Daffodil International University

Department of Software Engineering

Faculty of Science & Information Technology

Midterm Exam Examination, Summer 2025

Level: 2 **Term: 1** **Course Code: SE 131, Course Title: Data Structure**

Section: A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P

Instructor: AB(A), DMA(B,C,D), RJM(E,F), MHS(G), MBH(H,I), MRD(J,K,O), SAN(L), AAS(M,N), AF(P) **Modality: Physical**

One and a half hours (1:30 Hrs) **Marks: 25**

Directions:

- **Students need to go through the CASE STUDY shown in this exam paper.**
- **Analyze and answer specific section based on your own thinking and work. Answer questions serially.**

1. A. **Describe** why is it important to organize data using data structures? **Write** one example each of a linear and a non-linear data structure. **[CLO-1, Level-1] [Marks-2]**

   B. **Describe** what is time complexity in algorithms, and also **describe** why is it important when comparing two solutions to the same problem? **[CLO-1, Level-1] [Marks-2]**

2. **Scenario 1:** You are participating in an intergalactic space mission where each completed mission grants you encrypted coordinates required to unlock the next galaxy sector. After successfully completing a mission, you have collected the following 12 encrypted coordinates:

   57, 23, 89, 12, 46, 78, 35, 64, 91, 18, 53, 80

   Compute the complexity of Bubble Sort and complexity Binary Search to sort and search in this array. Show both complexity calculation steps and reasoning. **[CLO-2, Level-2] [Marks-2+2]**

3. Use the same scenario "**Scenario 1**" and data given in **Question 2** for this question. These 12 coordinates are stored in an **unsorted array**. To unlock the next galaxy, you need to verify whether the **coordinate '64'** exists in your collection. **[CLO-3, Level-3, Marks-2+2+2=6]**

   a) If you need to sort by applying **Bubble Sort** to arrange the coordinates in **Descending order**, then **Build** the **basic part of the code** to perform this sorting operation.
   b) To find out the coordinate "64", by using **Binary Search**, **Apply** the steps of Binary search to find out it.
   c) If the required coordinate 64 is found, **Build** the **basic part of the code** to **delete** that coordinate from the array.

4. A. You are given a set of available memory addresses: "4001", "4010", "4030", "4050", "4070", "4080". You are tasked with storing the following country names into a singly linked list: "Bangladesh", "Yeomen", "Canada", "USA", "Germany". **Illustrate** the following operation: **[CLO-3, Level-3] [Marks-2*4=8]**

   a) Sketch the linked list.
   b) Sketch the linked list, after deleting "USA".
   c) After deletion sketch the linked list, after inserting the "Pakistan", "Palestine" as 2nd and 4th elements.
   d) After the answer of question number (c), Insert "Israel"?

   B. **Scenario 2**: In a theater ticket booking system, users' booking requests are handled using a stack. Each time a user books a ticket, their booking ID is pushed onto a stack. The system allows the following operations: push(),pop(),peek(),display().

   The following code simulates how bookings are managed:


```
int main() {
push(10); push(20); push(30); display(); pop(); peek(); pop(); pop(); display(); return 0; }
```

   Now, what happens internally when you call push(10), to explain it **build** the code to implement **the push function** only. **[CLO-3, Level-3] [Marks-3]**

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Midterm Exam Examination, Spring 2024

Course Code: SE 131 . Course Title: Data Structure

Level: 1 Term: 3 Section: A, B, C, D, E, F, G, H, I

Instructor: AB-A,B,E, RMS-C,D, MHS-F, SI-G,H,I Modality: Physical

Date: March 23, 2024 Time: 11:15 AM – 12:45 PM

One and a half hours (1:30) **Marks: 25**

Directions:

- **Students need to go through the CASE STUDY shown in this exam paper.**
- **Analyze and answer specific section based on your own thinking and work. Answer questions serially.**

1. **A.** Suppose you want to find how many vowels and consonants are present in "Daffodil International University". **Describe** the type of operation you need to perform to find total number of vowel and consonant in the given name? ***[CLO-1, Level-2] [Marks-2]***

   B. Suppose you have declared one array type variable, **explain** the concept of memory allocation. ***[CLO-1, Level-2] [Marks-2]***

