NAME:	Eshan Bhuse
UID:	2021300013
SUBJECT	Design and analysis of algorithm
EXPERIMENT NO :	1B
AIM:	Experiment on finding the running time of an insertion sort and selection sort.
ALGORITHM	**Main function:** step 1: start Step2: call generate_numbers() function Step 2: call operation()function Step 3: end generate_numbers() function: step 1: start step 2: crate the file pointer step 3: open the file in writing mode step 3: starts the loop from 0 to 100000 step 4: insert the 100000 random numbers in the file step 5: close the file handle step 6: end operation function(): step 1: start step 2: open the file in reading mode step 3: start the loop from 0 to 100000 and increment it with 100 step 4: create two arrays step 5: start the loop from 0 to j and scan the data from file

step 6: before sorting store the time
step 7: perform selection sort
step 8: check the time after the sorting
step 9: calculate the time taken by the algorithm
step 10: before sorting store the time
step 11: perform selection sort
step 12: check the time after the sorting
step 13: calculate the time taken by the algorithm

Selection sort:

step 1: start
step 2: start the loop
step 3: initialize the min element
step 4: start the loop from i+1 to n
step 5: check the condition:
if jth element less than min element then minimum element will be j.
step 6: if minimum element not equal to i,
then initialize variable t with array(i)
perform ith element = array of min
array(min) = t
step 7: end.

Insertion sort:

Step 1: start
Step 2: start the loop from 1 to n
Step 3: initialize j with i-1
Step 4: current element is array(i)
Step 5: if array(key)>0 and j>=0
Repeat below steps 6,7
Step 6: j+1th element will jth element
Step 7: decrement j
Step 8: array(j+1) = current.
Step 9: end.

THEORY:

Tabular Difference between Insertion Sort and Selection Sort:

Sr.No	Insertion Sort	Selection Sort
1.	Inserts the value in the pre-sorted array to sort the set of values in the array.	Finds the minimum / maximum number from the list and sort it in ascending / descending order.
2.	It is a stable sorting algorithm.	It is an unstable sorting algorithm.
3.	The best-case time complexity is Ω(N) when the array is already in ascending order. It have $\Theta(N^2)$ in worst case and average case.	For best case, worst case and average selection sort have complexity $\Theta(N^2)$.
4.	The number of comparison operations performed in this sorting algorithm is less than the swapping performed.	The number of comparison operations performed in this sorting algorithm is more than the swapping performed.
5.	It is more efficient than the Selection sort.	It is less efficient than the Insertion sort.
6.	Here the element is known beforehand, and we search for the correct position to place them.	The location where to put the element is previously known we search for the element to insert at that position.
7.	The insertion sort is used when: • The array is has a small	The selection sort is used when • A small list is to

