



**East Delta University**  
**School of Science, Engineering and Technology**  
**Department of Department of Computer Science and Engineering**

***Course Outline – Data Structure***

**Credit Hours: 03**

**Program: Regular**

**Semester: 3rd**

**Course Type: major**

**Instructor: Kazi Ekramul Hoque**

**Designation: Assistant Professor**

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**Class Information:**

**Consultation Hour:**

**Class Link (optional):**

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***1. Course Description (Course Summary)***

This module provides an introduction to data structure and algorithms, types of data structures and programming principles. Student will learn abstract data type concepts using class and apply ADT concept in the implementation of data structures. Recursive function, algorithm efficiency, order of magnitude analysis and Big O notation will be discussed. Students will implement operations that can be applied to data structures using various sorting and searching techniques. Further, students will be exposed to linear data structures such as linked lists, stack and queue. Non-linear data structures such as tree and graphs will also be discussed. At the end of the course, students should be able to implement and apply the theory and concepts of data structure in the mini project which is conducted in group.

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**2. Course Learning Outcomes (CLO)**

Upon successful completion of the course, students will be able to-

CLO 1	Develop knowledge of basic data structures for storage and retrieval of ordered or unordered data. Data structures include: arrays, linked lists, binary trees, heaps, and hash tables.
CLO 2	develop knowledge of applications of data structures including the ability to implement algorithms for the creation, insertion, deletion, searching, and sorting of each data structure.
CLO 3	Develop sound techniques on designing, developing, and documenting well-structured programs using proper software engineering principles.
CLO 4	Learn to analyze and compare algorithms for efficiency using Big-O notation
CLO 5	Implement projects requiring the implementation of the above data structures.
CLO 6	Use mathematical techniques to analyze the efficiency of the various algorithms presented, as well as the common operations on the data structures discussed.

The CLO's are aligned with PLO's (Program Learning Outcomes) and EDU Graduate Attributes (EDUGA) as shown in the table below:

<b>CLO</b>	<b>PLO</b>	<b>EDUGA</b>
CLO 1	1, 2, 4	1
CLO 2	1, 2, 3	1,3
CLO 3	4, 6	1,3
CLO 4	4	1,2,4

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CLO 5	6,7	1,2,4
CLO 6	4,6	1,4

### ***3. Course Impact on the Learners***

Data structures course is designed to serve not only the Computer Science major but also Computer Science minors as well as Computer Engineering students and Electrical Engineering students. Students will learn to acquire the ability to translate a problem statement into an algorithm and then translate that algorithm into working code. A student who who completes this course should not only acquire a larger repertoire of programming tools, but should also acquire the skill and expertise to make thoughtful choices about implementations, which will not only influence program extensibility and program elegance, but also performance. The use of frameworks is not inconsistent with this view, but there is a constraint of time. To fully appreciate the impact of implementation and choice of data structures on performance, students must be actively involved understanding the inner workings of the basic data structures and in the analysis of them, including an understanding of how different inputs can cause different performance behaviors.

### ***4. Learning Resources***

#### **a) Textbooks**

1. Seymour Lipschutz: Data Structure.

#### **b) Suggested Readings**

1. Narasimha Karumanchi: Data Structures and Algorithms Made Easy : Data Structure and Algorithmic Puzzles.
2. Weiss, Mark A. Data Structures and Algorithm Analysis in C++. 4th Edition. Pearson 2014. ISBN-13: 978-0-13-284737-7 .
3. Malik, D S. Data Structures in C++, 2nd Edition, Cengage Learning.

#### **c) Online Learning**

- ☐ Graph Representation part 01 - Edge List

<https://www.youtube.com/watch?v=ZdY1Fp9dKzs>

- ☐ Graph Representation part 02 - Adjacency Matrix

<https://www.youtube.com/watch?v=9C2cpQZVRBA>

- ☐ Graph Representation part 03 - Adjacency List

<https://www.youtube.com/watch?v=k1wraWzqtvQ>

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- ☐ Graph Traversals - BFS & DFS -Breadth First Search and Depth First Search  
<https://www.youtube.com/watch?v=pcKY4hjDrxk>
- ☐ AVL Tree - Insertion and Rotations  
[https://www.youtube.com/watch?v=jDM6\\_TnYIqE](https://www.youtube.com/watch?v=jDM6_TnYIqE)
- ☐ Insertion sort algorithm  
<https://www.youtube.com/watch?v=i-SKeOcBwko>
- ☐ Topological Sorting | How to find all the possible topological orderings of a given graph?  
<https://www.youtube.com/watch?v=a3UDL-v6-44>
- ☐ Hash Tables and Hash Functions  
[https://www.youtube.com/watch?v=KyUTuwz\\_b7Q](https://www.youtube.com/watch?v=KyUTuwz_b7Q)

