular Queues, DeQueue Priority Queues. Linked Lists: Introduction, single linked list, representation of a linked list in memory, Different Operations on a Single linked list, Reversing a single linked list, Advantages and disadvantages of single linked list circular linked list, double linked list and Header linked list.	10
III	Searching Techniques: Sequential and binary search. Sorting Techniques: Basic concepts, Sorting by bubble sort, Insertion sort, Selection Sort, quick sort, heap sort, merge sort, radix sort and counting sort algorithms.	7
IV	Trees: Definition of tree, Properties of tree, Binary Tree, Representation of Binary trees using arrays and linked lists, Operations on a Binary Tree, Binary Tree Traversals (recursive), Binary search tree, B-tree, B+ tree, AVL tree, Threaded binary tree.	7
V	Graphs: Basic concepts, Different representations of Graphs, Graph Traversals (BFS & DFS), Minimum Spanning Tree (Prims & Kruskal) Dijkstra's shortest path algorithms. Hashing: Hash function, Address calculation techniques, Common hashing functions, Collision resolution: Linear and Quadratic probing, Double hashing.	8
	Total	**40**

Roll No. ▲

3E1202

3E1202

B.Tech. III Sem. (Main) Examination, April/May - 2022
Artificial Intelligence & Data Science
3AID4-05 Data Structures and Algorithms
AID, CAI, CS, IT

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates:

*Attempt **all ten** questions from **Part A**. All five questions from **Part B** and three questions out of **Five** questions from **Part C**.*

Schematic diagrams must be shown wherever necessary. Any data missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination (As mentioned in form No. 205).

PART - A (Word limit 25)

(Answer should be given up to 25 words only) **(10×2=20)**

(All questions are **compulsory**)

1. Define static and dynamic Array. **(2)**
2. Explain stack. **(2)**
3. Write differences between Array and Queue. **(2)**
4. Write Concept of Header linked list. **(2)**
5. What do you mean by sequential search? **(2)**
6. Define radix sort. **(2)**
7. Explain B-tree. **(2)**
8. Define complete binary tree. **(2)**
9. How to represent graph in memory? Explain. **(2)**
10. Explain Double hashing. **(2)**

PART - B (Word limit 100)

(Answer should be given up to 100 words) **(5×4=20)**

(All questions are compulsory)

1. Convert following infix expression to postfix expression :
   a. A+B/C-D^E-F. **(2)**
   b. A/B-(C+D)*E/F^G. **(2)**
2. Write an algorithm to insert a node in doubly linked list. **(4)**

3. Explain binary search technique in deatil. (4)
4. Discuss the operations performed on a binary tree. (4)
5. Explain minimum spanning tree. Discuss prims algorithm with suitable example. (4)

PART - C (Any Three)

(Design/Problem solving skills) (3×10=30)

Attempt any three questions.

1. a. How to perform factorial calculation using stack? Explain. (5)
   b. Write an algorithm to delete an item from circular Queue. (5)
2. a. Explain circular linked list. Write an algorithm to insert a node into circular linked list. (5)
   b. Discuss insertion sort with suitable example. (5)
3. What is an AVL tree? Explain the concept of balance factor. Create an AVL tree using following sequences :
   68, 35, 45, 70, 15, 91, 40, 73, 20, 79. (10)
4. Discuss Breadth first search and Depth first search traversal with suitable example. (10)
5. a. Explain Dijkastra's shortest path algorithm in detail. (5)
   b. Write down the algorithm of Bubble Sort. Sort the following elements using Bubble sort :
   68, 98, 35, 48, 62, 52, 30. (5)

3E1138

Roll No. Total No of Pages: 4

3E1138

B. Tech. III - Sem. (Main / Back) Exam., Dec. 2019
PCC Computer Science & Engineering
3CS4-05 Data Structures and Algorithms
CS, IT

Time: 3 Hours **Maximum Marks: 120**

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and four questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 Define data structure. Mention any two applications of data structures.

Q.2 Mention the purpose of B^+ - Trees.

Q.3 What is the difference between internal sorting and external sorting?

Q.4 What is meant by abstract data type?

Q.5 What are the applications of stack?

Q.6 What do you mean by circular linked list?

Q.7 Compare graph and tree.

Q.8 Differentiate between linear and non-linear data structure.

Q.9 What is a dequeue?

Q.10 Define Hash function.

PART – B

(Analytical/Problem solving questions) **[5×8=40]**

Attempt any five questions

Q.1 Difference between linear queue and circular queue. Also write the advantage and disadvantage of circular queue. [8]

Q.2 What do you mean by tower of Hanoi problem? Explain with suitable example. [8]

Q.3 Convert following expressions in its equivalent post fix expressions – [8]

(i) A * (B + C * D) + E

(ii) A * B ^ C + D

Q.4 Define Binary Search Tree. Write algorithm to implement insertion operation on Binary search tree. [8]

Q.5 The in – order & pre – order traversal sequence of nodes in a binary tree are given below:

In-order: E A C K F H D B G

Pre-order: F A E K C D H G B

Draw the binary tree. [8]

Q.6 What is a priority queue? How can it be implemented? Explain an application of priority queue. [8]

Q.7 What is a Threaded Binary Tree? Explain the advantages of using a threaded binary tree. [8]

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) [4×15=60]

Attempt any four questions

Q.1 Create the linked list to represent the following polynomials – [15]

$5x^5 + 4x^4 + 6x^2 - 4$

$8x^6 + 4x^4 + 3x^3 + 2x^2 + x$

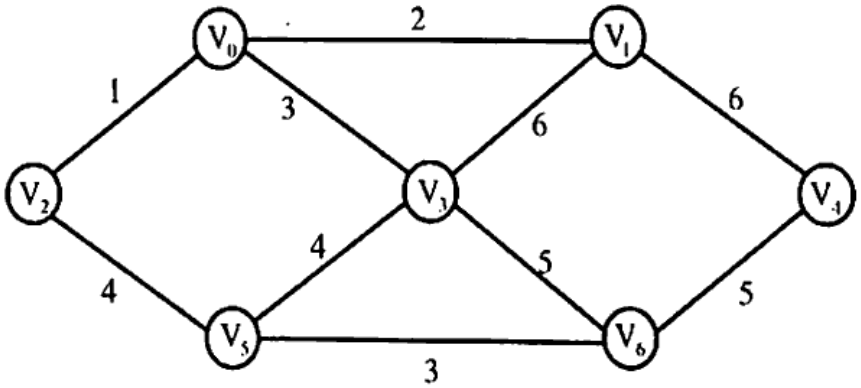
Write a function add () to add these polynomials and print the resultant linked list.

Q.2 Define a B–Tree. What are the application of B–Tree? Draw a B–Tree of order 4 (four) by insertion of the following keys in order :

Z, U, A, I, W, L, P, X, C, J, D, M, T, B, Q, E, H, S, K, N, R, G, Y, F, O, V. [15]

Q.3 What is sorting? Write an algorithm to sort the real number using insertion sort and selection sort. What is the time complexity for both selection and insertion sort? [15]

Q.4 (a) Define the spanning tree. Write the Prim's algorithm to find the minimum cost spanning tree of the following: [8]



(b) Describe the Dijkstra's algorithm for finding shortest path with help of suitable example. [7]

Q.5 (a) What is AVL tree? Explain the balancing methods of AVL tree with an example. [8]

(b) What do you mean by hashing and collision? Discuss the advantages and disadvantages of hashing over other searching techniques. [7]

3E1138

Roll No. Total No of Pages: 3

3E1138

B. Tech. III - Sem. (Main) Exam., Dec. - 2018
PCC Computer Science & Engineering
3CS4 – 05 Data Structures and Algorithms
CS, IT

Time: 3 Hours **Maximum Marks: 120**

Instructions to Candidates:

Attempt all ten questions from Part A, selecting five questions from Part B and four questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 What are the applications of stack?

Q.2 Write down the recursive algorithm to solve tower of Hanoi problem?

Q.3 What are the differences between normal queue and circular queue?

Q.4 Write down the advantages and disadvantages of singly linked list?

Q.5 Write down the asymptotic upper bound of bubble sort, selection sort, quick sort and heap sort?

Q.6 Write down the algorithm of binary search.

Q.7 Write down the differences between B tree and B+ tree.

Q.8 Write down the differences between BFS and DFS.

Q.9 What do you mean by spanning tree?

Q.10 Write short note on hash functions.

PART – B

(Analytical/Problem solving questions) **[5×8=40]**

Attempt any five questions

Q.1 Translate infix expression into its equivalent postfix expression:

(a) (A - B) * (D/E)

(b) (A + B↑D) / (E - F) +G

Q.2 Write down the algorithm for insertion of a node in the middle of doubly linked list.

Q.3 Sort the following elements using quick sorting algorithm.

< 2, 10, 9, 6, 1, 15, 5, 11 >

Q.4 A Binary tree T has 9 nodes, The in order and pre order traversal for T yield the following sequences of nodes:

IN order: E A C K F H D B G

Pre order: F A E K C D H G B

Draw the tree T

Q.5 What are the different AVL tree rotations? Explain with suitable example.

Q.6 Write down the algorithm to important stack using linked list.

Q.7 Suppose a binary tree T is in memory write a recursive procedure which finds the depth Dp of T.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) [4×15=60]

Attempt any four questions

Q.1 Write a C program to perform following operations over singly linked list.

(a) Create

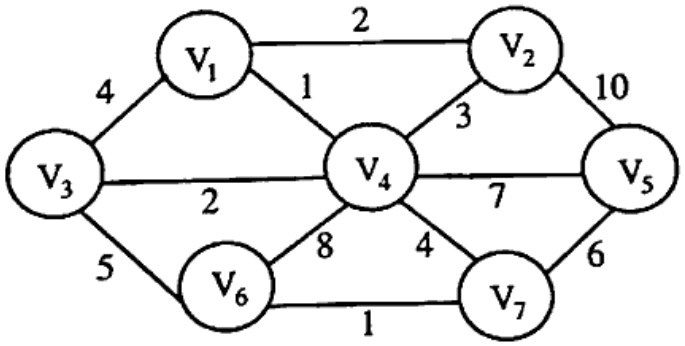
(b) Traversal

(c) Insertion of node at user specified location

Q.2 Write down the algorithm of counting sorting and sort following elements using counting sorting.

< 2, 1, 3, 9, 6, 1, 3, 9, 6, 5, 6, 8, 5, 3 >

Q.3 Obtain minimal spanning tree using prim's and Kruskal's algorithm on the following graph



Q.4 Write a C program to implement merge sorting.

