



Department of Software Engineering (SE)
Faculty of Science and Information Technology (FSIT)
Daffodil International University (DIU)
(Version 2.0)

Course Code: SE 131		CIE Marks: 60
ISCED: 0612-131		SEE Marks: 40
Course Title: Data Structure		Total Marks: 100
Semester: Spring 2024		
Credit Value: 3 (Theory)		Contact Hours: 2.5 (Total weeks: 18)
Prerequisite: SE121, SE122, SE123		
Course Type: Core		
Level: 2	Term: 1	Section:

CIE: Continuous Internal Evaluation, SEE: Semester End Examination

Instructor Details

Name:	
Employee ID:	
Designation:	
Department:	
Office Address:	
Telephone/Extension:	
Mobile:	
Website:	
GTA/UTA(If Any):	

Class Schedule with Counseling Hour

Time/ Date	8:30 AM- 9:45 AM	9:45 AM- 11:00 AM	11:00 AM- 12:15 PM	12:15 PM- 1:30 PM	1:30 PM- 2:45 PM	2:45 PM- 4:00 PM	4:00 PM- 5:15 PM	5:15 PM- 6:30 PM
Saturday								
Sunday								
Monday								
Tuesday								
Wednesday								
Thursday								

Course Content (from syllabus)

Overview of Data Structures, Algorithm and Complexity, Time Space Tradeoff, Recursion, Iteration , Record, Pointer, Implementation of Memory, Array: Traverse, Insert, Insert at any position, Delete at any position, Linear Search, Linear Search complexity, Binary Search, Binary Search Complexity,

Searching- Bubble Sort, Factorial and Tower of Hanoi Problem; Marge, Stack: Stack data Insertion, Stack Deletion, Stack : Search, Prefix, Infix and Postfix Expressions, Queue: Queue data Insertion, Queue Deletion, Queue: Search, Double Ended Queue, Priority Queue, Hashing: Hash Indices and Hash Functions, Static Linked List: List ADTs, Linked List data Insertion, Deletion, Search, Double Way Linked List: data Insertion, Deletion, Search, Circular Way Linked List: data Insertion, Deletion, Search, Tree, Tree terminologies, Binary Search Tree: Insertion, Deletion, Search, AVL Tree, Heaps, Heap Sort, Graph, Graph Terminologies, Adjacency matrix, Adjacency List, Graph data Insertion, Graph Deletion, Graph: Search.

Rationale of the Course

The course "Data Structure" offers a comprehensive exploration of foundational concepts in computer science, providing students with a systematic understanding of various data structures and algorithms. Beginning with fundamental topics such as array manipulation and linear and binary searches, students gain hands-on experience in traversing arrays and mastering search algorithms. As the curriculum progresses, more complex structures like stacks, queues, and linked lists are covered in depth, emphasizing practical implementation through insertion, deletion, and search operations. Sorting algorithms and memory management principles are addressed, enhancing students' problem-solving skills. Real-world applications of hashing techniques and tree structures deepen understanding, while graph theory introduces participants to graph manipulation and search algorithms. Throughout the course, emphasis is placed on analyzing time and space complexity, empowering students to make informed algorithmic decisions. Through hands-on exercises, students develop a strong foundation in algorithmic thinking, enabling them to tackle programming challenges with confidence by the course's conclusion.

Course Objectives

To provide a solid conceptual understanding of the fundamentals of data Structure, More specifically,

- To provide the knowledge of basic data structures and their implementations.
- To understand the importance of data structures in the context of writing efficient programs.
- To develop skills to apply appropriate data structures in problem-solving.
- To learn how data are stored in our computer memory
- Be familiar with writing recursive methods

Course Learning Outcomes (CLOs) with Mappings

At the end of the course, students will be able to:

CLOs	CLO Descriptions	Program Learning Outcomes (PLOs)	Learning Domains (C, P, A)	BNQF Skill
CLO1	Describe the basics of Data Structure	PLO2	C1	Fundamental Domain
CLO2	Interpret the performance and complexity of various data structure	PLO2	C2	Fundamental Domain
CLO3	Apply the static and dynamic data structure, linear data structure	PLO1	C3	Fundamental Domain
CLO4	Apply the concept of non-linear data structure	PLO1	C3	Fundamental Domain

Mapping of CLOs with PLOs

Course Learning Outcome	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1	√											
CLO2	√											
CLO3		√										
CLO4		√										