**d) Critical Essays/ Articles**

**5. *Assessment and Evaluation***

**a) Assessment Methods**

- i. Quizzes: Altogether 4 quizzes may be taken during the semester, 2 quizzes will be taken for midterm and 2 quizzes will be taken for final term. Out of this 2 quiz for each term best 1 quiz will be counted. No makeup quizzes will be taken. Students are strongly recommended not to miss any quizzes.
- ii. Assignment: The students will have to form a group of maximum 4 members. The topic or case studies will be given as assignment in groups during the class which they have to prepare at home and will submit on or before the due date. No late submission of assignments will be accepted. Students will have to do the presentation on the given topic as assignment
- iii. Continuous Assessment:
- iv. Class Attendance
- v. Viva
- vi. Presentation
- vii. Final Assessment

**viii. Marks Distribution**

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<b>S/L</b>	<b>Head of Marks Distribution</b>	<b>Method of Assessment</b>	<b>Method Applied</b>	<b>Platform Used</b>	<b>Marks</b>
<b>1</b>	Continuous Assessment	Ed-video, Quiz test, Class Test,	Assignment	Google classroom	15
			Ed-video	Edpuzzle	5
			Class Test	Offline on campus	20
<b>2</b>	Class Attendance	Class Attendance	Class Recording	Blackbox	5
<b>3</b>	Midterm Assessment	Written Exam	Time-bound written exam	Offline on campus	25
<b>4</b>	Final Assessment	Written Exam	Time-bound written exam	Offline on campus	30
	<b>Total</b>				<b>100</b>

### ***6. Learning and Teaching Activities***

#### **Topics to be covered**

The instructor will offer Learning and Teaching Activities (39 hours) to students through various platforms.

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<b>Lecture No./ Week</b>	<b>Topics {Sub-topic}</b>	<b>Topic/ Content-based learning outcome</b>	<b>Interaction Methods {Student Engagement}</b>	<b>Teaching Strategies</b>	<b>Alignment with CLO</b>
1	<b>Introduction</b> -Data types, Abstract data types and data structures.	Different data structure techniques will be discussed	Interactive Discussion	lecture discussion with multi media interactive discussion	1
2	<b>String Processing</b> -Introduction, Basic Terminology, Storing Strings, Character Data Type, String Operations, Word/Text Processing, Pattern Matching Algorithms	Discussion based on string operations	Interactive Discussion	lecture discussion with multi media	1, 2
3	<b>Array Operations</b> -Linear Search, Binary Search	To know Two searching algorithm of array	Interactive Discussion	lecture discussion with multi media	1,2
4	<b>Array Operations</b> -Insertion, Deletion, Bubble Sort	Multiple array operations will be discussed	Interactive Discussion	lecture discussion with multi media	1,2

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5	<b>Array Operations-</b> Merge Sort, Quick Sort	To know about the basic sorting techniques of array elements	Interactive Discussion	lecture discussion with multi media	1,2
6	<b>Linked Lists:</b> Introduction, Linked Lists, Representation of Linked Lists in Memory	To know how linked lists are created	Interactive Discussions	lecture discussion with multi media	1,2,4
7	<b>Linked Lists:</b> Traversing a Linked Lists, Insertion into a Linked Lists, Deletion from a Linked Lists	Discussing basic operations of linked list	Interactive Discussion	lecture discussion with multi media	1,2,4
8	<b>Linked Lists:</b> Circularly Linked Lists, Header Linked Lists, Two way Lists	To know the higher level linked list operations	Interactive Discussion	lecture discussion with multi media	1,2,4
9	<b>Stack, Queue and Recursion-</b> Introduction, Stack, Array, Representation of Stack, Linked Representation of Stack	To know how data can be stored and operated in stack and queue To know the representation of stack and queue	Interactive Lecture	lecture discussion with multi media	6,7