Q.5 What do you mean by hash functions? Explain common hashing functions along with all address calculation techniques.

3E1652-1612

Roll No. ____ Total No. of Pages : 3

3E1652-1612

B. Tech. (Sem. III) (Main / Back) Examination, December - 2017

Computer Sc. & Engineering

3CS2A Data Structures and Algorithms

CS, IT, EX, EC, EI

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Attempt any five questions, selecting one question from each unit. All Questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.

Use of following supporting materials is permitted during examination. (Mentioned in form No. 205)

1. Nil 2. Nil

UNIT - I

1 (a) Define algorithm. What do you understand by best, worst and average case analysis of an algorithm. 8

(b) Using suitable example explain row major and column major form of array. 8

OR

1 (a) Explain the difficulties in estimating exact execution time of Algorithms. 8

(b) Explain Asymptotic notations : Big-Oh, theta, Omega using suitable example. 8

UNIT - II

2 (a) Define the concept of recursion using stack using suitable examples. What are the difficulties in dealing with infix expression ? 8

(b) Convert following expressions in its equivalent postfix expressions.

(i) $A*(B+C*D)+E$

(ii) $A*B\hat{}C+D$ 8

OR

2 (a) Explain tower of Hanoi problem. Explain using suitable diagram and example. 8

(b) Explain transposition of sparse matrices with algorithms of varying complexity. 8

UNIT - III

3 (a) Compare binary search and sequential search. 8

(b) Using suitable diagram explain the concept of Head Node in linked lists. 8

OR

3 (a) Write the algorithm for insertion and deletion in doubly and circularly connected linear linked lists. 8

(b) Write down the following polynomial.

$3x^4-2x^2+9x-11$ by a linked list. 8

UNIT - IV

4 (a) Define the concept of balanced trees. Write pseudo code for insertion into and deletion from AVL tree. 8

(b) Define the different applications of trees for representation of sets. 8

OR

4 (a) Define the following binary tree
(i) Complete binary tree.
(ii) Strictly binary tree. 8

(b) Write an algorithm for inorder travesal of a threaded binary tree. 8

UNIT - V

5 (a) Compare Internal sorting and External sorting. 8

(b) By taking suitable example explain the principle of operation of heap sort. 8

(c) Prove that Heap sort, Merge sort and Quick sort takes $\Omega(n \log n)$ tie in the worst case. 8

OR

5 Write short notes on following :
(a) DFS traversal Algorithms 8

(b) Comparison of sorting Algorithms in terms of time complexity. 8

Total No. of Questions: 25 Total No. of Pages: 03

Roll No. _____

B.Tech. III-Sem. (Main/Back) Exam Jan. 2019
Computer Science Engineering
3CSU02 Data Structures and Algorithms
3EU3022

Time: 3 Hours Maximum Marks: 100
Min. Passing marks: 33

Instructions to candidates: -

***PART A** : Short answer questions (up to 25 words) 10 x 2 marks = 20 marks. All ten questions are compulsory.*

***PART B** : Analytical Problem Solving questions (up to 100 words) 6 x 5 marks = 30 marks. Candidates have to answer six questions out of eight.*

***PART C** : Descriptive Analytical Problem solving questions 5 x 10 marks = 50 marks. Candidates have to answer five questions out of seven.*

PART A

Q.1 Why we need to do algorithm analysis ?

Q.2 Discuss BST.

Q.3 Write the name of an algorithm which can be used as a single source single destination shortest path algirithm.

Q.4 Give Comparision between tree and graph ?

Q.5 Define Spanning tree. What is MST ?

Q.6 Which data structures are used for BFS and DFS of a graph ?

Q.7 What are linear and non-linear data structures ?

Q.8 What is linked list? What are its types?

Q.9 Explain the advantages of Binary search over linear search ?

Q.10 How is an array different from Linked list ?

PART B

Q.1 Write the following infix expressions in their postfix and prefix forms:

(a) D-B+C

(b) (A+B)*C-D*F+C

Q.2 What is queue? How it is different from stack and how is it implemented ?

Q.3 Create lexically ordered Binary Search Tree for the following :-

JAN, FEB, MAR, APR, MAY,JUNE, JULY, AUG, SEPT, OCT, NOV, DEC.

Q.4 Write the essantial differences between complete binary tree and strict binary tree?

Q.5 Calculate the address of the element A[3,2] using row major order for an array A[1..5, 1..5] of elements. It is stored at location 2033 and the size of each element is 3 Bytes.

Q.6 How insertion and selection sorts are different ? Explain.

Q.7 What is the value of the following postfix expression :

6,8,2,4,+,-,* - ?

Q.8 What is asymptotic analysis of an algorithm ? What are asymptotic notations ?

PART C

Q.1 Create the AVL tree.

21, 26, 30, 9, 4, 14, 28, 18, 15, 10, 2, 3, 7.

Q.2 Write an algorithms for inserting a node and deleting a node from a doubly linked list ? What are the advantages of doubly linked list over singly linked list ?

Q.3 Define AVL tree ? Discuss the term "Balance factor". Explain the various rotations of AVL tree?

Q.4 Analyze the running time for merge sort algorithm Argye upon its wrost case. best caseand average case running time.

Q.5 Write shote note (any two) :-

(i) Heap sort

(ii) B- tree

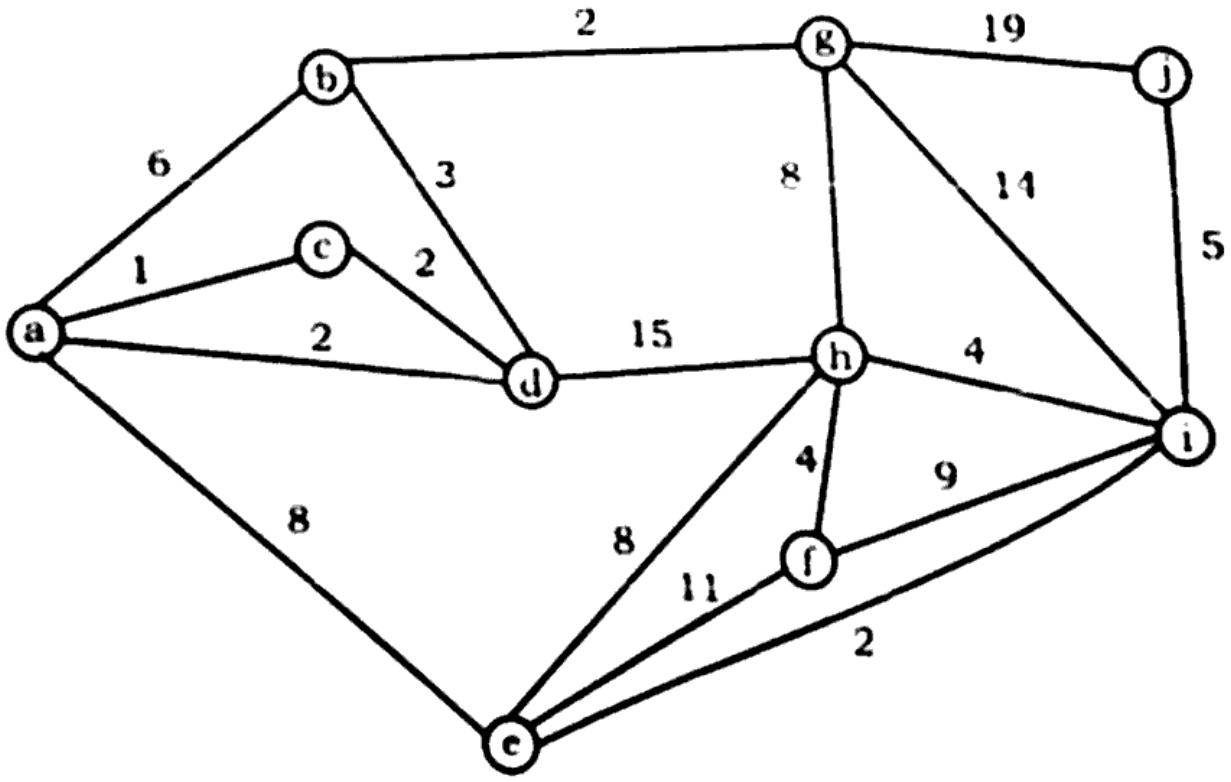
(iii) Tree traversal techniues

Q.6 What are the various ways to represeant a graph? Find the following two for the graph given below in Q.7 :

(i) Adjacency list representation

(ii) Adjacency matric representation

Q.7 Using prim's and kruskal's algorithm , find the minimum spannning tree for the following graph ? What is the weight of a minimum spanning tree of the following graph?



Roll No. ▲

3E1202

3E1202

B.Tech. III Sem. (Main) Examination, April/May - 2022
Artificial Intelligence & Data Science
3AID4-05 Data Structures and Algorithms
AID, CAI, CS, IT

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates:

*Attempt **all ten** questions from **Part A**. All five questions from **Part B** and three questions out of **Five** questions from **Part C**.*

Schematic diagrams must be shown wherever necessary. Any data missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination (As mentioned in form No. 205).

PART - A (Word limit 25)

(Answer should be given up to 25 words only) **(10×2=20)**

(All questions are **compulsory**)

1. Define static and dynamic Array. **(2)**
2. Explain stack. **(2)**
3. Write differences between Array and Queue. **(2)**
4. Write Concept of Header linked list. **(2)**
5. What do you mean by sequential search? **(2)**
6. Define radix sort. **(2)**
7. Explain B-tree. **(2)**
8. Define complete binary tree. **(2)**
9. How to represent graph in memory? Explain. **(2)**
10. Explain Double hashing. **(2)**

PART - B (Word limit 100)

(Answer should be given up to 100 words) **(5×4=20)**

(All questions are compulsory)

1. Convert following infix expression to postfix expression :
   a. A+B/C-D^E-F. **(2)**
   b. A/B-(C+D)*E/F^G. **(2)**
2. Write an algorithm to insert a node in doubly linked list. **(4)**

3. Explain binary search technique in deatil. (4)
4. Discuss the operations performed on a binary tree. (4)
5. Explain minimum spanning tree. Discuss prims algorithm with suitable example. (4)

PART - C (Any Three)

(Design/Problem solving skills) (3×10=30)

Attempt any three questions.