Course plan specifying content, CLOs, co-curricular activities (if any), teaching learning and assessment strategy mapped with CLOs:

Week/ Lesson (hour)	Lesson Topic	Teaching Learning Strategy	Assessment Strategy	Corresponding CLOs
Week-1 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Discussion on OBE of Data Structure	Classroom discussion, Open discussion.	Class Test, Midterm exam	CLO1
	Lesson 2: Data Structure main concept, basic operations, Algorithm, complexity.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam	CLO1
Week-2 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Time Space Trade-off, Recursion, Iteration.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam	CLO1
	Lesson 2: Iteration.: Array – Traverse, Insert, Insert at any position.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam	CLO1
Week-3 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Array Deletion Operation	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam	CLO1, CLO2
	Lesson 2: Linear Search, Linear Search complexity Class Test -1	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam	CLO1, CLO2
Week-4 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Binary Search.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam	CLO2
	Lesson 2: Binary Search Complexity.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam	CLO2

Week-5 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Sorting- Bubble Sort & Merge Sort.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam	CLO2
	Lesson 2: Prefix, Infix Operation	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Assignment, Midterm exam	CLO2
Week-6 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Postfix Operation.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Assignment, Midterm exam	CLO2
	Lesson 2: Review class on topic discussed in Week 1- Week 5, Presentation on a given topic.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture note, Open discussion.	Presentation, Open discussion	CLO1, CLO2
Week-7 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Stack – Stack data Insertion, Stack Deletion, Stack – Search.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam	CLO1, CLO3
	Lesson 2: Static Linked List – List ADTs, Linked List data Insertion. Class Test -2	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam	CLO1, CLO3
Week-8 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Linked List Deletion, Linked List – Search.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Assignment, Midterm exam, Final exam	CLO1, CLO3
	Lesson 2: Double Way Linked List – Double Way Linked List data Insertion.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Assignment, Midterm exam, Final exam	CLO1, CLO3
Week-9 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Double Way Linked List Deletion, Double Way Linked List – Search.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Assignment, Midterm exam, Final exam	CLO1, CLO3
	Lesson 2: Circular Way Linked List – Circular Way Linked List data Insertion.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Assignment, Midterm exam, Final exam	CLO1, CLO3
Week-10 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Circular Way Linked List Deletion, Circular Way Linked List – Search.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Assignment, Midterm exam Final exam	CLO1, CLO3

	Lesson 2: Concept of Queue, Queue Data Storage in Memory.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam, Final exam	CLO1, CLO3
Week-11 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Queue Traversing	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam, Final exam	CLO1, CLO3
	Lesson 2: Queue insertion and deletion.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam, Final exam	CLO1, CLO3
Week-12 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Searching in Queue.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam, Final exam	CLO1, CLO3
	Lesson 2: Queue – Double Ended Queue, Priority Queue.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Midterm exam, Final exam	CLO1, CLO3
Week-13 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Concept of Heap, Heap Sort.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Final exam	CLO1, CLO3
	Lesson 2: Tree- Concept of Tree, Binary Search Tree. Class Test -3	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Class Test, Final exam	CLO1, CLO4
Week-14 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Binary Search Tree – Tree data Insertion, Tree Deletion	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Assignment, Final exam	CLO1, CLO4
	Lesson 2: Hashing - Hash Indices and Hash Functions.	Classroom discussion, Voice over PPT, Lecture video, Lecture note, Open discussion.	Assignment, Final exam	CLO1, CLO4
Week-15 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Tree – Search, AVL.	Classroom discussion, Voice over PPT, Lecture video, Lecture note.	Assignment, Final exam	CLO1, CLO4
	Lesson 2: Concept of Recursion.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture note.	Assignment, Final exam	CLO1, CLO4
Week-16 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Implementation of Recursion.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture video, Lecture note.	Assignment, Final exam	CLO1, CLO4
	Lesson 2: Review class on topic discussed in Week 8- Week 12.	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture note, Open discussion.	Assignment, Final exam	CLO1, CLO4