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10	<b>Stack, Queue and Recursion</b> -Arithmetic Expression: Polish Notation, Application of Stack, Recursion, Towers of Hanoi	Discussing recursive techniques	Interactive Discussion	lecture discussion with multi media	6,7
11	<b>Stack, Queue and Recursion</b> -Implementation of Recursive Procedure by Stack, Queues, Linked Representation of Queues, Circular Queues	Student will understand the recursive implementation of stack and queue	Interactive Discussion	lecture discussion with multi media	6,7
12	<b>Stack, Queue and Recursion</b> -Dequeues, Priority Queues, Applications of Queues.	To know the higher level operations of stack and queue	Interactive Discussion	lecture discussion with multi media	6,7
13-14	MID TERM EXAMINATION		Interactive Discussion	lecture discussion with multi media	
15	<b>Trees</b> -Introduction, Binary Trees, Representing Binary Trees in memory	Understanding basic operations of Tree	Interactive Discussions	lecture discussion with multi media	1,2,3



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16	<b>Trees-</b> Traversing Binary Trees, Traversing Algorithms using Stack	Learning the different traversing algorithm of tree	Interactive Discussion	lecture discussion with multi media	4,6
17	<b>Trees-</b> Binary Search trees, Searching and Inserting in Binary search Trees, Deleting in a Binary search Tree	To understand the operations of binary search tree	Interactive Discussion	lecture discussion with multi media	4,6
18	<b>Trees-</b> AVL Search Tree, Insertion in an AVL Search Tree, Deletion in an AVL Search Tree, m-way search Trees.	To learn the manipulation of elements in AVL search Tree	Interactive Discussion	lecture discussion with multi media	4,6
19	<b>Trees-</b> Searching, Insertion and Deletion in an m-way Search tree, B- Trees, Searching, Insertion and Deletion in a B-Tree	To learn the manipulation of elements in Binary search Tree	Interactive Discussion	lecture discussion with multi media	4,6
20	<b>Trees-</b> Heap: Heapsort, Path Lengths: Halfman Algoirthm.	To learn the sorting techniques if Heap Tree	Interactive Discussion	lecture discussion with multi media	4,6

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21	<b>Graphs and Their Applications</b> -Introduction, Graph Theory Terminology	To understand the basic graph theory	Interactive Discussions	lecture discussion with multi media	1,4
22	<b>Graphs and Their Applications</b> -Sequential Representation of Graphs: Adjacency Matrix, Path Matrix	To learn how graph can be expressed with matrix and their operations	Interactive Discussions	lecture discussion with multi media	6,7
23	<b>Graphs and Their Applications</b> -Linked Representation of Graph, Operations on Graphs, Traversing a Graph,	To learn how graph can be implemented with linked list	Interactive Discussions	lecture discussion with multi media	6,7
24	<b>Graphs and Their Applications</b> -Spanning Trees, BFS, DFS.	To understand the searching algorithms of graph	Interactive Discussions	lecture discussion with multi media	6,7
25-26	FINAL EXAMINATION				

**7. EDU Graduate Attributes**

SL	University Graduate Attributes
1	Domain knowledge
2	Research Understanding

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3	Leadership Development <ol style="list-style-type: none"><li>1. Sustainable Leadership</li><li>2. Digital Leadership</li><li>3. Moral and Ethical Leadership</li><li>4. Innovative Leadership</li></ol>
4	Soft-skill Development <ol style="list-style-type: none"><li>1. Effective Communication Skills</li><li>2. Critical Thinking and Problem Solving</li><li>3. Emotional Intelligence (EQ)</li></ol>
5	Global Citizenship

**8. Program Learning Outcome**

PLO 1	Understand and apply knowledge of computer science and engineering to analyze complex engineering problems and identify their solutions.
PLO 2	Demonstrate the ability to explain the theory and concepts of underlying computer science and engineering.
PLO 3	Prepare to be employed in IT industries and be engaged in learning, understanding, and applying new ideas.
PLO 4	Demonstrate an ability to use current techniques, skills and tools for computing practice.
PLO 5	Prepare to take up Masters / Research programs, and adopt the future challenges like virtual reality and robotics
PLO 6	Function effectively as an individual, and as a member or leader in designing and implementing software systems and effectively manage conflicts, optimize resources and meet deadlines.
PLO 7	Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

**9. *Assessment Policies***

**10. *Course Policies***

**11. *Examination Policies***