1. a. How to perform factorial calculation using stack? Explain. (5)
   b. Write an algorithm to delete an item from circular Queue. (5)
2. a. Explain circular linked list. Write an algorithm to insert a node into circular linked list. (5)
   b. Discuss insertion sort with suitable example. (5)
3. What is an AVL tree? Explain the concept of balance factor. Create an AVL tree using following sequences :
   68, 35, 45, 70, 15, 91, 40, 73, 20, 79. (10)
4. Discuss Breadth first search and Depth first search traversal with suitable example. (10)
5. a. Explain Dijkastra's shortest path algorithm in detail. (5)
   b. Write down the algorithm of Bubble Sort. Sort the following elements using Bubble sort :
   68, 98, 35, 48, 62, 52, 30. (5)

POORNIMA COLLEGE OF ENGINEERING

DEPARTMENT OF INFORMATION TECHNOLOGY

ABC Analysis

Course: B. Tech. **Class/Semester: IIyr/IIISem** **Date: 16/08/2023**
Name of Faculty: Shazia Haque **Name of Subject: DSA** **Subject Code: 3IT4-05**

ABC Analysis (RGB method)

Unit No.	A (Hard Topics)	B (Topics with average hardness level)	C (Easy to understand topics)	Preparedness for 'A' topics
1	Stack Applications: Reversing list, Factorial Calculation, Infix to postfix Transformation, Evaluating Arithmetic Expressions and Towers of Hanoi.	Multiple stack implementation using single array	Stacks: Basic Stack Operations, Representation of a Stack using Static Array and Dynamic Array	PPTs and Video Lecture
2	DeQueue, Priority Queues. Different Operations on a Single linked list, reversing a single linked list, Advantages and disadvantages of single linked list circular linked list, double linked list and Header linked list.	Application of Queues- Round Robin Algorithm. Circular Queues Linked Lists: Introduction, single linked list, representation of a linked list in memory,	Queues: Basic Queue Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack	PPTs and Video Lecture Discuss with Mentor

3	Quick sort, heap sort and merge sort	Sorting Techniques: Basic concepts, sorting by bubble sort, Insertion sort, selection sort, radix sort and counting sorting algorithms.	Searching Techniques: Sequential and binary search.	PPTs and Video Lecture Or SPL
4	Binary search tree, B-tree, B+ tree, AVL tree, Threaded binary tree.	Representation of Binary trees using arrays and linked lists, Operations on a Binary Tree, Binary Tree Traversals (recursive)	Trees: Definition of tree, Properties of tree, Binary Tree	PPTs and Video Lecture
5	Minimum Spanning Tree (Prim's &Kruskal's) Dijkstra's shortest path algorithms.	Graph Traversals (BFS & DFS). Hashing: Hash function, Address calculation techniques, and Common hashing functions, Collision resolution: Linear and Quadratic probing, Double hashing.	Graphs: Basic concepts, Different representations of Graphs.	PPTs and Video Lecture Discuss with Mentor

POORNIMA COLLEGE OF ENGINEERING, JAIPUR
DEPARTMENT OF INFORMATION TECHNOLOGY

SYLLABUS BLOWN UP

Campus: PCE Course: B.TECH	**Class/Section: II YEAR/III Sem**	**Date:20/07/2023**
Name of Faculty: Shazia Haque	**Name of Subject: Data Structures and Algorithms**	**Code: 3IT4-05**

S.No.	Topic as per Syllabus	BLOWN UP TOPICS (Upto 10 TIMES SYLLABUS)
1.	**UNIT-1:STACK**	
	1.1Basic Stack Operations	1.1.1 Definition & Representation 1.1.2 Push & Pop Operations
	1.2 Representation of stack using array, dynamic array and Linked List	1.2.1 Methods to represent stack using array 1.2.2 Method to represent stack using dynamic array 1.2.3 Method to represent stack using Linked List
	1.3Multiple stack implementation using single array	1.3.1 Implementation of two stacks by using a single array
	1.4Stack Applications	1.4.1 Tower of Hanoi 1.4.2 Function Call & Return 1.4.3 Parenthesis Matching 1.4.4 Backtracking 1.4.5 Expression Evaluation 1.4.5.1 Precedence & Associativity 1.4.5.2 Difficulties in dealing with infix expressions 1.4.5.3 Resolving precedence of operators and association of operands 1.4.5.4 Postfix expressions 1.4.5.5 Prefix Expressions 1.4.5.6 Conversion of expression from one form to other form using stack (with & without parenthesis) 1.4.5.7 Evaluation of expression in infix, postfix & prefix forms using stack
2.	**UNIT-2:QUEUES and LINKED LIST** 2.1 Queue and operations on queues	2.1.1 Definition of queue data structure

		2.1.2 Operations on queues 2.1.2.1 Enqueue operation 2.1.2.2 Dequeue operation
	2.2 Types of queues	2.2.1 Linear Queue 2.2.1.1 Representation and implementation using array 2.2.1.2 Representation and implementation using Linked List 2.2.2 Circular Queue 2.2.1.1 Representation and implementation using array 2.2.1.2 Representation and implementation using Linked List 2.2.3 Double Ended Queue (DEQUEUE) 2.2.1.1 Representation and implementation using array 2.2.1.2 Representation and implementation using Linked List 2.2.4 Priority Queue 2.2.1.1 Representation and implementation using array 2.2.1.2 Representation and implementation using Linked List
	2.3 Applications of Queues	2.3.1 Scheduling Algorithm- Round Robin Algorithm 2.3.2 Spooling Algorithm 2.3.3 Simulation
	2.4 Linked List	2.4.1 Introduction and Definition 2.4.2 Array v/s Linked List 2.4.3 Storage Representation & Memory Allocation 2.4.3.1 Concept of Head Node in Linked List 2.4.3.2 Allocation of memory for nodes
	2.5 Types of Linked Lists	2.5.1 Singly Linked List 2.5.1.1 Insertion Operation 2.5.1.1.1 From Beginning 2.5.1.1.2 From End 2.5.1.1.3 At Specified Position 2.5.1.2 Deletion Operation 2.5.1.2.1 From Beginning 2.5.1.2.2 From End 2.5.1.2.3 At Specified Position 2.5.1.3 Reversing a singly linked list 2.5.2 Circular Singly Linked List 2.5.2.1 Insertion Operation 2.5.2.1.1 From Beginning 2.5.2.1.2 From End 2.5.2.1.3 At Specified Position 2.5.2.2 Deletion Operation 2.5.2.2.1 From Beginning 2.5.2.2.2 From End 2.5.2.2.3 At Specified Position 2.5.3 Doubly Linked List 2.5.3.1 Insertion Operation

		2.5.3.1.1 From Beginning 2.5.3.1.2 From End 2.5.3.1.3 At Specified Position 2.5.3.2 Deletion Operation 2.5.3.2.1 From Beginning 2.5.3.2.2 From End 2.5.3.2.3 At Specified Position 2.5.4Circular Doubly Linked List 2.5.4.1 Insertion Operation 2.5.4.1.1 From Beginning 2.5.4.1.2 From End 2.5.4.1.3 At Specified Position 2.5.4.2 Deletion Operation 2.5.4.2.1 From Beginning 2.5.4.2.2 From End 2.5.4.2.3 At Specified Position 2.5.5 Header Linked List 2.5.5.1 Concept of a Header Node 2.5.5.2 Uses of Header Linked Lists
3.	**UNIT – 3: SEARCHING & SORTING TECHNIQUES**	
	3.1 Searching techniques	3.1.1 Linear Search 3.1.2 Binary Search 3.1.3 Comparison of Linear and Binary Search
	3.2 Sorting Techniques	3.2.1 Basic concepts 3.2.2 Bubble Sort 3.2.3 Insertion Sort 3.2.4 Selection Sort 3.2.5 Quick Sort 3.2.6 Heap Sort 3.2.7 Merge Sort 3.2.8 Radix Sort 3.2.9 Counting Sort
4.	**UNIT- 4: TREES**	
	4.1 Introduction	4.1.1 Definition of Tree 4.1.2 Properties of Tree
	4.2 Binary Tree	4.2.1 Definition of Binary Tree 4.2.2 Representation of Binary Tree 4.2.2.1 Using Array Representation

		4.2.2.2 Using Linked List Representation
	4.3 Operations on Binary Tree	4.3.1 Traversals 4.3.1.1 Preorder (Recursive) 4.3.1.2 Postorder (Recursive) 4.3.1.3 Inorder (Recursive) 4.3.1.4 Preorder (Iterative) 4.3.1.5 Postorder (Iterative) 4.3.1.6 Inorder (Iterative) 4.3.1.7 Level Order Traversal
	4.4 Binary Search Tree (BST)	4.4.1 Definition of BST 4.4.2 Operations on BST 4.4.2.1 Insertion 4.4.2.2 Deletion 4.4.2.3 Traversal
	4.5 B Tree	4.5.1 Definition of B Tree 4.5.2 Operations on B Tree 4.5.2.1 Insertion 4.5.2.2 Deletion 4.5.2.3 Traversal
	4.6 B^+Tree	4.6.1Definition of B^+ Tree 4.6.2 Operations on B^+Tree 4.6.2.1 Insertion 4.6.2.2 Deletion 4.6.2.3 Traversal
	4.7 AVL Tree	4.7.1 Concept and advantage of Height balanced tree 4.7.2 Balance Factor of a node 4.7.3 Operations on AVL Tree 4.7.3.1 Insertion 4.7.3.2 Deletion 4.7.3.3 Traversal
	4.8 Threaded Binary Tree	4.8.1 Concept of Thread 4.8.2 Right in threaded binary tree 4.8.3 Left in threaded binary tree 4.8.4 In threaded binary tree
5.	**UNIT-5: GRAPHS AND HASHING**	
	5.1Graph Basic concepts	5.1.1 Definition 5.1.2 Directed, Undirected and weighted graphs

		5.1.3 Relation between Trees and Graphs
	5.2 Graph Traversals	5.2.1 Breadth First Search (BFS) 5.2.2 Depth First Search (DFS)
	5.3 Minimum Cost Spanning Tree	5.3.1 Definition 5.3.2 Algorithms to calculate Minimum Cost Spanning Tree 5.3.2.1 Kruskal's Algorithm 5.3.2.2 Prim's Algorithm
	5.4 Shortest Path Algorithm	5.4.1 Single Source multiple Destination Algorithm 5.4.1.1 Dijkstra's Algorithm
	5.5 Hashing	5.5.1 Definition and Advantages 5.5.2 Hash Function 5.5.3 Address Calculation techniques 5.5.4 Common Hash Functions
	5.6 Collision Resolution Techniques	5.6.1 Linear Probing 5.6.2 Quadratic Probing 5.6.3 Double Hashing 5.6.4 Chaining

