

Design and Analysis of Algorithm (DAA)

Lab File

Name : Abir Banerjee

Registration No. : 209303126

Section : CCE D

1. BINARY SEARCH – ITERATIVE

CODE :

```
#include <iostream>
using namespace std;

int binarySearch(int array[], int x, int l, int h){
    while (l <= h){
        int m = l+(h-l)/2;
        if (array[m] == x)
            return m;
        if (array[m] < x)
            l = m+1;
        else
            h = m-1;
    }
    return -1;
}

int main(void){
    cout<<"Registration Number : 209303126"<<endl;
    int n,x;
    cout<<"Enter size of array"<<endl;
    cin>>n;
    int array[n];
    for(int i=0;i<n;i++){
        cout<<"Enter element "<<(i+1)<<endl;
        cin>>array[i];
    }
    cout<<"Enter the element to look for "<<endl;
    cin>>x;
    int result = binarySearch(array, x, 0, n - 1);
    if (result == -1)
        cout<<"Not found";
    else
        cout<<"Element is found at index "<< result<<" and position "<<result+1;
}
```

OUTPUT :

```
Reg Number : 209303126
Enter size of array
5
Enter element 1
10
Enter element 2
22
Enter element 3
34
Enter element 4
46
Enter element 5
58
Enter the element to look for
46
Element is found at index 3 and position 4
```

2.BINARY SEARCH – RECURSIVE

Code:

```
#include <iostream>
using namespace std;

int binarySearch(int array[], int x, int l, int h){
    if (l == h){
        if (array[l] == x)
            return array[l];
        else{
            return -1;
        }
    }
    else{
        int m = l+(h-l)/2;
        if(x==array[m]){
            return m;
        }
        else if(x<array[m]){
            return binarySearch(array,x,l,m-1);
        }
        else{
            return binarySearch(array,x,m+1,h);
        }
        return -1;
    }
}

int main(void){
    int n, x;
    cout << "Enter size of array" << endl;
    cin >> n; int array[n];
    for (int i = 0; i < n; i++){
        cout << "Enter element " << (i + 1) << endl;
        cin >> array[i];
    }
    cout << "Enter the element to look for " << endl;
    cin >> x;
    int result = binarySearch(array, x, 0, n - 1);
    if (result == -1)    cout << "Not found";
    else    cout << "Element is found at index " << result << " and position " << result + 1;
}
```

OUTPUT:

```
Registration Number: 209303126
Enter size of array
5
Enter element 1
1
Enter element 2
2
Enter element 3
3
Enter element 4
4
Enter element 5
5
Enter the element to look for
3
Element is found at index 2 and position 3
```

3. SELECTION SORT

Code:

```
#include <iostream>
using namespace std;

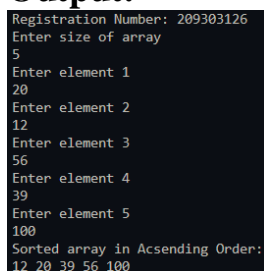
void swap(int *a, int *b) {
    int temp = *a;
    *a = *b;
    *b = temp;
}

void printArray(int array[], int size) {
    for (int i = 0; i < size; i++) {
        cout << array[i] << " ";
    }
    cout << endl;
}

void selectionSort(int array[], int size) {
    for (int i = 0; i < size - 1; i++) {
        int x = i;
        for (int j = i+1; j < size; j++) {
            if (array[j] < array[x])
                x = j;
        }
        swap(&array[x], &array[i]);
    }
}

int main() {
    cout << "Registration Number: 209303126" << endl;
    int n, x;
    cout << "Enter size of array" << endl;
    cin >> n;
    int data[n];
    for (int i = 0; i < n; i++) {
        cout << "Enter element " << (i+1) << endl;
        cin >> data[i];
    }
    selectionSort(data, n);
    cout << "Sorted array in Ascending Order:\n";
    printArray(data, n);
}
```

Output:

A screenshot of a terminal window showing the output of the C++ program. The text is as follows:

```
Registration Number: 209303126
Enter size of array
5
Enter element 1
20
Enter element 2
12
Enter element 3
56
Enter element 4
39
Enter element 5
100
Sorted array in Ascending Order:
12 20 39 56 100
```