2. **Scenario 1:** In the 3rd semester you have 6 different courses. Out of 100 you have got 76 in MAT102, 65 in SE131, 74 in SE132, 85 in SE133, 71 in SE212, 79 in STA101 course. Consider each mark as an element of an array. After considering the elements your array will look like "76", "65", "74", "85", "71", "79". You have to work with this numbers.
   A. As the above mentioned array is not sorted and you need to sort all the elements in ascending order by applying bubble sort algorithm. **Calculate** the Complexity of Bubble soft algorithm. ***[CLO-2, Level-3] [Marks-2]***
   B. If you need to apply linear search and binary search both for the data given above to find out "79", **explain** which one will perform good and why? ***[CLO-2, Level-3] [Marks-2]***

3. **Scenario 2:** If there exists one array with 20 elements. The elements are a, b, c, d, e, f, g, h, I, j, k l, m, n, o, p, q, r, s, t. ***[CLO-3, Level-3] [Marks-6]***
   a. If you need to search "p", Apply Binary Search to find out it.
   b. If you need to do sort all the data in descending order, **illustrate** the basic part of the code to do the operation.
   c. If you need to delete one element like: "c", **illustrate** down the basic part of the code to do the operation.

4. **A.** Suppose you have been given the following linked list. Each node contains a data and a pointer / memory address to next node. There is no additional memory space available in the memory. If the start node is: 5076, then- ***[CLO-3, Level-3] [Total Marks-11]***

Memory Address: 1050	
Data: 5	Next: 5076

Memory Address: 674	
Data: 75	Next: Null

Memory Address: 1280	
Data: 76	Next: 674

Memory Address: 5076	
Data: 15	Next: 1280

   i. **Construct** the linked list and available linked list. [Sub marks 3]
   ii. **Show** pseudo code/Basic part of the code for the linked list Node construction and data assign. [Sub marks 3]
   iii. If you need to insert one new data in the linked list, **investigate** what will happen? [Sub marks 1]
   iv. If you are asked to delete "76", from the linked list, **investigate** what will happen? [Sub marks 1]

   B. **Build** the pseudo code (or main part of the code) of pop function of a Stack data structure. Make sure that the function does not crash the program when popping from an empty stack. [Sub marks 3]

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Midterm Exam Examination, Spring 2025

Course Code: SE 131, Course Title: Data Structure

Level: 1 Term: 3 Section: A, B, C, D, E, F, G, H, I, J, K

Instructor: AB, RI, DMA, MSP, MRD, TM, KF, And SAM **Modality: Physical**

One and a half hours (1:30 Hrs) **Marks: 25**

Directions:

- **Students need to go through the CASE STUDY shown in this exam paper.**
- **Analyze and answer specific section based on your own thinking and work. Answer questions serially.**

1. A. Describe the advantages of a Linked List over an Array with examples. Explain how these advantages impact the performance of data structures **[CLO-1, Level-1] [Marks-2]**

   B. Define linear and non-linear data structures and identify key differences with examples. **[CLO-1, Level-1] [Marks-2]**

2. The students of the 42nd batch of the Software Engineering Department decided to go on the Ruma Thanchi Circuit trek. Before the trek, they tracked the weather temperatures to ensure they are fully prepared to tackle the adventure ahead. They stored the temperatures in an unsorted array. **[CLO-2, Level-2] [Marks-4]**

30	28	31	27	32

   a. Insert 29 at index 2 and Describe the iteration steps.

   b. Delete 31 from the array, Describe the iteration steps, and Compute its time complexity.

3. A teacher has a list of unsorted student marks from a recent exam. The marks are as follows: [72, 85, 90, 45, 60] **[CLO-3, Level-3] [Marks-6]**

   a) If you need to sort, illustrate the pseudocode of bubble sort to sort all the data in ascending order.

   b) After sorting, a student named Alex wants to check if their score, 85, is on the list. For that, apply an efficient search technique.

   c) Now, illustrate the time complexity of that efficient search technique.