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE PLAN (Deployment)

Campus: PCE Course: B.TECH	**Class/Section: II YEAR/III Sem**	**Date:22/08/2023**
Name of Faculty: SHAZIA HAQUE	**Name of Subject: Data Structures and Algorithms**	**Code: 3IT4-05**

S.No.	TOPIC AS PER BLOWNUP SYLLABUS	LECT. NO.	CO Attained	PLANNED DATE	ACTUAL DEL. DATE	REF. / TEXT BOOK WITH PAGE NO.
0.	**Zero lecture**	L0	-			
	UNIT:1 STACK					
	INTRODUCTION OF UNIT I					
1.	**Introduction** 1.1Basic Stack Operations 1.1.1 Definition & Representation 1.1.2 Push & Pop Operations	L1	CO1, CO2			T1, T2
	Conclusion **Introduction** 1.2 Representation of stack using array, dynamic array and Linked List 1.2.1 Methods to represent stack using array 1.2.2 Method to represent stack using dynamic array 1.2.3 Method to represent stack using Linked List	L2	CO2, CO3			T2
	Conclusion **Introduction** 1.3 Multiple stack implementation using single array 1.3.1 Implementation of two stacks by using a single array	L3	CO2			T1,T2
	Conclusion **Introduction** 1.4Stack Applications 1.4.1 Tower of Hanoi 1.4.2 Function Call & Return 1.4.3 Parenthesis Matching 1.4.4 Backtracking	L4	CO3			T2
	Conclusion **Introduction** 1.4Stack Applications 1.4.5 Expression Evaluation	L5	CO3			T2

	1.4.5.1 Precedence &Associativity 1.4.5.2 Difficulties in dealing with infix expressions 1.4.5.3 Resolving precedence of operators and association of operands 1.4.5.4 Postfix expressions 1.4.5.5 Prefix Expressions **Conclusion** **Introduction** 1.4Stack Applications 1.4.5.6 Conversion of expression from one form to other form using stack (with & without parenthesis) 1.4.5.7 Evaluation of expression in infix, postfix & prefix forms using stack **Conclusion** **Conclusion of Unit I**	L6	CO3			T2
2.	**UNIT:2-QUEUE AND LINKED LIST** **INTRODUCTION OF UNIT II** **Introduction** 2.1 Queue and operations on queues 2.1.1 Definition of queue data structure 2.1.2 Operations on queues 2.1.2.1 Enqueue operation 2.1.2.2 Dequeue operation **Conclusion**	L7	CO1, CO2			T1, R3
	Introduction 2.2 Types of queues 2.2.1 Linear Queue 2.2.1.1 Representation and implementation using array 2.2.1.2 Representation and implementation using Linked Lis **Conclusion**	L8	CO2, CO3			T2, R1
	Introduction 2.2 Types of queues 2.2.2 Circular Queue 2.2.1.1 Representation and implementation using array 2.2.1.2 Representation and implementation using Linked List **Conclusion**	L9	CO2, CO3			T1
	Introduction 2.2 Types of queues 2.2.3 Double Ended Queue (DEQUEUE)	L10	CO2, CO3			T2

	2.2.1.1 Representation and implementation using array 2.2.1.2 Representation and implementation using Linked List **Conclusion**					
	Introduction 2.2 Types of queues 2.2.4 Priority Queue 2.2.1.1 Representation and implementation using array 2.2.1.2 Representation and implementation using Linked Lis **Conclusion**	L11	CO2, CO3			T1
	Introduction 2.3 Applications of Queues 2.3.1 Scheduling Algorithm- Round Robin Algorithm 2.3.2 Spooling Algorithm 2.3.3 Simulation **Conclusion**	L12	CO3			T1
	Introduction 2.4 Linked List 2.4.1 Introduction and Definition 2.4.2 Array v/s Linked List 2.4.3 Storage Representation & Memory Allocation 2.4.3.1 Concept of Head Node in Linked List 2.4.3.2 Allocation of memory for nodes **Conclusion**	L13	CO1, CO2			T2, R2
	Introduction 2.5 Types of Linked Lists 2.5.1 Singly Linked List 2.5.1.1 Insertion Operation 2.5.1.1.1 From Beginning 2.5.1.1.2 From End 2.5.1.1.3 At Specified Position 2.5.1.2 Deletion Operation 2.5.1.2.1 From Beginning 2.5.1.2.2 From End 2.5.1.2.3 At Specified Position 2.5.1.3 Reversing a singly linked list **Conclusion**	L14	CO2, CO3			T2
	Introduction 2.5 Types of Linked Lists 2.5.1 Circular Singly Linked List 2.5.1.1 Insertion Operation 2.5.1.1.1 From Beginning	L15	CO2, CO3			T2, R2

	2.5.1.1.2 From End 2.5.1.1.3 At Specified Position 2.5.1.2 Deletion Operation 2.5.1.2.1 From Beginning 2.5.1.2.2 From End 2.5.1.2.3 At Specified Position 2.5.1.3 Reversing a singly linked list **Conclusion**					
	Introduction 2.5 Types of Linked Lists 2.5.1 Doubly Linked List 2.5.1.1 Insertion Operation 2.5.1.1.1 From Beginning 2.5.1.1.2 From End 2.5.1.1.3 At Specified Position 2.5.1.2 Deletion Operation 2.5.1.2.1 From Beginning 2.5.1.2.2 From End 2.5.1.2.3 At Specified Position 2.5.1.3 Reversing a singly linked list **Conclusion**	L16	CO2, CO3			R2, T1
	Introduction 2.5 Types of Linked Lists 2.5.1 Circular Doubly Linked List 2.5.1.1 Insertion Operation 2.5.1.1.1 From Beginning 2.5.1.1.2 From End 2.5.1.1.3 At Specified Position 2.5.1.2 Deletion Operation 2.5.1.2.1 From Beginning 2.5.1.2.2 From End 2.5.1.2.3 At Specified Position 2.5.1.3 Reversing a singly linked list **Conclusion**	L17	CO2, CO3			R2, T2
	Introduction 2.5 Types of Linked Lists 2.5.5 Header Linked List 2.5.5.1 Concept of a Header Node 2.5.5.2 Uses of Header Linked List **Conclusion** **Conclusion of Unit II**	L18	CO2, CO3			T1
	OPEN BOOK TEST	L19	-			
3	**UNIT:3 –SEARCHING& SORTING TECHNIQUES**					

	INTRODUCTION OF UNIT III **Introduction** 3.1 Searching techniques 3.1.1 Linear Search 3.1.2 Binary Search 3.1.3 Comparison of Linear and Binary Search **Conclusion**	L20	CO4			T1
	Introduction 3.2 Sorting Techniques 3.2.1 Basic concepts 3.2.2 Bubble Sort 3.2.3 Insertion Sort **Conclusion**	L21	CO4			T2, R3
	Introduction 3.2 Sorting Techniques 3.2.1 Selection Sort 3.2.2 Heap Sort 3.2.3 Quick Sort **Conclusion**	L22	CO4			T1
	Introduction 3.2 Sorting Techniques 3.2.1 Merge Sort 3.2.2 Radix Sort 3.2.3 Counting Sort **Conclusion**	L23	CO4			T1
	Conclusion of Unit III **REVISION LECTURE** **I MID TERM EXAM**	L24	-			
4	**UNIT:4- TREES** **INTRODUCTION OF UNIT-4** **Introduction** **4.1** Introduction to Tree data structure 4.1.1 Definition of Tree 4.1.2 Properties of Tree **Conclusion**	L25	CO1, CO2			T2
	Introduction **4.2** Binary Tree 4.2.1 Definition of Binary Tree 4.2.2 Representation of Binary Tree 4.2.2.1 Using Array Representation 4.2.2.2 Using Linked List Represen **Conclusion**	L26	CO1,CO 2			T1
	Introduction 4.3 Operations on Binary Tree 4.3.1 Traversals 4.3.1.1 Preorder (Recursive) 4.3.1.2 Postorder (Recursive) 4.3.1.3 Inorder (Recursive) 4.3.1.4 Preorder (Iterative)	L27	CO2			R1,T2

	4.3.1.5 Postorder (Iterative) 4.3.1.6 Inorder (Iterative) 4.3.1.7 Level Order Traversal **Conclusion** **Introduction** 4.4 Binary Search Tree (BST) 4.4.1 Definition of BST 4.4.2 Operations on BST 4.4.2.1 Insertion 4.4.2.2 Deletion 4.4.2.3 Traversal **Conclusion** **Introduction** 4.5 B Tree 4.5.1 Definition of B Tree 4.5.2 Operations on B Tree 4.5.2.1 Insertion 4.5.2.2 Deletion 4.5.2.3 Traversal **Conclusion** **Introduction** 4.6 B^+Tree 4.6.1Definition of B^+ Tree 4.6.2 Operations on B^+Tree 4.6.2.1 Insertion 4.6.2.2 Deletion 4.6.2.3 Traversal **Conclusion** **Introduction** 4.7 AVL Tree 4.7.1 Concept and advantage of Height balanced tree 4.7.2 Balance Factor of a node 4.7.3 Operations on AVL Tree 4.7.3.1 Insertion 4.7.3.2 Deletion 4.7.3.3 Traversal **Conclusion** **Conclusion of Unit IV** **Revision Class (Unit-IV)** **UNIT:5- GRAPHS AND HASHING** **INTRODUCTION OF UNIT-5** **Introduction** 5.1Graph Basic concepts 5.1.1 Definition 5.1.2 Directed, Undirected and weigh graphs 5.1.3 Relation between Trees and Graphs	L28 L29 L30 L31 L32 L33	CO2 CO2 CO2 CO2 - CO1, CO2			T2 R2,T1 T1 T2,R1 T1
5						

	Conclusion **Introduction** 5.2 Graph Traversals 5.2.1 Breadth First Search (BFS) 5.2.2 Depth First Search (DFS) **Conclusion**	L34	CO2, CO3			T1
	Introduction 5.3 Minimum Cost Spanning Tree 5.3.1 Definition 5.3.2 Algorithms to calculate Minimum Cost Spanning Tree 5.3.2.1 Kruskal's Algorithm 5.3.2.2 Prim's Algorithm **Conclusion**	L35	CO2, CO3			T2
	Introduction 5.4 Shortest Path Algorithm 5.4.1 Single Source multiple Destination Algorithm 5.4.1.1 Dijkstra's Algorithm **Conclusion**	L36	CO2, CO3			T1
	Introduction 5.5 Hashing 5.5.1 Definition and Advantages 5.5.2 Hash Function 5.5.3 Address Calculation techniques 5.5.4 Common Hash Functions **Conclusion**	L37	CO4			T1
	Introduction 5.6 Collision Resolution Technique 5.6.1 Linear Probing 5.6.2 Quadratic Probing 5.6.3 Double Hashing 5.6.4 Chaining **Conclusion** **Conclusion of Unit V**	L38	CO4			T2
	REVISION CLASS	L39	-			
	Class Test-V (Unit-V)	L40	-			

REMARKS (REF.) — T1: Data Structures - Seymour Lipschutz, T2: Fundamentals of computer Algorithms - Ellis Horowitz, Sanguthevar Rajasekaran & Sartaj Sahani

R1: An Introduction to data structures with applications - Jean Paul Tremblay, P. G. Sorenson, R2: Data Structures using C and C++ - Yedidyah Langsam, Aaron M. Tenenbaum, Moshe J. Augenstein, R3: Algorithm Design - M. T. Goodrich, R. Tamassia

POORNIMA
COLLEGE OF ENGINEERING

Affiliated to RTU, Kota • Approved by AICTE & UGC under 2(f) • NAAC A+ Accredited

Session: 2023-24 (ODD Sem.)

