United International University
B.Sc. in Computer Science & Engineering (CSE)

CSE 2215: Data Structure and Algorithms-I

Mid Exam: Fall 2024 Time: 1 Hour 30 mins Marks: 30

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Answer all of the following questions.

1. (a) Consider the following function "FuncA". Find the time Complexity of the function using asymptotic notation. [4]

```
int FuncA(n) {
      int sum = 0;
      for( i = 0; i<n; i++) {
          for(j = 0 ; j<n ; j = j*3){
             for(k = 0 ; k < n ; k = k*2 ){
               sum = sum + 1;
               }}}
      for(i = 0; i<=sum ; i++){
         sum = sum + 1;
         break;}
      if(sum > n*n)
        printf("%d", sum);
      return sum;}
```

FuncA

2. (a) How many element comparisons are needed for the following instance of the Descending Order Quick Sort to find the first and second partitioning elements? [3]

16 23 19 28 7 11 19 12 21

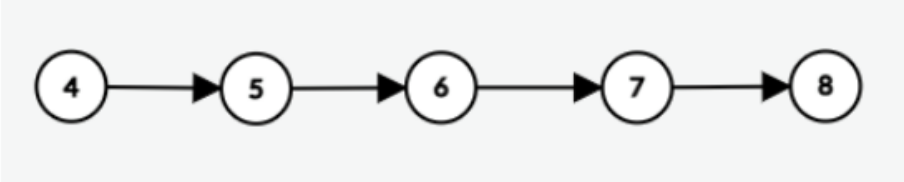
(b) You are given an array A = { 5, 2, -2, -2, 4, -3, -5, 4, 5, 3, -1, 2 }. Each element in the array ranges from -5 to 5. Sort the array using the Counting Sort algorithm, and clearly illustrate the intermediate steps of the cumulative sum array [3]

3. (a) Consider a memory system with row-wise memory allocation, a double array X[128][64] where each double is 8 bytes. let X[20][10] = m + 50000 where m is the last 2 digits of your

student id.[Example; if student id = 0112410261 ,then m = 61] Calculate the memory address of beginning of the array and X[22][15]. [4]

(b) If the system was column-wise will there be any changes to the result. Show your reasoning. [2]

4. The initial state of a Linked List is given below: [6]



Show the effect of executing the following function. Assume that each of the nodes has two fields; data and next, where data is of integer type and next will contain the address of the next node.

```
void function() {
      Node *temp1 = head;
      Node *temp2 = head;
      While (temp2 != Null or temp2->next != Null) {
            temp1 = temp1->next;
            temp2 = temp2->next->next;
      }
      temp1->next = temp1->next->next;
}
```

5. Suppose you are designing a text editor, where you want to implement the features given below. [3]

   (a) Undo operations: remove the last typed character

   (b) Redo operations: restore the most recently undone character

   Which data structure(s) will you prefer to implement these two features? Briefly explain.

6. (a) Consider there is a Stack "A" that is implemented using "Singly Linked List". The Linked List stores data in node. Now, write pseudocode for "Push" which adds a node and "Pop" which removes the last inserted node and removes it from the "Linked list". [3]

   (b) Consider the following Linked list bellow. If we want to implement a "Queue" using this Linked list, Where should "enqueue" operation add a new node. Justify your answer. [2]

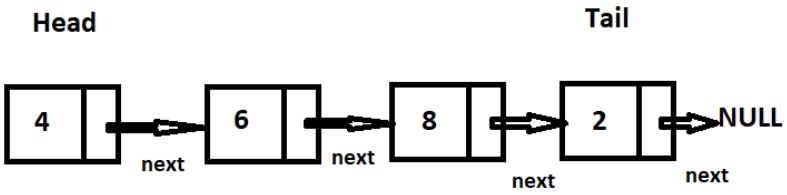


Figure 1: Question: 6