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Panel-C, Batch C1
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FDS Assignment - 3

Problem statement: Write a C program to create a student database using an array of structures. Apply searching (linear and Binary search) and sorting techniques (Insertion sort, selection sort, Shell sort).

Objective:-

1. To understand use of an array of structures for maintaining records.
2. To implement, analyze and compare linear and binary search.
3. To implement, analyze and compare selection, insertion and shell sort.

Theory:

- Searching:-

1) Linear search:- It is the most basic search technique. In this type of search you go through the entire list and try to fetch a match for a single element until it's found, otherwise the search continues till the end of that data set.

2) Binary search:- A searching algorithm used in a sorted array by repeatedly dividing the search interval in half. The idea of binary search is to use the information that the array is sorted.

Sorting:-

Selection Sort:- It is an array by repeatedly binding the minimum element from the unsorted part and putting it at the beginning.

Shell sort:- The method starts by sorting pairs of elements for a part from each other. then progressively reducing gap between elements to be compared.

Insertion Sort:- The array is virtually split into a sorted and an unsorted part values, from the unsorted part are picked and placed at correct position in sorted part.

Platform:

- Linux
- VS Code, Eclipse

Pseudocode:-

linear search:-

```
int linear(struct student s[], int n, integer)
```

```
{ int i, flag;
```

```
  for (i=0; i < n; i++)
```

```
  {
```

```
    if (s[i].roll no == key)
```

```
    { flag = 1;
```

```
      break;
```

```
    }
```

```
  }
```

Binary Search:-

```
int Binary(struct student s[], int high, int low, integer)
```

```
{ int mid;
```

```
while (high >= low)
```

```
{ mid = (high + low) % 2;
```

```
if (s[mid].roll no > key) {
```

```
high = mid - 1;
```

```
}
```

```
else if (s[mid].roll no < key) {
```

```
low = mid + 1;
```

```
}
```

```
else {
```

```
return mid;
```

```
}
```

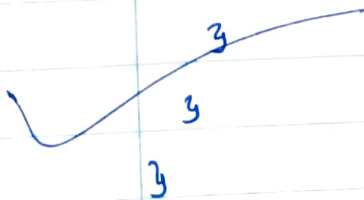
```
else {
```

```
return mid;
```

```
}
```

```
if (high < low) {
```

```
return -1;
```



Selection sort:

```
void selectionsort () {  
    for i = 0 to n-2 {  
        minpos = i  
        for j = i+1 to n-1 {  
            if a[j] < a[minpos] {  
                minpos = j;  
            }  
        }  
        if (minpos != i) {  
            swap (a[i], a[minpos]);  
        }  
    }  
}
```

Bubble sort :

```
void bubble () {  
    for i = 0 to n-1 {  
        for j = 0 to n-1-i {  
            if a[j] > a[j+1] {  
                swap (a[j], a[j+1])  
            }  
        }  
    }  
    display (a, n);  
}
```


Insertion Sort:

```
void insertion sort (arr[], n)
{
    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;
    }
}
```

Time Complexity.

1. linear search :- $O(n)$
2. Binary search :- $O(\log n)$
3. selection sort :- $O(n^2)$
4. Insertion sort :- $O(n^2)$
5. Bubble sort :- $O(n^2)$

Conclusion:- Thus, implemented different searching and sorting method on student database. This system is all set to perform searching and sorting under different cases.

FAQ's

Q1) What is meant by database? How to maintain in C?

→ A database is an organized collection of structured information or data, typically sorted in a computer system.
Database can be maintained by creating structure in C.

Q2) What are application of searching and sorting?

→ Searching: ① Find an element in sorted array.
② Pickup nearest phone book and open it to 1st page of names.

Sorting: - ① TV to sort channels based on audience viewing time.
② Sport scores are quickly organized by quick sort algorithm in real-time.

Q3) Compare and contrast linear search and binary search

	Linear Search	Binary Search
Definition	It starts searching from the 1 st elements and compare each elements with a searched element till the element is not found.	Finds the position of the searched element by finding the middle element of the array.
Sorted Data	Elements don't need to be arranged in sorted order	Elements must be arranged in sorted order.
Approach	Sequential approach	divide and conquer approach. www.mitwpu.edu.in

Size	Preferably for the small sized data set.	Preferable for the large size data sets.
Efficiency	less efficient in case of large sized data sets	more efficient in case of large sized data sets.
Time Complexity	$O(n)$	$O(\log n)$

Q4] Compare and contrast bubble, selection, insertion and Shell sort.

→ Bubble Sort:-

Time complexity $\rightarrow O(n^2)$
Simple and easy method
Efficient for small list

Insertion sort:-

Time complexity $\rightarrow O(n^2)$
Relatively simple and easy to implement
Good for almost sorted data

Shell sort:-

Time complexity $= O(n \log n)$
Good for external file sorting
can be applied to files of any size

Selection sort :-

Time complexity $\rightarrow O(n^2)$

Can be applied on linked lists

Not stable as insertion and bubble sort.

Shell sort Also

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