Name of College: POORNIMA COLLEGE OF ENGINEERING

Department of INFORMATION TECHNOLOGY

Zero Lecture

Name of Faculty: Shazia Haque Branch: Information Technology
1). Name of Subject with Code: Data Structures and Algorithms (3IT4-05)

2). Self-Introduction:
a). Name: *Shazia Haque*
b). Qualification: *M. Tech (IT)*
c). Designation: *Assist. Prof. (IT)*
d). Research Area: *DBMS*
e). E-mail Id: shazia@poornima.org
f). Other details: Information about areas of proficiency/ expertise such as subject taught, laboratory taken, Member of Professional body, Academic Proficiency, Book Authored, Paper published in National and International Conference/Journals etc.

- Subjects Taught: CSP, SE-II, DBMS, SSE, DSA, PPL, OOP, DP
- Labs Taken: CPL, DSA Lab, OOP Lab, Database Lab etc
- Books Authored: CP& IT (B. Tech Ist Sem)

3). Introduction of Students:
a). *Identifying and keeping records* of students based on merit/ weak in academics, smart/ dull in extra & co-curricular activity, day scholar/ hosteller, Hindi or English medium, urban or rural family background, their learning style (seeing, hearing, doing) etc.
b*). Achievement of students in previous years*

Sr. No.	Average result of 12th	No. of student scored marks above 80%	Marks 60% above (No. of students)	Marks between 40%-60% (No. of students)	English Medium Students (No.)	Hindi Medium Students (No.)	No. of Hostellers	No. of Day Scholar
1	86.45%	11	34	11	31	34	16	49

4). Instructional Language: - 100%English

5). Introduction to subject: - (Pl. separate out subject specific matter and general matter valid for all subjects and group/place them appropriately)

a). Relevance to Branch: Data Structures and Algorithms is a subject that involves the structuring of data in primary memory and IT branch is directly related with programming . Hence the requirement for IT Engineers to understand this subject is very important.

b). Relevance to Society: As IT engineers are expected to serve the society by writing efficient and easy to use software hence DSA is relevant to society also.

c). Relevance to Self: I have a teaching experience of around 11 years and I have taught DSA many times and every time I teach it I come across new ways and methods of implementing various data structures.

d). Relation with laboratory: We have a lab called Data Structures Lab (3IT8) related with this subject. This lab deals with understanding the various data structures like Array, Stack, Queue, Linked List, Tree, Graph etc and their implementation in C Programming Language. The objective of this lab is to make students understand the practical implementation of various data structures and algorithms to perform different operations on them.

e). Connection with previous year and next year: In the previous year we have C programming. Now Data structures Lab is implemented in C Language only. In next year you will study Advanced Data Structures(ADS) and the knowledge of DSA is mandatory for understanding of ADS.

6). Syllabus of Rajasthan Technical University, Kota

a). Index Terms/ Key Words: Algorithm, Time Complexity, Space Complexity, Stack, Queue, Linked List, Tree, Graph

b). RTU Syllabus with Name of Subject & Code: Data Structures and Algorithms (3IT4-05)

Unit No.	Contents	Hours
I	Stacks: Basic Stack Operations, Representation of a Stack using Static Array and Dynamic Array, Multiple stack implementation using single array, Stack Applications: Reversing list, Factorial Calculation, Infix to postfix Transformation, Evaluating Arithmetic Expressions and Towers of Hanoi.	8
II	Queues: Basic Queue Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack, Application of Queues- Round Robin Algorithm. Circular Queues, DeQueue Priority Queues. Linked Lists: Introduction, single linked list, representation of a linked list in memory, Different Operations on a Single linked list, Reversing a single linked list, Advantages and disadvantages of single linked list circular linked list, double linked list and Header linked list.	10
III	Searching Techniques: Sequential and binary search. Sorting Techniques: Basic concepts, Sorting by bubble sort, Insertion sort, Selection Sort, quick sort, heap sort, merge sort, radix sort and counting sort algorithms.	7
IV	Trees: Definition of tree, Properties of tree, Binary Tree, Representation of Binary trees using arrays and linked lists, Operations on a Binary Tree, Binary Tree Traversals (recursive), Binary search tree, B-tree, B+ tree, AVL tree, Threaded binary tree.	7
V	Graphs: Basic concepts, Different representations of Graphs, Graph Traversals (BFS & DFS), Minimum Spanning Tree (Prims &Kruskal) Dijkstra's shortest path algorithms. Hashing: Hash function, Address calculation techniques, Common hashing functions, Collision resolution: Linear and Quadratic probing, Double hashing.	8
	Total	**40**

c). ABC analysis (RGB method) of unit & topics:

Unit No.	A (Hard Topics)	B (Topics with average hardness level)	C (Easy to understand topics)	Preparedness for 'A' topics
1	Stack Applications: Reversing list, Factorial Calculation, Infix to postfix Transformation, Evaluating Arithmetic Expressions and Towers of Hanoi.	Multiple stack implementation using single array	Stacks: Basic Stack Operations, Representation of a Stack using Static Array and Dynamic Array	PPTs and Video Lecture
2	DeQueue, Priority Queues. Different Operations on a Single linked list, reversing a single linked list, Advantages and disadvantages of single linked list circular linked list, double linked list and Header linked list.	Application of Queues- Round Robin Algorithm. Circular Queues Linked Lists: Introduction, single linked list, representation of a linked list in memory,	Queues: Basic Queue Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack	PPTs and Video Lecture Discuss with Mentor
3	Quick sort, heap sort and merge sort	Sorting Techniques: Basic concepts, sorting by bubble sort, Insertion sort, selection sort, radix sort and counting sorting algorithms.	Searching Techniques: Sequential and binary search.	PPTs and Video Lecture Or SPL
4	Binary search tree, B-tree, B+ tree, AVL tree, Threaded binary tree.	Representation of Binary trees using arrays and linked lists, Operations on a Binary Tree, Binary Tree Traversals (recursive)	Trees: Definition of tree, Properties of tree, Binary Tree	PPTs and Video Lecture
5	Minimum Spanning Tree (Prim's &Kruskal's) Dijkstra's shortest path algorithms.	Graph Traversals (BFS & DFS). Hashing: Hash function, Address calculation techniques, and Common hashing functions, Collision resolution: Linear	Graphs: Basic concepts, Different representations of Graphs.	PPTs and Video Lecture Discuss with Mentor

		and Quadratic probing, Double hashing.		

Note: Red – A category (Tough Topics)
Green– B Category (Average topics)
Blue – C Category (Easy Topics)

7). Books/ Website/Journals & Handbooks/ Association & Institution:

a). Recommended Text & Reference Books and Websites:

S. No.	Title of Book	Authors	Publisher	Cost (Rs.)	No. of books in Library
Text Books					
T1	Data Structures	Seymour Lipschutz	TMH	Rs.395	55
T2	Fundamentals of computer Algorithms	Ellis Horowitz, Sanguthevar Rajasekaran & Sartaj Sahani	Galgotia Publications	Rs.240	20
Reference Books					
R1	An Introduction to data structures with applications	Jean Paul Tremblay, P. G. Sorenson	TMH	Rs.475	06
R2	Data Structures using C and C++	Yedidyah Langsam, Aaron M. Tenenbaum, Mosh e J. Augenstein	PHI Learning	Rs.350	29
R3	Algorithm Design	M. T. Goodrich, R. Tamassia	John Wiley & Sons	Rs.397	13
Websites related to subject					
1	www.nptel.iitm.ac.in				
2	http://en.wikibooks.org/wiki/Data_Structures				

b). Journals & Handbooks: - To give information about different Journals & Handbooks available in library related to the subject and branch.

1. **Journal of Discrete Algorithms**
2. **Journal of Experimental Algorithms**

c). Associations and Institutions: - To give information about different Associations and Institutions related to the subject and branch.

1. IACSIT – International Association of computer Science and Information Technology (www.iacsit.org)
2. ASIS&T - Association for Information Science and Technology

8). Syllabus Deployment: -

a). Total weeks available for academics (excluding exams/ holidays) as per PGC calendar-

Semester	III
No. of Working days available(Approx.)	75
No. of Weeks (Approx.)	13

- Total weeks available for covering RTU syllabus- 10-11 weeks (Approx.)
- Total weeks available for special activities (as mentioned below)- 02 weeks (Approx.)

