# Air University
## (Mid-Term Examination: Fall 2023)

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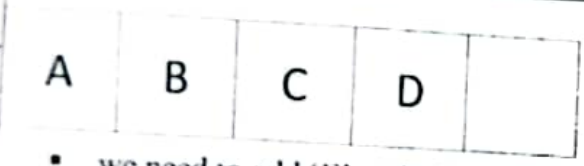
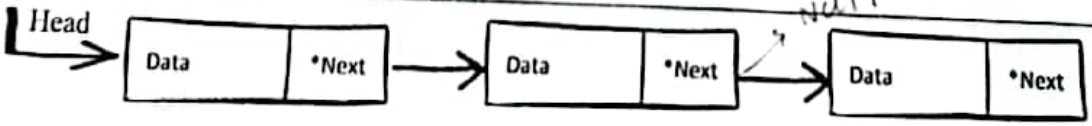
|---|---|---|---|
| Course Name: | Data Structures and Algorithms | Total Marks: | 50 |
| Course Code: | CS-214 | Date: | |
| Program: | BS-CYS | Time: | |
| Semester: | III | Duration: | 2 Hours |
| Section: | A+B | FM Name: | Dr. Syed M. Sajjad |
| Hod Signatures: | 17/4/23 | FM Signatures: | |

**Note:**

**All questions must be attempted.**
**This examination carries 25% weight towards the final grade.**
**Return the question paper with the answer sheet**

| | | |
|---|---|---|
| | **Q. No. 1 (CLO 1)** | **14 Marks** |
| a |  <br>• we need to add 'E' at the head of the list<br>• What will be the time complexity of this operation? Provide justification for your answer. | 6 |
| b | We perform the following operations on an empty stack: **push (9), push (3), pop, push (7), push (2), pop, pop, pop, push (6), pop**. Write the sequence of popped out values. | 8 |
| | **Q. No. 2 (CLO 2)** | **16 Marks** |
| a | For each of the following scenarios choose the "best" data structure from the following list: an Array, Linked List, Doubly Linked list, Circular Linked List, Stack, Queue, or Tree. In each case, justify your answer briefly.<br>a) A restaurant needs to first serve the customers who come first<br>b) A list must be maintained so that any element can be accessed randomly<br>c) A program needs to maintain a history of the operations it performed, so that it can undo or redo any operation<br>d) The size of data to be stored is unknown. The entries need to be entered as they come in. Entries must be deleted when they are no longer needed. It is important that structure has flexible memory management. | 6 |
| b |  <br>Write a code for removing node from tail in the above link list. Provide explanation and justification for your answer. | 10 |

| | Q. No. 3 (CLO 3) | 10 Marks |
|---|---|---|
| | Write the algorithm/pseudocode for the `find(int x)` method for a linked list class that returns `true` if there is a node in the list with value `x`, and returns `false` otherwise. | 10 |

| | Q. No. 4 (CLO 4) | 10 Marks |
|---|---|---|
| | Calculate the time complexity of following code. | |

```
int a=0, b=0;
for (i=0; i<n; i++) {
    if (i<k) {
        a = i;
        b = n - i;
    }
    else {
        for (j=k; j<n; j++) {
            a = a + j;
            b = a - k;
        }
    }
}
```

10

********** End of Question Paper **********