Experiment No.1
Insertion Sort
Date of Performance:
Date of Submission:

Title: Insertion Sort

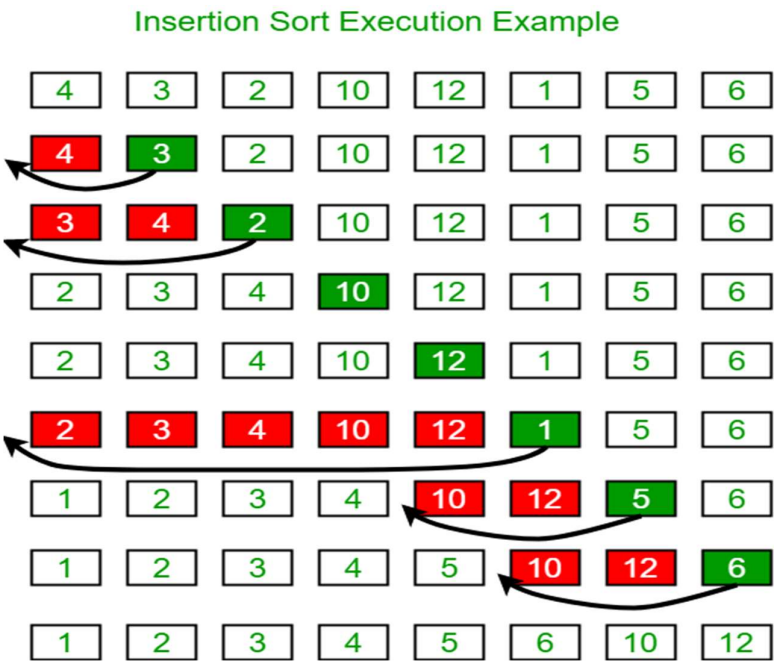
Aim: To implement Selection Comparative analysis for large values of 'n'

Objective: To introduce the methods of designing and analysing algorithms

Theory:

Insertion sort is a simple sorting algorithm that works similar to the way you sort playing cards in your hands. The array is virtually split into a sorted and an unsorted part. Values from the unsorted part are picked and placed at the correct position in the sorted part.

Example:



Algorithm and Complexity:

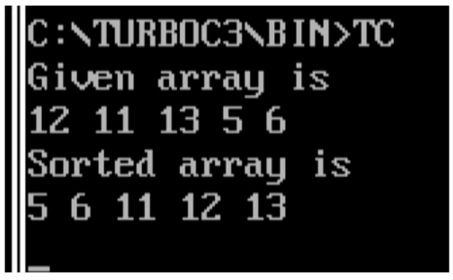
INSERTION-SORT(A)	*cost*	*times*
1 **for** $j = 2$ **to** $A.length$	c_1	n
2 $key = A[j]$	c_2	$n-1$
3 // Insert $A[j]$ into the sorted sequence $A[1..j-1]$.	0	$n-1$
4 $i = j-1$	c_4	$n-1$
5 **while** $i > 0$ and $A[i] > key$	c_5	$\sum_{j=2}^{n} t_j$
6 $A[i+1] = A[i]$	c_6	$\sum_{j=2}^{n}(t_j-1)$
7 $i = i-1$	c_7	$\sum_{j=2}^{n}(t_j-1)$
8 $A[i+1] = key$	c_8	$n-1$

Implementation:

```
#include <stdio.h>
void insertionSort(int arr[], int n) {
   int i, key, j;
   for (i = 1; i < n; i++) {
      key = arr[i];
      j = i - 1;
      // Move elements of arr[0..i-1], that are greater than key,
      // to one position ahead of their current position
      while (j >= 0 && arr[j] > key) {
         arr[j + 1] = arr[j];
         j = j - 1;
      }
      arr[j + 1] = key;
   }
}
void printArray(int arr[], int n) {
   int i;
```

```
    for (i = 0; i < n; i++)
        printf("%d ", arr[i]);
    printf("\n");
}
int main() {
    int arr[] = { 12, 11, 13, 5, 6 };
    int n = sizeof(arr) / sizeof(arr[0]);
    printf("Given array is \n");
    printArray(arr, n);
    insertionSort(arr, n);
    printf("Sorted array is \n");
    printArray(arr, n);
    return 0;
}
```

Output:



Conclusion: The implementation of the insertion sort algorithm demonstrated its effectiveness in sorting small to moderate-sized datasets. While its simplicity and efficiency are notable, scalability limitations highlight the need for alternative algorithms for larger datasets. Nonetheless, insertion sort remains a valuable foundational concept in computer science education.