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SUBJECT	Data Analysis and Algorithm
EXPERIMENT NO:	Experiment 1-B
DATE OF PERFORMANCE	2-02-23
AIM:	To find the running time or time complexity of an algorithm like Selection or Insertion sort.
THEORY:	Selection Sort: Selection sort is a simple sorting algorithm. This sorting algorithm is an in-place comparison-based algorithm in which the list is divided into two parts, the sorted part at the left end and the unsorted part at the right end. Initially, the sorted part is empty and the unsorted part is the entire list. The smallest element is selected from the unsorted array and swapped with the leftmost element, and that element becomes a part of the sorted array. This process continues moving unsorted array boundary by one element to the right. This algorithm is not suitable for large data sets as its average and worst case complexities are of O(n2), where n is the number of items. Insertion Sort: This is an in-place comparison-based sorting algorithm. Here, a sub-list is maintained which is always sorted. For example, the lower part of an array is maintained to be sorted. An element which is to be inserted in this sorted sub-list, must find its appropriate place and then it has to be inserted there. Hence the

	name, insertion sort. The array is searched sequentially, and unsorted items are moved and inserted into the sorted sub-list (in the same array). Its average and worst-case complexity are of O(n2), where n is the number of items.
ALGORITHM:	Algorithm for Selection Sort: Step 1 − Set MIN to location 0 Step 2 − Search the minimum element in the list. Step 3 − Swap with value at location MIN Step 4 − Increment MIN to point to next element. Step 5 − Repeat until list is sorted. Algorithm for Insertion Sort: Step 1 − If it is the first element, it is already sorted. return 1; Step 2 − Pick next element Step 3 − Compare with all elements in the sorted sub-list. Step 4 − Shift all the elements in the sorted sub-list that is greater than the value to be sorted. Step 5 − Insert the value. Step 6 − Repeat until list is sorted
PROGRAM:	

```c
#include<stdio.h>
#include<stdlib.h>
#include<math.h>
#include<time.h>
void dataInput() {
 //generate 100000 random numbers
 for (int i=0;i<100000; i++)
 {
 int temp = rand();
 FILE *fptr;
 fptr = fopen("Numgenerated.txt", "a");
 fprintf(fptr, "%d\n", temp);
 fclose(fptr);
 }
}
void swap(long *xp, long *yp) {
 long temp = *xp;
```

```
 *xp = *yp;
 *yp = temp;
}
//selection sort algorithm
void selectionSort(long arr[], int n) {
 int i, j, min_idx;
 for (i = 0; i < n-1; i++) {
 min_idx = i;
 for (j = i+1; j < n; j++)
 if (arr[j] < arr[min_idx])
 {
 min_idx = j;
 }
 swap(&arr[min_idx], &arr[i]);
 }
}
//insertion sort algorithm
void insertionSort(long arr[], int n) {
 int i, key, j;
 for (i = 1; i < n; i++) {
 key = arr[i];
 j = i-1;
 while (j >= 0 && arr[j] > key) {
 arr[j+1] = arr[j];
 j = j-1;
 }
 arr[j+1] = key;
 }
}
int main() {
 dataInput();
 FILE *fptr;
 fptr = fopen("Numgenerated.txt", "r");
 long arr[100000], arr1[100000], arr2[100000];
 for (int i = 0; i < 100000; i++)
 {
 fscanf(fptr, "%8ld", &arr[i]);
 }
 fclose(fptr);
 int s = 100;
 printf("Size\tSelection Sort\tInsertion Sort\n");
 for(int i=0;i<=1000;i++) {
 for (int j = 0; j < 100000; j++) {
```

```
 arr1[j] = arr[j];
 arr2[j] = arr[j];
 }
 double diff1, diff2;
 struct timespec start, end;
 int i;
 clock_gettime(CLOCK_MONOTONIC, &start);
 selectionSort(arr1, s);
 clock_gettime(CLOCK_MONOTONIC, &end);
 diff1 = (end.tv_sec - start.tv_sec) + (end.tv_nsec -
start.tv_nsec);
 clock_gettime(CLOCK_MONOTONIC, &start);
 insertionSort(arr2, s);
 clock_gettime(CLOCK_MONOTONIC, &end);
 diff2 = (end.tv_sec - start.tv_sec) + (end.tv_nsec -
start.tv_nsec);
 printf("%d\t%f\t%f\n", s, diff1, diff2);
 s+=100;
 }
 return 0;
}
```