Note: Individual faculty must calculate the exact no. of lectures available according to time table etc. after consultation with HOD.

b). Special Activities (To be approved by HOD, Dean & Campus Director & must be mentioned in deployment):

- Open Book Test- Once in a semester
- Quiz (50% Technical & 50% Aptitude)- Once in a semester
- Special Lectures (SPL)- 10% of total no. of lectures including following
    i. One PPT by the faculty, who is teaching the subject
    ii. SPL by expert faculty at PGC level
    iii. SPL by expert from industry/academia (other institution)
- Revision classes:- 1 to 3 turn at the end of semester (Before II Mid Term Exam)
- Solving Important Question Bank- 1 Turn before I & II Mid Term Exam (each) - Total Two turn.

c). Lecture schedule per week

i). University scheme (L+T+P) = 3+0+0

ii). PGC scheme (L+T+P) = 3+1+0

Sr. No.	Name of Unit	No. of lectures	Broad Area	Degree of difficulty (High/Medium/Low)	No. of Question in RTU Exam.	Text/ Reference books
1.	Introduction and Complexity Analysis	06	Efficiency Calculation	High	2	T1/R1
2.	Array, Stack and Queue	12	Linear Data Structures	Medium	2	T1, T3/R1
3.	Linked List & Searching Techniques	04	Linear Data Structures & Searching Techniques	Medium	2	T1/R1
4.	Trees	07	Non Linear Data Structures	High	2	T1/R3
5.	Graph & Sorting Techniques	06	Non Linear Data Structures & Sorting Techniques	High	2	T1/R2

d). Introduction & Conclusion: Each subject, unit and topic shall start with introduction & close with conclusion. In case of the subject, it is Zero lecture.

e). Time Distribution in lecture class: - Time allotted: 60 min.

i. First 5 min. should be utilized for paying attention towards students who were absent for last lecture or continuously absent for many days + taking attendance by calling the names of the students and also sharing any new/relevant information.
ii. Actual lecture delivery should be of 50 min.
iii. Last 5 min. should be utilized by recapping/ conclusion of the topic. Providing brief introduction of the coming up lecture and suggesting portion to read.
iv. After completion of any Unit/Chapter a short quiz should be organized.
v. During lecture student should be encouraged to ask the question**.**

Note: Pl. ensure that each student is having Lecture Note Book. Pl. Write day and date, name of the teacher, Name of Sub. with code, Unit and lecture no. and topics to be covered at the beginning of each lecture and ensure that students write in lecture note book. Ask students to leave 4/5 pages blank for copying the note from fellow students in case of their absenteeism.

9). Tutorial: - An essential component of Teaching- Learning process in Professional Education.

Objective: - To enhance the recall mechanism.
To promote logical reasoning and thinking of the students.

To interact personally to the students for improve numerical solving ability.

a). *Tutorial processing:* - Tutorial sheet shall be provided to each students

Ist Phase: - It is consisting of questions to be solved in the class assignment session in test mode on perforated sheet given in tutorial notebook (20 minutes).

IInd Phase: - Indicating/Initializing the weak issues/ drawback and Evaluating and providing the grade. Making a group with good student for assisting the weak students to explain/solve questions by every student on plain papers given in tutorial note book (20 minutes).

IIIrd Phase: - Solving/ explaining difficulties of lecture class and providing the new home assignment (20 minutes). To be done in tutorial note book.

b). *Home assignment shall comprise of two parts:*

Part (i) Minimum essential questions, which are to be solved and submitted by all with in specified due date.

Part (ii) Other important questions, which may also be solved and submitted for examining and guidance by teacher.

10). Examination Systems:

Sr. No.	**Name of the Exam**	**Max. Marks**	**% of passing marks**	**Nature of paper Theory + Numerical**	**Syllabus coverage (in %)**	**Conducted by**
1.	Ist Mid Term Exam	60	40%	Theory+Numerical	60%	PGC
2.	IInd Mid Term Exam	60	40%	Theory+Numerical	40%	PGC
3.	University (End) Term Exam	70	40%	Theory+Numeric	100%	RTU

Place & Date:

Jaipur, 23/8/2023

Name of Faculty with Designation

Shazia Haque, Assistant Prof. IT

Poornima College of Engineering

Department of Information Technology

Sub Code: 3IT4-05 **Sub Name: Data Structures and Algorithms**

Date: 30.9.23 **Submission Date: 7.10.2023**

Assignment No. 1

Topic: Linked Lists

Max. Marks: 20

Q. 1. CO1. Compare Arrays and Linked lists with respect of their advantages and disadvantages. [3]

Q. 2. CO 2. Write algorithms for insertion, deletion and traversal operations on: [10]

I. Circular Singly Linked List
II. Circular Doubly Linked List

Q. 3. CO 2. Define a Header Linked List. What is the advantage of creating a Header Linked List? [2]

Q. 4. CO 3.What is meant by a Self-Referential Structure in C language? Explain and also declare a self-referential structure. [3]

Q. 5. CO 4. What is a NULL pointer? Why is it used to represent an empty linked list? Explain. [2]

****

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF INFORMATION TECHNOLOGY

3IT4-05 DSA: CO & PO Attainment through Assignment 1

Student Attainment Level 3 Count	**53**
Student Attainment Level 3 %	**95**
Student Attainment Level 2 Count	**8**
Student Attainment Level 2%	**5**
Student Attainment Level 1 Count	**5**
Student Attainment Level 1 %	**3**

CO-Gap Identification

COs	CO1	CO2	CO3	CO4	CO5	Overall CO
Targets	3.00	2.60	3.00	3.00		2.67
Attainment	1.80	2.18	2.42	2.08		2.17
Gap	1.20	0.42	0.58	0.92		0.5

PO Attainment

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Targets	3.00	3.00	3.00	3.00							2.00	2.00	1.00	1.00	
Attainment	2.54	2.08	2.24	2.18							1.01	1.01	0.34	0.33	
Gap	0.46	0.92	0.76	0.82							0.99	0.99	0.66	0.66	

Gap identified:

CO1 has gap of 1.20, whereas CO2, CO3 and CO4 has very less of 0.42, 0.58 and 0.92 respectively.

Action Taken:

To fill the gap in CO1, Emphasis is on giving question related to CO1 while designing I Midterm paper.

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

II B.TECH. (III Sem.) **Roll No. _____**

FIRST MID TERM EXAMINATION 2023-24

Code: 3IT4-05 Category: PCC Subject Name–DATA STRUCTURES AND ALGORITHMS

(BRANCH – INFORMATION TECHNOLOGY)

Course Credit: 03

Max. Time: 2 hrs. **Max. Marks: 60**

NOTE:- Read the guidelines given with each part carefully.

Course Outcomes (CO):

At the end of the course the student should be able to:

CO1: Define and compare various Linear and Non-Linear Data Structures along with their applications.

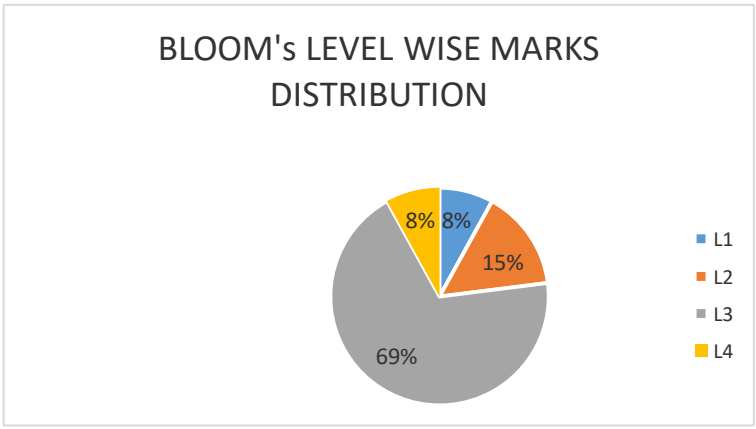
CO2: Explain the memory representation of arrays, linked lists, stacks, queues, trees, and graphs; and apply various operations on these data structures.

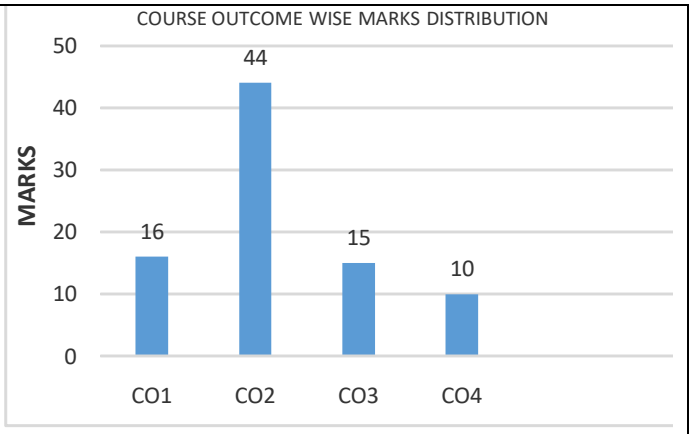
CO3: Choose appropriate data structure for the specified problem definition and compare the benefits of dynamic and static implementation of data structures.

CO4: Select appropriate sorting and searching technique for an application and explain the concept of Hashing.

	PART - A: (All questions are compulsory) Max. Marks (10)				
		Marks	**CO**	**BL**	**PO**
Q.1	Define the term Data Structure. What are the types of Data Structures?	**2**	**CO 1**	L1	PO3
Q.2	Convert the following expressions into postfix notation: (i) A * B ^ C / D (ii) A * (B + C * D) + E	**2**	**CO 1**	L4	PO3
Q.3	What is meant by Self Referential structure? Explain and declare a Self Referential structure for a Double Linked List.	**2**	**CO 2**	L3	PO4
Q.4	What are the advantages of a Linked List in comparison to an array?	**2**	**CO 1**	L2	PO3
Q.5	Write and explain the syntax of malloc() function.	**2**	**CO 2**	L2	PO4
	PART - B: (Attempt 4 questions out of 6) Max. Marks (20)				
Q.6	Write the algorithm to evaluate a Postfix Expression.	**5**	**CO 1**	**L3**	PO3
Q.7	Explain the applications of Stack.	**5**	**CO 1**	**L1**	PO3
Q.8	Compare Arrays and Linked Lists and list their advantages and disadvantages.	**5**	**CO 2**	**L1**	PO4
Q.9	What is meant by a Header Linked List? Explain its advantages.	**5**	**CO 2**	**L1**	PO4
Q.10	Write algorithm to reverse a Singly Linked List.	**5**	**CO 2**	**L2**	PO4
Q.11	Write an algorithm for converting an Infix expression into Postfix form.	**5**	**CO 3**	**L3**	PO3
	PART - C: (Attempt 3 questions out of 4) Max. Marks (30)				
Q.12	Explain Stack as an abstract data structure. Write algorithms for various operations of Stack implemented using contiguous memory allocation.	**10**	**CO 3**	**L3**	PO3
Q.13	Compare and explain in detail the contiguous and non-contiguous implementation of stack. Highlight the advantages and drawbacks of both the implementations.	**10**	**CO 2**	**L3**	PO4
Q.14	Write algorithms to insert at the beginning and the end of a Doubly Linked List.	**10**	**CO 2**	**L3**	PO4

Q. 15	Write algorithms to insert and delete an element in a Sorted Singly Linked List.	**10**	**CO 4**	**L3**	PO3





BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating)

CO – Course Outcomes; PO – Program Outcomes

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF INFORMATION TECHNOLOGY

3IT4-05 DSA: CO & PO Attainment through Mid Term 1

Student Attainment Level 3 Count	**41**
Student Attainment Level 3 %	**71**
Student Attainment Level 2 Count	**11**
Student Attainment Level 2%	**19**
Student Attainment Level 1 Count	**6**
Student Attainment Level 1 %	**10**

CO-Gap Identification

COs	CO1	CO2	CO3	CO4	CO5	Overall CO
Targets	2.00	3.00	3.00	3.00		2.75
Attainment	1.74	1.82	2.27	1.80		1.93
Gap	0.26	1.18	0.73	1.20		0.83

PO Attainment

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Targets	3.00	3.00	3.00	3.00							2.00	2.00	1.00	1.00	
Attainment	2.28	1.69	1.95	1.82							0.88	0.88	0.34	0.33	
Gap	0.72	1.31	1.05	1.18							1.12	1.12	0.66	0.67	

Gap identified:

CO1 has gap of 0.26, whereas CO2, CO3 and CO4 has gap of 1.18, 0.73 and 1.20 respectively.