4. BUBBLE SORT

Code:

```
#include <iostream>
using namespace std;

void bubbleSort(int array[], int size){
    for (int i = 0; i < size; ++i){
        for (int j = 0; j < size - i - 1; ++j){
            if (array[j] > array[j + 1]){
                int temp = array[j];
                array[j] = array[j + 1];
                array[j + 1] = temp;
            }
        }
    }
}

void printArray(int array[], int size){
    for (int i = 0; i < size; ++i){
        cout << " " << array[i];
    }
    cout << "\n";
}

int main(){
    cout<<"Registration Number: 209303126"<<endl;
    cout<<"Enter size of array"<<endl;
    int n; cin>>n;
    int data[n];
    for(int i=0;i<n;i++){
        cout<<"Enter element "<<(i+1)<<endl;
        cin>>data[i];
    }
    bubbleSort(data, n);
    cout << "Sorted Array in Ascending Order:\n";
    printArray(data, n);
}
```

Output:

```
Registration Number: 209303126
Enter size of array
5
Enter element 1
-1
Enter element 2
100
Enter element 3
-20
Enter element 4
200
Enter element 5
89
Swapping elements 100 and -20
Swapping elements 200 and 89
Swapping elements -1 and -20
Swapping elements 100 and 89
Sorted Array in Ascending Order:
-20 -1 89 100 200
```

5. QUICK SORT

Code:

```
#include <iostream>
using namespace std;

void printArray(int array[], int size){
    int i;
    for (i = 0; i < size; i++)
        cout << array[i] << " ";
    cout << endl;
}

int partition(int array[], int low, int high){
    int pivot = array[low];
    int i = low+1;
    int j=high;
    do{
        while(array[i] < pivot){
            i++;
        }
        while(array[j] > pivot){
            j--;
        }
        if(i<j){
            int temp = array[i];
            array[i] = array[j];
            array[j] = temp;
        }
    }while(i<j);

    int temp = array[j];
    array[j] = array[low];
    array[low] = temp;
    return j;
}

void quickSort(int array[], int low, int high){
    if (low < high){
        int pi = partition(array, low, high);
        quickSort(array, low, pi - 1);
        quickSort(array, pi + 1, high);
    }
}

int main(){
    cout<<"Registration Number: 209303126"<<endl;
    cout<<"Enter size of array"<<endl;
    int n; cin>>n;
    int data[n];
    for(int i=0;i<n;i++){
        cout<<"Enter element " <<(i+1)<<endl;
```

```
    cin>>data[i];
}
cout << "Unsorted Array: \n";
printArray(data, n);
quickSort(data, 0, n - 1);
cout << "Sorted array in ascending order: \n";
printArray(data, n);
}
```

Output:

```
Registration Number: 209303126
Enter size of array
6
Enter element 1
-10
Enter element 2
9
Enter element 3
-8
Enter element 4
7
Enter element 5
-6
Enter element 6
5
Unsorted Array:
-10 9 -8 7 -6 5
Sorted array in ascending order:
-10 -8 -6 5 7 9
```

6. Merge Sort

Code:

```
#include<iostream>
using namespace std;
void display(int *array, int size) {
    for(int i = 0; i<size; i++)
        cout << array[i] << " ";
    cout << endl;
}
void merge(int *array, int l, int m, int r) {
    int i, j, k, nl, nr;
    nl = m-l+1; nr = r-m;
    int larr[nl], rarr[nr];
    for(i = 0; i<nl; i++)
        larr[i] = array[l+i];
    for(j = 0; j<nr; j++)
        rarr[j] = array[m+1+j];
    i = 0; j = 0; k = l;
    while(i < nl && j < nr) {
        if(larr[i] <= rarr[j]) {
            array[k] = larr[i];
            i++;
        }else{
            array[k] = rarr[j];
            j++;
        }
        k++;
    }
    while(i<nl) {
        array[k] = larr[i];
        i++; k++;
    }
    while(j<nr) {
        array[k] = rarr[j];
        j++; k++;
    }
}
void mergeSort(int *array, int l, int r) {
    int m;
    if(l < r) {
        int m = l+(r-l)/2;
        mergeSort(array, l, m);
        mergeSort(array, m+1, r);
        merge(array, l, m, r);
    }
}
int main() {
    cout<<"Registration Number : 209303126"<<endl;
```



```
int n;
cout << "Enter the number of elements: "<<endl;
cin >> n;
int arr[n];
for(int i = 0; i<n; i++) {
cout << "Enter element "<<(i+1)<<endl;
    cin >> arr[i];
}
cout << "Array before Sorting: ";
display(arr, n);
mergeSort(arr, 0, n-1);
cout << "Array after Sorting: ";
display(arr, n);
}
```

