Design and Analysis of Algorithm (DAA)

Lab File

Name : Abir Banerjee

Registration No. : 209303126

Section : CCE D

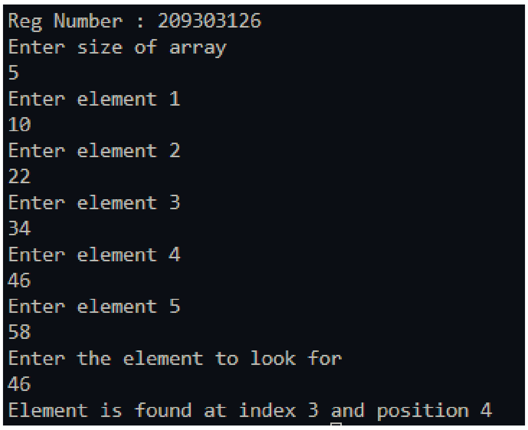
1. BINARY SEARCH – ITERATIVE

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
```

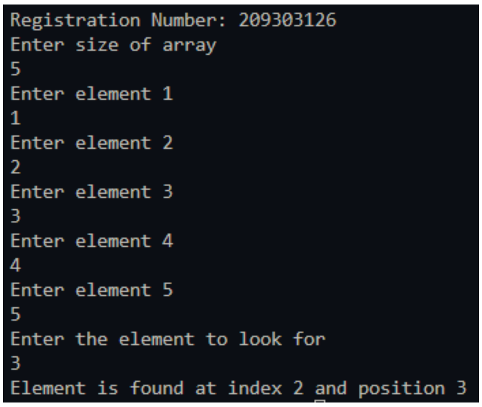
2.BINARY SEARCH – RECURSIVE

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:



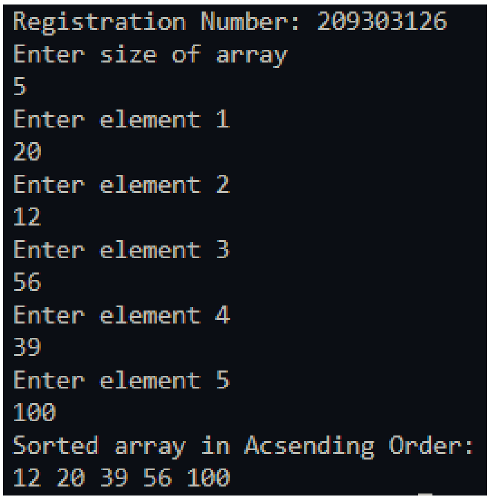
```
Registration Number: 209303126
Enter size of array
5
Enter element 1
1
Enter element 2
2
Enter element 3
3
Enter element 4
4
Enter element 5
5
Enter the element to look for
3
Element is found at index 2 and position 3
```

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 Acsending Order:\n";
  printArray(data, n);
}
```

Output:



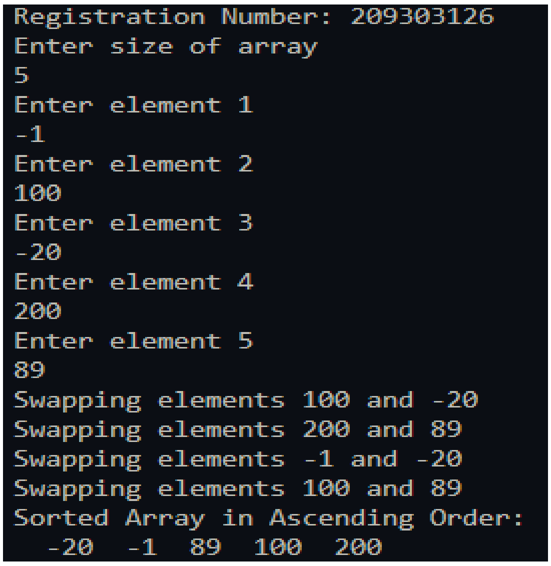
```
Registration Number: 209303126
Enter size of array
5
Enter element 1
20
Enter element 2
12
Enter element 3
56
Enter element 4
39
Enter element 5
100
Sorted array in Acsending Order:
12 20 39 56 100
```

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
```

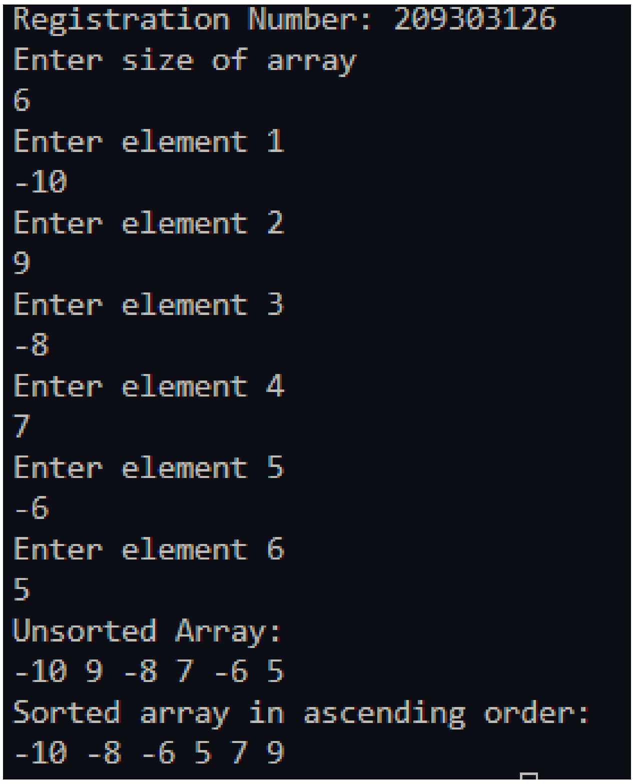
5. QUICK SORT

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

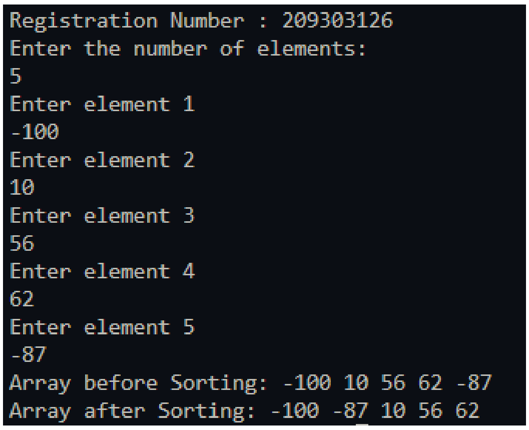
Code:

```
#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
```