Action Taken:

Gap in CO1, CO2, CO3 and CO4 is still not filled so Class Test has been given to students having questions related to CO1, CO2, CO3 and CO4 while designing.

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

II B.TECH. (III Sem.) **Roll No. _____**

SECOND MID TERM EXAMINATION 2023-24

Code: 3IT4-05 Category: PCC Subject Name–DATA STRUCTURES AND ALGORITHMS

(BRANCH – INFORMATION TECHNOLOGY)

Course Credit: 03

Max. Time: 2 hrs. **Max. Marks: 60**

NOTE:- Read the guidelines given with each part carefully.

Course Outcomes (CO):

At the end of the course the student should be able to:

CO1: Define and compare various Linear and Non-Linear Data Structures along with their applications.

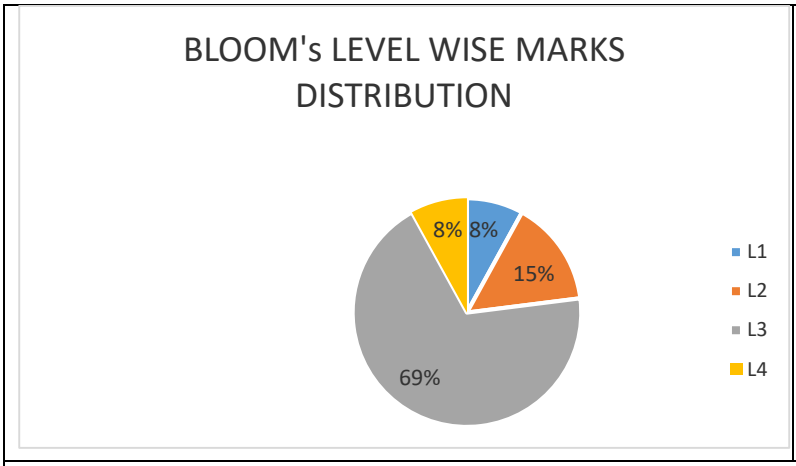
CO2: Explain the memory representation of arrays, linked lists, stacks, queues, trees, and graphs; and apply various operations on these data structures.

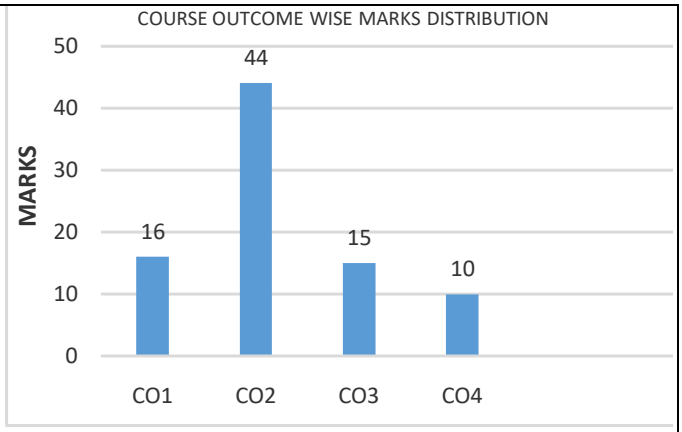
CO3: Choose appropriate data structure for the specified problem definition and compare the benefits of dynamic and static implementation of data structures.

CO4: Select appropriate sorting and searching technique for an application and explain the concept of Hashing.

	PART - A: (All questions are compulsory) Max. Marks (10)				
		Marks	**CO**	**BL**	**PO**
Q.1	Differentiate between a Tree and a Graph.	**2**	**CO 1**	L1	PO3
Q.2	What is Hashing? What is a Hash Function? Give example.	**2**	**CO 1**	L4	PO3
Q.3	What is a Height Balanced Tree? Explain its advantage.	**2**	**CO 2**	L3	PO4
Q.4	Draw the Binary Search Tree that results from inserting into an initially empty tree records with the keys: E A SY Q U E S T I O N	**2**	**CO 1**	L2	PO3
Q.5	Define Minimum Cost Spanning Tree. Name the algorithms used to compute a Minimum cost Spanning Tree?	**2**	**CO 2**	L2	PO4
	PART - B: (Attempt 4 questions out of 6) Max. Marks (20)				
Q.6	Give the Heap that results when starting with empty heap, nodes are inserted successively for the keys: TECHNICAL COMPETENCY Assume alphabetical ordering of the keys.	**5**	**CO 1**	**L3**	PO3
Q.7	Insert the following keys into an initially empty B-Tree of order 3: a, g, f, b, k, d, h, m, j, e, s, i, r, x, l, n, t, u and p. Show B-Tree at each step.	**5**	**CO 1**	**L1**	PO3
Q.8	What are the methods to store a Graph in Primary memory? Explain with examples.	**5**	**CO 2**	**L1**	PO4
Q.9	What is a Threaded Binary Tree? Discuss the advantages and disadvantages of a threaded storage representation for binary trees.	**5**	**CO 2**	**L1**	PO4
Q.10	Write and explain the recursive algorithms for postorder and inorder traversals of a Binary Tree.	**5**	**CO 2**	**L2**	PO4
Q.11	Write and explain the algorithm for Quick Sort.	**5**	**CO 3**	**L3**	PO3
	PART - C: (Attempt 3 questions out of 4) Max. Marks (30)				
Q.12	Write and explain the algorithm for calculating shortest path from single source to single destination? Explain with an example.	**10**	**CO 3**	**L3**	PO3
Q.13	Explain the method of inserting a value in an AVL Tree. Insert the following list of elements in an AVL tree: 3, 5, 11, 8, 4, 1, 12, 7, 2, 6 and	**10**	**CO 2**	**L3**	PO4

	10. Show AVL Tree at each step.				
Q.14	What are m-way search trees? Explain the node structure of a B^+ Tree. Insert the following values in a B^+ Tree of order 3: 28, 12, 10, 45, 34, 86, 100, 28, 34, 36 and 70. Show the Tree at each step.	**10**	**CO 2**	**L3**	PO4
Q. 15	Write the algorithms of Depth First Search (DFS) and Breadth First Search (BFS) Traversals of a Graph.	**10**	**CO 4**	**L3**	PO3





BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating)

CO – Course Outcomes; PO – Program Outcomes

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF INFORMATION TECHNOLOGY

3IT4-05 DSA: CO & PO Attainment through Mid Term 2

Student Attainment Level 3 Count	47
Student Attainment Level 3 %	84
Student Attainment Level 2 Count	7
Student Attainment Level 2%	13
Student Attainment Level 1 Count	2
Student Attainment Level 1 %	4

COs	CO1	CO2	CO3	CO4	CO5	Overall CO
Targets	2.00	3.00	3.00	3.00		2.67
MID I Attainments	1.74	1.82	2.27	1.80		1.93
Attainments Mid II	1.87	2.54	2.56	2.35		2.42
Attainments Cumulative	1.80	2.18	2.42	2.08		2.17
Gap	0.20	0.82	0.58	0.92		0.49

Overall CO Attainments for PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Targets	3.00	3.00	3.00	3.00							2.00	2.00	1.00	1.00	
MID I Attainments	2.28	1.69	1.95	1.82							0.88	0.88	0.34	0.33	
Attainments Mid II	2.80	2.47	2.53	2.54							1.13	1.13	0.33	0.33	
Attainments Cumulative	2.54	2.08	2.24	2.18							1.01	1.01	0.34	0.33	
Gap	0.46	0.92	0.76	0.82							0.99	0.99	0.66	0.67	

Gap identified:

CO1 has gap of 0.20, whereas CO2, CO3 and CO4 has gap of 0.82, 0.58 and 0.92 respectively.

Action Taken:

Gap in CO1, CO2, CO3 and CO4 is not reduced now. Another activity is required to reduce the gap of these COs.