Output:

```
Registration Number : 209303126
Enter the number of elements:
5
Enter element 1
-100
Enter element 2
10
Enter element 3
56
Enter element 4
62
Enter element 5
-87
Array before Sorting: -100 10 56 62 -87
Array after Sorting: -100 -87 10 56 62
```

7. KNAPSACK PROBLEM

Code:

```
#include<bits/stdc++.h>
using namespace std;
int max(int a, int b){
    if (a > b){ return a;}
    else{ return b; }
}z
int knapsack(int W, int wt[], int prof[], int n){
    int i, w;
    int knap[n + 1][W + 1];
    for (i = 0; i <= n; i++){
        for (w = 0; w <= W; w++){
            if (i == 0 || w == 0)
                knap[i][w] = 0;
            else if (wt[i - 1] <= w)
                knap[i][w] = max(prof[i - 1] + knap[i - 1][w - wt[i - 1]], knap[i - 1][w]);
            else
                knap[i][w] = knap[i - 1][w];
        }
    }
    return knap[n][W];
}
int main(){
    int n;
    cout<<"For registration number : 209303126 \n";
    cout<<"Enter number of values \n";
    cin>>n;
    int prof[n], wt[n];
    for (int i = 0; i < n; i++){
        cout<<"Enter the profit and weight of object"<<(i+1)<<endl;
        cin>>prof[i];
        cin>>wt[i];
    }
    cout<<"Enter the capacity of the knapsack \n";
    int weight;
    cin>>weight;
    cout<<"Maximum Profit is "<< knapsack(weight, wt, prof, n);
    return 0;
}
```

Output:

```
For registration number : 209303126
Enter number of values
5
Enter the profit and weight of object1
15 2
Enter the profit and weight of object2
4 15
Enter the profit and weight of object3
10 30
Enter the profit and weight of object4
20 80
Enter the profit and weight of object5
1 2
Enter the capacity of the knapsack
100
Maximum Profit is 40
```

8. INSERTION SORT

Code:

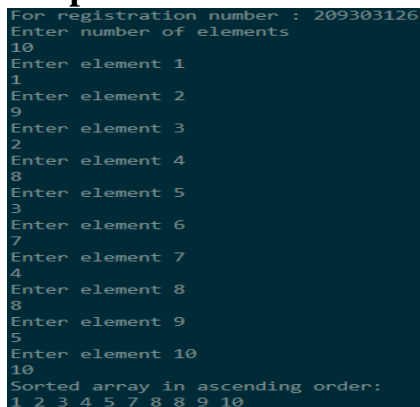
```
#include <iostream>
using namespace std;

void printArray(int array[], int size) {
    for (int i = 0; i < size; i++) {
        cout << array[i] << " ";
    }
    cout << endl;
}

void insertionSort(int array[], int size) {
    for (int step = 1; step < size; step++) {
        int key = array[step];
        int j = step - 1;
        while (key < array[j] && j >= 0) {
            array[j + 1] = array[j];
            --j;
        }
        array[j + 1] = key;
    }
}

int main() {
    cout<<"Enter number of elements"<<endl;
    int n;
    cin>>n;
    int a[n];
    for(int i=0;i<n;i++){
        cout<<"Enter element "<<(i+1)<<endl;
        cin>>a[i];
    }
    insertionSort(a,n);
    cout << "Sorted array in ascending order:\n";
    printArray(a,n);
}
```

Output:



```
For registration number : 209303126
Enter number of elements
10
Enter element 1
1
Enter element 2
9
Enter element 3
2
Enter element 4
8
Enter element 5
3
Enter element 6
7
Enter element 7
4
Enter element 8
8
Enter element 9
5
Enter element 10
10
Sorted array in ascending order:
1 2 3 4 5 7 8 8 9 10
```