North South University
Department of Electrical and Computer Engineering
Assignment 01 –Summer 2023
CSE 225 - Data Structures and Algorithms

1. Calculate time complexity of the following 'Tower f Hanoi' algorithm: (15)

```
void towerOfHanoi(int n, char sourceRod, char auxiliaryRod, char targetRod) {
   if (n == 1) {
      std::cout << "Move disk 1 from rod " << sourceRod << " to rod " <<
targetRod << std::endl;
      return;
   }
   towerOfHanoi(n - 1, sourceRod, targetRod, auxiliaryRod);

   std::cout << "Move disk " << n << " from rod " << sourceRod << " to rod " <<
targetRod << std::endl;

    towerOfHanoi(n - 1, auxiliaryRod, sourceRod, targetRod);
}
```

2. Calculate the time complexity of the **recursive** Binary Search algorithm: (15)

```
int binarySearch(int arr[], int p, int r, int num) {
  if (p <= r) {
    int mid = (p + r)/2;
    if (arr[mid] == num)
      return mid ;
    if (arr[mid] > num)
      return binarySearch(arr, p, mid-1, num);
    if (arr[mid] < num)
      return binarySearch(arr, mid+1, r, num);
  }
  return -1;
}
```

3. Calculate time complexity of the Insertion-Sort algorithm for the **worst-case** scenario: (15)

```
void insertionSort (int A[], int length){
   int key, i;
   for(int j = 1; j < length; j++){
      key = A[j];
      i = j - 1;
      while(i > -1 && A[i] > key){
         A[i+1] = A[i];
         i = i - 1;
```

```
        }
        A[i+1] = key;
    }
}
```

4. Write the advantages and disadvantages of the Unsorted List data structure. Can you apply the Binary Search algorithm on an unsorted list? (10)

5. Compare the Linear Search and the Binary Search algorithms. (10)

6. Write the **delete** operation for the 'Unsorted list' data structure. And find the time complexity. You can use **int** as data type. (5)

7. Explain in your own words what is a linear and, a non-linear data structure. (5)

8. What is a two-dimensional array? Declare a 2D array and initialize it with random integer values. When do you use a 1D array and when do you use a 2D array, give an example. (10)