4. A. Suppose, You need to store the names of the 21st February martyrs: "Salam", "Rafiq", "Barkat", "Jabbar", "Barkat" into a linked list. There are available memory addresses like:

1952	1966	1969	1971	2024	1111

   Illustrate the following operation: **[CLO-3, Level-3] [Marks-8]**

   a) Sketch the linked list. [2]

   b) Sketch the linked list, After deleting "Rafiq" and "Jabbar". [2]

   c) Again sketch the linked list, after inserting the "Shafiq" and "Sobhan" as first and last elements. [2]

   d) Illustrate the line of the code for C program to create the structure of a node with two data and one pointer. [2]

   B. You are the chief engineer on a space mission, responsible for stacking satellite modules before launch. The rocket can only carry 5 modules at a time. The current stack of modules is Alpha, Beta, Gamma, Delta, and Epsilon. Perform the following operations and illustrate the state of the stack after each step mentioning the current top value: **[CLO-3, Level-3] [Marks-3]**

   a) Draw the initial stack of satellite modules.

   b) Show the status of the stack after Pushing "Mercury" into the stack.

   c) Sketch the stack after Popping 3 modules

   d) Draw the stack after Pushing "Solaris" into the stack.

   e) Sketch the stack after Popping 4 modules.

   f) Draw the stack after Pushing "Polaris" into the stack.

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Midterm Exam Examination, Fall 2024

Course Code: SE 131, Course Title: Data Structure

Level: 2 Term: 1 Section: A, B, C, D, E, F, G, H, I, J, K, L, M, N

Instructor: AB, DMA, MSP, FRR, AAM, MJ, AAS, SAM Modality: Physical

One and a half hours (1:30 Hrs) Marks: 25

Directions:

- **Students need to go through the CASE STUDY shown in this exam paper.**
- **Analyze and answer specific section based on your own thinking and work. Answer questions serially.**

1.

A. **Describe the difference between time complexity and space complexity with examples. State how does each measure affect the performance of an algorithm?** **[CLO-1, Level-1] [Marks-2]**

B. **Define recursion and write an example of a recursive function.** **[CLO-1, Level-1] [Marks-2]**

2. **You're participating in a treasure hunt, and each clue unlocks a code to the next level. After completing a level, you collected 14 codes: 48, 72, 33, 15, 59, 27, 84, 66, 31, 93, 20, 45, 77, 88. These codes are stored in an unsorted array. To proceed to the next level, you need to check if the code '66' is in your collection.** **[CLO-2, Level-2] [Marks-4]**

A. **To find out code "66" which associate a searching algorithm which is time efficient and can be performed after organizing the elements in a specific order. Compute the steps involved in finding the code '66.**

B. **Compute the time complexity of this searching algorithm.**

3. **Scenario 2: If there exists one array with several elements, and the elements are m, a, h, n, i, s, a then**

[CLO-3, Level-3] [Marks-6]

a) **If you need to do sort, then Apply bubble sort to sort all the data in ascending order.**

b) **If you need to apply binary search, illustrate the basic part of the code to for the binary search operation.**

c) **If you need to insert one element like: "c" as third element, illustrate the basic part of the code to do the operation.**

4. A. **Suppose, there are available memory addresses like "1111", "1999", "2015", "2017", "2022", "2024". Now, You need to store "Apple", "Mango", "Banana", "Orange", "Papaya", "Strawberry" into a linked list. Illustrate the following operation:** **[CLO-3, Level-3] [Marks-8]**

a) Sketch the linked list. [2]

b) Sketch the linked list. After deleting "Strawberry" and "3607" [2]

c) Again sketch the linked list. after inserting the "Cherry" and "Blackberry" as first and last elements. [2]

d) If you need to construct a node with two data and one pointer, then write down the line of the code for C program to create the structure, count and allocate memory for the linked list? [2]

B. **Suppose you have the STACK of books on your table, Size is 5, there are some elements: A, B, C, D, E. Illustrate the following operation step by step:** **[CLO-3, Level-3] [Marks-3]**

a) Draw the Stack.

b) Show the status of the Stack after Pushing "M" in the Stack.

c) Sketch the Stack after Popping 3 elements.

d) Draw the Stack after Pushing "S" in the Stack.

e) Sketch the Stack after Popping 4 elements.

f) Draw the Stack after Pushing "P" in the Stack.