Week-17 Lesson 1 & 2 [2.5 Hours]	Lesson 1: Graph, Graph Terminologies, Adjacency matrix, Adjacency List.	Classroom discussion, Voice over PPT, Lecture video, Lecture note.	Assignment, Final exam	CLO4
	Lesson 2: Graph data Insertion, Graph Deletion.	Classroom discussion, Voice over PPT, Lecture video, Lecture note.	Assignment, Final exam	CLO4
Week-18 Lesson 1 & 2 [2.5 Hours]	Lesson 2: Graph – Search	Classroom discussion, Voice over PPT, Lecture video, Lecture note.	Final exam	CLO4
	Lesson 1: Review class on Final Syllabus Topic	Brainstorming sessions, Classroom discussion, Voice over PPT, Lecture note, Open discussion.	Presentation, Open Discussion	CLO4

Overall Assessment Scheme

Assessment Task	CLO's				Mark (Total=100)	PLO's		Mark (Total =70)
	CLO1	CLO2	CLO3	CLO4		PLO1	PLO2	
Attendance	--	--	--		7			
Class Test 1	5(15)				Average 15			
Class Test 2		5(15)						
Class Test 3			5(15)					
Assignment		5			5		5	5
Presentation					8			
Midterm Exam	4	4	17		25	8	17	25
Final exam			24	16	40	40		40

Marks Distribution

Class attendance	7
Assignment	5
Presentation (Mandatory)	8
3 Quizzes	15
Midterm Test	25
Semester Final Examination	40
Total	100

Evaluation Policy (Grading Policy)

Marks obtained out of 100	Grade	Grade point equivalent	Remarks
80% and above	A+	4.00	Outstanding
75% to less than 80%	A	3.75	Excellent

70% to less than 75%	A-	3.50	Very Good
65% to less than 70%	B+	3.25	Good
60% to less than 65%	B	3.00	Satisfactory
55% to less than 60%	B-	2.75	Above Average
50% to less than 55%	C+	2.50	Average
45% to less than 50%	C	2.25	Below Average
40% to less than 45%	D	2.00	Pass
Less than 40%	F	0.00	Fail

Class Make-up Procedure

Missed class will be taken at convenient free class hour following the procedure of the university.

Textbook/Recommended Readings

Data Structures: A Pseudocode Approach with C, 2nd Edition, by Richard F. Gilberg (Author), Behrouz A. Forouzan (Author)

Reference Books/ Other Supplementary Readings

1. Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles" is a book written by Narasimha Karumanchi.
2. Data Structures (SIE) Paperback – January 1, 2014
3. <https://www.geeksforgeeks.org/data-structures/>

Course Materials and Slides

All course materials and slides will be available in DIU Blended Learning Center, and Google Classroom. (Everyone is requested to join Google Classroom and BLC account).

Software/Tools used

CodeBlocks, Online C Compiler

Exam Dates

According to the Examination Schedule

Academic Code of Conduct

Academic Integrity:

Academic offenses under the Academic Code of Conduct include plagiarism, personification, physical and online cheating, falsification of a document, and any other dishonest behavior related to gaining academic gain or avoiding evaluation exercises by a student. The university's Disciplinary Committee may decide to impose severe penalties for these offenses.

Special Instructions:

- Attendance at all classes and exams is required of the students. To take the final test, a student needs to have attended at least 70% of classes.

- After ten minutes of the scheduled start time, students will not be permitted to enter the classroom.
- Plagiarism will automatically result in a zero on that exam or assignment.
- There won't often be a make-up exam. However, if a student misses an exam due to a serious sickness, the death of a family member, an emergency involving the family, or humanitarian reasons, they MUST request permission to make up the exam in writing through the course instructor to the chairperson within 48 hours of the exam date. The application must be submitted with the appropriate supporting documentation for the reason(s) for the absence from the exam.
- There won't be a makeup exam for the final exam. However, if a student is unable to attend the final exam due to a serious illness, a family member's death, an emergency, or humanitarian reasons, they MUST request an incomplete grade in writing from the course instructor via the chairperson within 48 hours of the exam date. Along with the application, appropriate supporting documentation for the reason(s) for missing the final exam must be provided. It is the student's duty, in consultation with the course instructor, to schedule an incomplete exam by the deadline specified in the academic calendar.
- It is required that all cell phones be in silent mode during class and test times.
- Exam cheating is not tolerated at all. Examinees will be penalized for cheating if they are found in possession of cheat sheets, used or not; if they write on their palms, the backs of calculators, chairs, or adjacent walls; if they copy from cheat sheets or other sources; if they copy from other examiners, etc. Cheating only carries a single, multi-semester expulsion, as determined by the university's disciplinary committee.