Poornima College of Engineering
Department of Information Technology

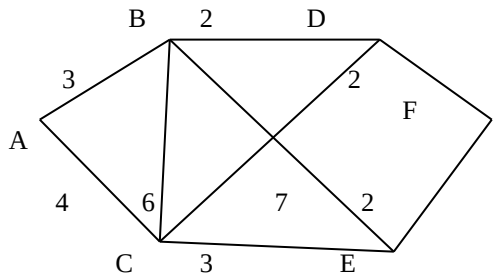
3IT-05 DATA STRUCTURES AND ALGORITHMS

Odd Sem 2023-24

Class Test Question Paper

Date: 12.10.2023

Max. Time: 1 hr. **Max. Marks: 30**

Q. No	Question	Marks	CO	BL	PO
Q.1	By taking suitable example explain the principle of insertion operation in Max heap.	**5**	**CO1**	**L2**	**PO1**
Q.2	Discuss the properties of B+ tree. Draw a B+ tree of order 4 by insertion of the following keys in order: 1, 4, 7, 10, 17, 21, 31, 25, 19, 20, 28, 42	**5**	**CO2**	**L3**	**PO2**
Q.3	Define the spanning tree. By using Prim's algorithm find the minimum cost spanning tree of the following: 	**5**	**CO3**	**L4**	**PO3**
Q.4	Discuss the advantages and disadvantages of Hashing over other searching techniques. Explain collision removal techniques in detail with suitable example.	**5**	**CO2**	**L3**	**PO2**
Q .5	Elaborate Breadth first search with suitable example and how it is different to depth first search.	**10**	**CO4**	**L4**	**PO4**

ATTAINMENT OF CO-PO (CLASS TEST) COMPONENT

Student Attainment Level 3 Count	**54**
Student Attainment Level 3 %	**86**
Student Attainment Level 2 Count	**8**
Student Attainment Level 2%	**13**
Student Attainment Level 1 Count	**1**
Student Attainment Level 1 %	**2**

ATTAINMENT OF CO (ASSIGNMENT-2) COMPONENT

CO-Gap Identification

CO Attainment						
Overall CO Attainments for PO	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO**
Targets	**3.00**	**2.60**	**3.00**	**3.00**		**2.67**
D1Attainments	**1.80**	**2.18**	**2.42**	**2.08**		**2.17**
Attainments D2	**2.89**	**2.45**	**2.86**	**2.86**		**2.53**
Attainments Cumulative	**2.19**	**2.18**	**2.48**	**2.30**		**2.23**
Gap	**0.81**	**0.42**	**0.52**	**0.70**		**0.43**

Describe what the reasons for gaps are

1. Gap in COs can be full filled by revision classes.

ATTAINMENT OF PO THROUGH CO (CLASS TEST) COMPONENT

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	Target CO for PO	PSO1	PSO2	PSO3	Target CO for PSO
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3.00	1	-	-	1.00
CO2	-	3	3	3	-	-	-	-	-	-	2	2	2.60	1	1	-	1.00
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3.00	-	1	-	1.00
CO4	-	3	-	-	-	-	-	-	-	-	-	-	3.00	-	1	-	1.00
CO5	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	
Target PO/PSO through CO	3.00	3.00	3.00	3.00							2.00	2.00	2.67	1.00	1.00		1.00

PO Attainment															
Overall CO Attainments for PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
Targets	3.00	3.00	3.00	3.00							2.00	2.00	1.00	1.00	
D1Attainments	2.54	2.08	2.24	2.18							1.01	1.01	0.34	0.33	
Attainments D2	2.89	2.86	2.83	2.83							1.28	1.28	0.33	0.33	
Attainments Cumulative	2.51	2.27	2.34	2.31							1.17	1.17	0.42	0.42	
Gap	0.49	0.73	0.66	0.69							0.83	0.83	0.58	0.58	

Gaps in PO through Class Test component:

Action to be taken: Revision of the units and practice of algorithms will be done in class.

Roll No. 22EKTT006 [Total No. of Pages : 3

3E1202

3E1202

B.Tech. III Sem. (Main&Back) Examination, January/February - 2024

Artificial Intelligence & Data Science

3AID4-05 Data Structures and Algorithms

AID, CAI, CS,IT,CCS, CDS,CIT,CSD, CSR

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates:

Attempt all Ten questions from Part A, Five questions out of Seven questions from Part B and Three questions out of Five questions from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/Calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No.205)

PART - A

(Answer should be given up to 25 words only)

ALL questions are Compulsory. **(10×2=20)**

1. What is Data structure?
2. Explain Asymptotic Notations?
3. What are linear and non-linear data structural .
4. What is linked list? What are its types?
5. Write applications of stacks.
6. Define complete Binary Tree?
7. Differentiate between static and Dynamic memory allocation.
8. What is the concept of minimum spanning Tree?
9. What is meant by abstract data type?
10. Compare tree and graph.

PART - B

(Analytical/Problem solving questions)

Attempt any FIVE questions. **(5×4=20)**

1. Explain tower of Hanoi problem in detail and write algorithm for that.
2. Calculate the address of the element A[15,25] using row major order and column major order for an array A[-15.....10, 15.....40] of elements. It is stored at location 100 and the size of each element is 4 bytes.
3. Write an algorithm to insert a node at specific location in circular linked list.
4. The in-order and pre-order traversal sequence of modes in a binary tree are given below:

   In-order: Q, B, K, C, F, A, G, P, E, D, H, R

   Pre-order: G, B, Q, A, C, K, F, P, D, E, R, H

   Draw the binary tree.
5. What is Priority Queue? How can it be implemented ? Write an applications of priority Queue.
6. Convert the following expression in its equivalent postfix expression.

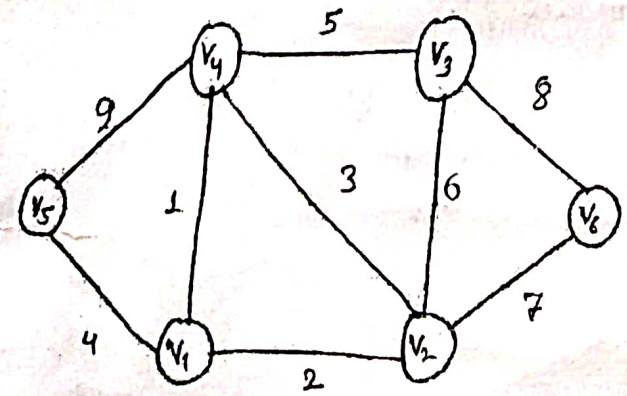
   A+(B×C - (D/E ^ F) ×G) ×H
7. Differentiate single linked list and circular linked list. Also write the advantage and disadvantages of circular linked list.

PART - C

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any THREE questions. **(3×10=30)**

1. Define the spanning tree. Write the Kruskal's algorithm to find the minimum cost spanning tree of the following.



2. What is an AVL Tree? Explain the concept of Balancing factor. Create an AVL tree using following sequence. 21,26,30,9,4,14,28,18,15,10,2,3,7

3. What is hashing and collision ? Discuss the advantages and disadvantages of hashing over other searching techniques.

4. Write an algorithm of Insertion sort. Sort the following elements using Insertion sort: 68,17,26,54,77,93,31,44,55,20

5. Write down the algorithm for following operations of doubly linked list :-

   a) Insertion of a node in the middle location.

   b) Delete a node from last location.

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE OUTCOMES

3IT4-05: Data Structures and Algorithms

After the completion of this course the students will be able to:

3IT4-05.1 (CO1): Define and compare various Linear and Non-Linear Data Structures along with their applications.

3IT4-05.2 (CO2) Explain the memory representation of arrays, linked lists, stacks, queues, trees, and graphs; and apply various operations on these data structures.

3IT4-05.3 (CO3) Choose appropriate data structure for the specified problem definition and compare the benefits of dynamic and static implementation of data structures.

3IT4-05.4 (CO4)**:** Select appropriate sorting and searching technique for an application and explain the concept of Hashing.

MAPPING OF CO WITH PO AND PSO

S. N.	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	**CO 1**	-	-	3	2	-	-	-	-	-	-	2	2	2	1	-
2	**CO 2**	-	-	-	3	-	-	-	-	-	-	2	2	3	1	1
3	**CO 3**	-	-	3	2	-	-	-	-	-	-	2	3	3	-	1
4	**CO 4**	-	-	3	2	-	-	-	-	-	-	-	2	3	-	1

PO Strongly Mapped:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO Moderately Mapped:

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO Low Mapped:

Nil

PSO Strongly Mapped:

Nil

PSO Moderately Mapped:

PSO-1

Analyze, design and develop efficient algorithms and software applications to deploy in secure network enabled environment meeting ever changing societal needs in economically acceptable terms.

PSO-2

Comprehend and apply knowledge of contemporary areas in Information Technology viz. Cloud based technologies, Machine Learning, Data Analytics, IOT and Network and Cyber Security to develop creative software solutions for automation of various industrial requirements.

PSO 3:

Exhibit familiarity and practical competence in modern programming languages and open source platforms so as to develop innovative projects related to business applications.

PSO Low Mapped:

NIL

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF INFORMATION TECHNOLOGY

3IT4-05: DATA STRUCTURES AND ALGORITHMS

RULES FOR CO/LO ATTAINMENT LEVELS: (TARGETS)

Course Category	Level 3	Level 2	Level 1
A	**60% of students getting >60% marks**	**50-60% of students getting >60% marks**	**40-50% of students getting >60% marks**

END TERM RTU COMPONENT: CO ATTAINMENT LEVELS

Course Category	Level 3	Level 2	Level 1
A	**50% of students getting >60% marks**	**40-50% of students getting >60% marks**	**30-40% of students getting >60% marks**

S. No.	Course Type	Attainment Level=1	Attainment Level=2	Attainment Level=3
1	**Theory Courses** Mid Semester Exams	**60% of students getting >60% marks**	**50-60% of students getting >60% marks**	**40-50% of students getting >60% marks**
2	**Theory Courses** University Exam	**50% of students getting >60% marks**	**40-50% of students getting >60% marks**	**30-40% of students getting >60% marks**
3	**Assignments/Unit Test**	40-50 % of students getting > 60% marks	50-60 % of students getting > 60% marks	60 % of students getting > 60% marks
4	**Any other**	NA	NA	NA

POORNIMA COLLEGE OF ENGINEERING, JAIPUR

DEPARTMENT OF INFORMATION TECHNOLOGY

3IT4-05: DATA STRUCTURES AND ALGORITHMS

CO WISE ASSESSMENT ACTIVITIES (AS MENTIONED IN SESSION PLAN)

CO	Assignment	Class Test	Mid Term - I	Mid Term - II
CO1	Y	Y	Y	Y
CO2	Y	Y	Y	Y
CO3	Y	Y	Y	Y
CO4	Y	Y	Y	Y

CO-PO/PSO MAPPING AND TARGETS

CO	PO												Avg.	PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	CO Targets	PSO1	PSO2	PSO3
CO1	-	-	3	2	-	-	-	-	-	-	2	2	3	2	1	-
CO2	-	-	-	3	-	-	-	-	-	-	2	2	2	3	1	1
CO3	-	-	3	2	-	-	-	-	-	-	2	3	3	3	-	1
CO4	-	-	3	2	-	-	-	-	-	-	-	2	2	3	-	1

ACTIVITY WISE ASSESSMENT TOOLS

Sr. No.	Activity	Assessment Method	Tools	Weightage Marks	Recommendation
1.	Assignment	Direct	Marks	20	For CO1, CO3
2.	Class Test	Direct	Marks	30	For CO1-CO4
3.	Mid Term- I	Direct	Marks	60	For CO1-CO4
4.	Mid Term- II	Direct	Marks	60	For CO1-CO4