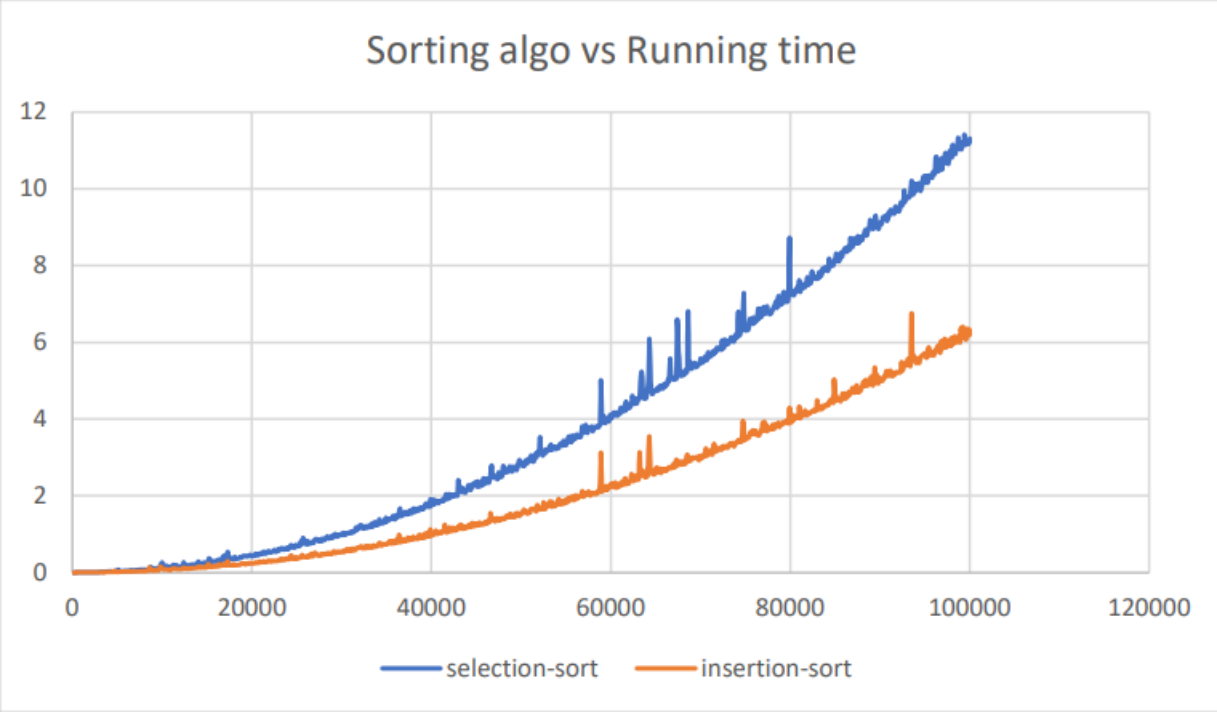
RESULT:

```
C:\Users\Neha\Desktop\GitHub\DAA\exp1b.exe
Size    Selection Sort  Insertion Sort
100     0.000012        0.000000
200     0.000044        0.000001
300     0.000096        0.000001
400     0.000176        0.000003
500     0.000264        0.000001
600     0.000386        0.000002
700     0.000536        0.000002
800     0.000701        0.000002
900     0.000925        0.000009
1000    0.001232        0.000005
1100    0.001545        0.000003
1200    0.001571        0.000003
1300    0.001772        0.000003
1400    0.002057        0.000003
1500    0.002350        0.000004
1600    0.002668        0.000004
1700    0.003390        0.000004
1800    0.003371        0.000004
1900    0.003820        0.000005
2000    0.004352        0.000005
2100    0.005056        0.000006
2200    0.005088        0.000006
2300    0.005657        0.000008
2400    0.006357        0.000006
2500    0.006864        0.000007
2600    0.007815        0.000007
2700    0.007759        0.000007
2800    0.008360        0.000008
2900    0.009965        0.000012
```

```
C:\Users\Neha\Desktop\GitHub\DAA\exp1b.exe
97600   15.901196       0.000369
97700   15.493696       0.000310
97800   15.290939       0.002102
97900   16.759025       0.003475
98000   16.445788       0.006344
98100   15.713695       0.004379
98200   17.077493       0.007205
98300   15.125437       0.007981
98400   15.618689       0.014344
98500   15.795432       0.009198
98600   17.063972       0.014483
98700   15.947403       0.009842
98800   16.351042       0.012385
98900   17.133259       0.023129
99000   16.166605       0.016086
99100   16.392617       0.016007
99200   17.152228       0.022485
99300   15.927627       0.018982
99400   16.306407       0.036748
99500   15.638367       0.027780
99600   16.695250       0.043523
99700   15.842777       0.026087
99800   15.514762       0.055853
99900   25.728001       0.041044
100000  16.277016       0.032407
100100  17.222078       0.088298

Process returned 0 (0x0)   execution time : 11885.034 s
Press any key to continue.
```

GRAPH:



CONCLUSION:	By performing the experiment, I learnt about Selection sort, insertion sort and found the running time for each sorting algorithm. I worked on random numbers and stored them into blocks and performed sorting on each block and calculated the time take by each block to sort the random data.