Appendix

Program Learning Outcomes (PLOs)

No.	Program Learning Outcomes
PLO1	Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PLO2	Identify, formulate, research and analyze complex engineering problems and reach substantiated conclusions using the principles of mathematics, the natural sciences and the engineering sciences.
PLO3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety and of cultural, societal and environmental concerns.
PLO4	Conduct investigations of complex problems, considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions.
PLO5	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 their limitations.
PLO6	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PLO7	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PLO8	Apply ethical principles and commit to the professional ethics, responsibilities and the norms of the engineering practice.
PLO9	Function effectively as an individual and as a member or leader of diverse teams and in multidisciplinary settings.
PLO10	Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.
PLO11	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's work as a team member or a leader to manage projects in multidisciplinary environments.
PLO12	Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

Learning Domain (Bloom's taxonomy)

- (a) **Cognitive Domain (Knowledge):** The cognitive domain aims to develop the mental skills and the acquisition of knowledge of the individual.

Domain Level	Definition
Remember (C1)	Retrieving, recalling, or recognizing information from memory.

Understand(C2)	Changing from one form of representation to another; illustrating a concept; drawing conclusions; determining cause and effect
Apply(C3)	Using learned materials, students can use/apply information in a new way.
Analyze(C4)	Breaking material or concepts into parts, determining how the parts related or interrelated to one another or to an overall structure or purpose.
Evaluate(C5)	Assessing, making judgments and drawing conclusions from ideas, information, or data.
Create(C6)	Developing a hypothesis; devising a procedure; inventing a product

(b) **Affective Domain (Attitude):** The affective domain includes how learners deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes.

Domain Level	Definition
Receiving (A1)	Being aware of or attending to something in the environment.
Responding(A2)	Showing some new behaviors as a result of experience.
Valuing(A3)	Showing some definite involvement or commitment.
Organization(A4)	Integrating a new value into one's general set of values, giving it some ranking among one's general priorities.
Characterization by value(A5)	Acting consistently with the new value.

(c) **Psychomotor Domain (skill):** Includes physical movement, coordination, and use of the motor-skill areas.

Domain Level	Definition
Imitating (P1)	Attempted copying of a physical behavior
Manipulation(P2)	Reproducing activity from instruction or memory
Precision(P3)	Fine tuning. Making minor adjustments in the physical activity in order to perfect it.
Articulation(P4)	Adapting and integrating expertise to satisfy a non- standard objective
Naturalization(P5)	Automated, unconscious mastery of activity and related skills at strategic level

BNQF Skills (4 year's Bachelors):

The Learning Outcome Domains are Fundamental Domain, Social Domain, Thinking Domain and Personal Domain. These domains are classified below.

Fundamental Skills:

- Demonstrate knowledge and critical understanding of the well-established principles of his/her field of study, and of the way in which those principles have developed.
- Apply underlying concepts and principles outside the context in which they were first studied, including, where appropriate, the application of those principles in an employment context.
- Apply knowledge and skills in addressing issues/solving problems with minimal supervision.
- Evaluate critically the appropriateness of different approaches to solving problems in his/her field of study.
- Support supervision of junior staff via a mentor or a leader/manager.

- Display advanced digital literacy which is adequate to perform complex tasks and bring about solutions.

Social Skills:

- Communicate and interact effectively and clearly, ideas, information, problems and solutions as a team to peers, experts and non-experts in Bangla and English.
- Express her/himself fluently and spontaneously in English and Bangla.
- Use language flexibly and effectively for social, academic and professional purposes.
- Produce clear, well structured, detailed text on complex subjects, showing controlled use of organizational patterns, connectors and cohesive devices in advanced proficiency level of Bangla and English.
- Demonstrate the ability to incorporate entrepreneurial skills in planning daily activities.
- Display advanced civic literacy and knowledge, exercising civic rights and obligations at all levels as well as participating in changes for the improvement of Bangladesh society.

Thinking Skills:

- Exercise a very substantial degree of autonomy and often significant responsibility in making
- Judgments/decisions towards the management of self, others, and for the allocation of substantial resources.
- Demonstrate professional knowledge and practical skills in both technical and management to lead a team in an inexperienced environment.

Personal Skills:

- Engage in self-direction and self-enterprise skills.
- Demonstrate social, professional, environmental, and ethical practice/ values.
- Showcase global knowledge and competencies to fulfill employment, entrepreneurial, and lifelong learning skills; and contribute significantly to society.