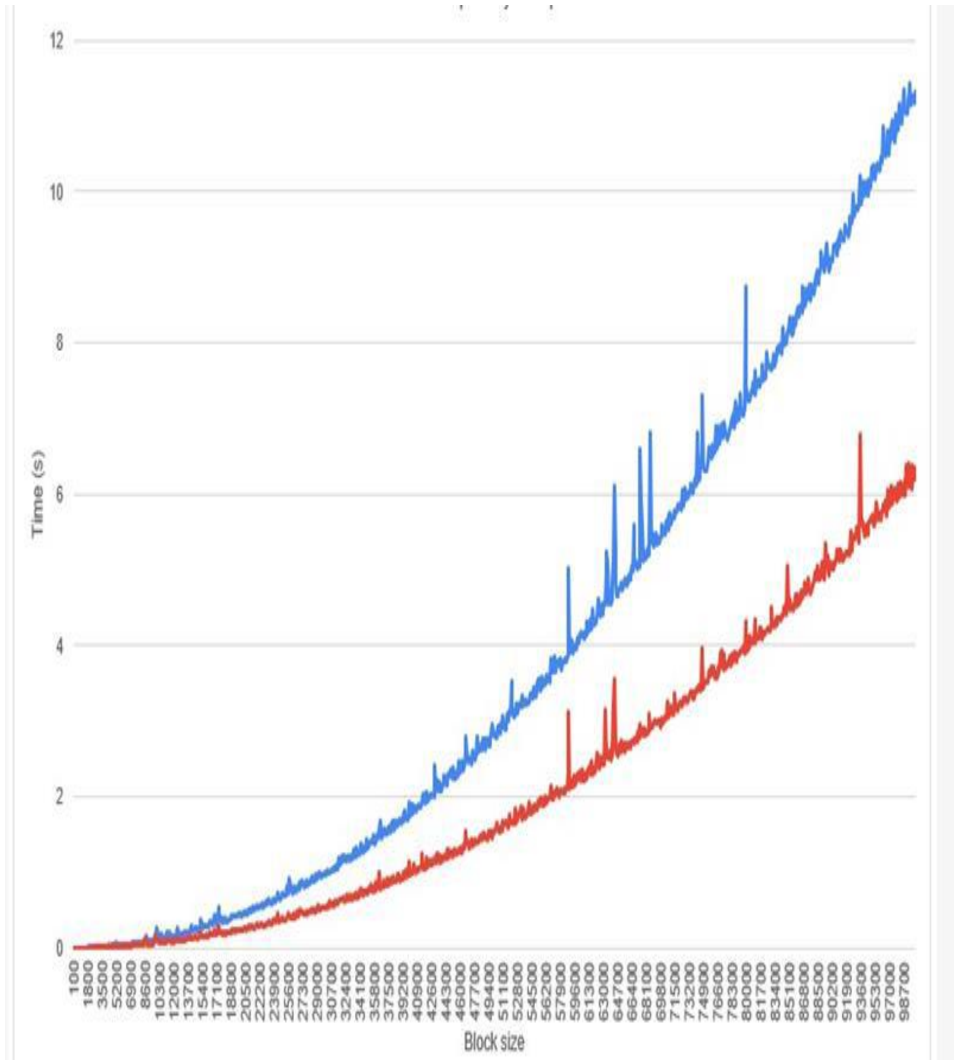
		number of elements • There are only a few elements left to be sorted	be sorted • The cost of swapping does not matter • Checking of all the elements is compulsory • Cost of writing to memory matters like in flash memory (number of Swaps is O(n) as compared to O(n2) of bubble sort)	
	8.	The insertion sort is Adaptive, i.e., efficient for data sets that are already substantially sorted: the time complexity is **O(kn)** when each element in the input is no more than **k** places away from its sorted position	Selection sort is an in-place comparison sorting algorithm	

PROGRAM:	

```c
#include<stdio.h>
#include<math.h>
#include<stdlib.h>
#include<time.h>
void selectionsort(int arr[],int n)
{
for(int i=0;i<n;i++)
{
int min_ind=i;
for(int j=i+1;j<n;j++)
{
if(arr[j]<arr[min_ind]) min_ind=j;
}
if(min_ind!=i)
{
int t=arr[i];
arr[i]=arr[min_ind];
arr[min_ind]=t;
}
}
}
void insertionsort(int arr[],int n)
{
for(int i=1;i<n;i++)
{
int j=i-1;
int key=arr[i];
while(j>=0 && arr[j]>key)
{
arr[j + 1] = arr[j]; j = j - 1;
}
arr[j + 1] = key;
}
}

void generate_numbers()
{

FILE *ptr;
ptr=fopen("number.txt","w");
for(int i=0;i<100000;i++)
```

```c
FILE *ptr;
ptr=fopen("number.txt","w");
for(int i=0;i<100000;i++)
{
    fprintf(ptr,"%d\n",rand() % 100000);
}
fclose(ptr);
}
void operation()
{
FILE *ptr;
ptr=fopen("number.txt","r");
for(int j=0;j<100000;j+=100)
{
int arr1[j]; int arr2[j];
for(int i=0;i<j;i++)
{
fscanf(ptr,"%d\n",&arr1[i]);
}
for(int i=0;i<j;i++)
{
arr2[i]=arr1[i];
}
clock_t start_selection=clock(); selectionsort(arr1,j);
clock_t end_selection = clock(); double currs=(double)(end_selection-
start_selection)/CLOCKS_PER_SEC;


clock_t start_insertion=clock(); insertionsort(arr2,j);
clock_t end_insertion=clock(); double curri=(double)(end_insertion-
start_insertion)/CLOCKS_PER_SEC; printf("\n%d\t%f\t%f",j,currs,curri);
}
}
int main()
{
generate_numbers(); operation();
return 0;
}
```

OBSERVATION:	**Graph of Selection sort and Insertion sort:**



CONCLUSION:	Successfully performed the experiment of Selection sort and insertion sort and found the running time for each sorting algorithm in C Language. Concluded that insertion sort is efficient than selection sort.