



Marwari University
Faculty of Technology
Department of Information and Communication Technology

**Subject: Design and Analysis
of Algorithms (01CT0512)**

Aim: Implementing the Sorting Algorithms and understanding the time and space complexities

Experiment 1


Date: 03-08-2025

Enrollment No: 92301733054

❖ Insertion Sort

Code:

```
#include <iostream>
#include <vector>
using namespace std;
void Print_Array(vector<int> Array)
{
    for (int i = 0; i < Array.size(); i++)
    {
        cout << Array[i] << " ";
    }
    cout << endl;
}
void Insertion_Sort(vector<int> &Array)
{
    for (int i = 1; i < Array.size(); i++)
    {
        int key = Array[i];
        int j = i - 1;
        while (j >= 0 && Array[j] > key)
        {
            Array[j + 1] = Array[j];
            j--;
        }
        Array[j + 1] = key;
    }
}
int main()
{
    vector<int> Array = {12, 45, 57, 78, 89, 62, 7, 49, 21, 23};
    cout << "Array Before Sorting :- " << endl;
    Print_Array(Array);
    Insertion_Sort(Array);
    cout << "Array After Sorting :- " << endl;
    Print_Array(Array);
    return 0;
}
```

 Marwadi University	Marwari University Faculty of Technology Department of Information and Communication Technology	
Subject: Design and Analysis of Algorithms (01CT0512)	Aim: Implementing the Sorting Algorithms and understanding the time and space complexities	
Experiment 1	Date: 03-08-2025	Enrollment No: 92301733054

Output:

```

PROBLEMS  SPELL CHECKER  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS  GITLENS
cd "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/" && g++ Insertion_Sort.cpp -o Insertion_Sort && "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/"Insertion_Sort
nikhilbhanderi@Nikhils-MacBook-Air Experiment - 1 % cd "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/" && g++ Insertion_Sort.cpp -o Insertion_Sort && "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/"Insertion_Sort
Array Before Sorting :-
40 23 12 55 6 1 51 55 77 2 13
Array After Sorting :-
1 2 6 12 13 23 40 51 55 55 77
nikhilbhanderi@Nikhils-MacBook-Air Experiment - 1 %

```

Time Complexity: $O(n)$
Space Complexity: $O(1)$

❖ Bubble Sort

Code:

```

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

void Print_Array(vector<int> Array)
{
    for (int i = 0; i < Array.size(); i++)
    {
        cout << Array[i] << " ";
    }
    cout << endl;
}

void Swap(int &x, int &y)
{
    int temp = x;
    x = y;
    y = temp;
}

void Bubble_Sort(vector<int> &Array)
{
    int size = Array.size();

```

Subject: Design and Analysis of Algorithms (01CT0512)
Aim: Implementing the Sorting Algorithms and understanding the time and space complexities
Experiment 1
Date: 03-08-2025
Enrollment No: 92301733054

```

for (int i = 0; i < size - 1; i++)
{
    bool Swapped = false;

    for (int j = 0; j < size - i - 1; j++)
    {
        if (Array[j] > Array[j + 1])

        {
            Swap(Array[j], Array[j + 1]);
            Swapped = true;
        }
    }
    if (Swapped == false)
    {
        break;
    }
}
return;
}

int main()
{
    vector<int> Array = {11,4,54,24,35,22,55,65,33,15,76,63};
    cout << "Array Before Sorting :- " << endl;

    Print_Array(Array);
    Bubble_Sort(Array);

    cout << "Array After Sorting :- " << endl;
    Print_Array(Array);

    return 0;
}

```



Marwari University
Faculty of Technology
Department of Information and Communication Technology

Subject: Design and Analysis of Algorithms (01CT0512)

Aim: Implementing the Sorting Algorithms and understanding the time and space complexities

Experiment 1

Date: 03-08-2025

Enrollment No: 92301733054

Output:

```
PROBLEMS  SPELL CHECKER  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS  GITLENS
cd "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/" && g++ tempCodeRunnerFile.cpp -o tempCodeRunnerFile && "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/"tempCodeRunnerFile
nikhilbhanderi@Nikhils-MacBook-Air Experiment - 1 % cd "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/" && g++ tempCodeRunnerFile.cpp -o tempCodeRunnerFile && "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/"tempCodeRunnerFile
Array Before Sorting :-
11 4 54 24 35 22 55 65 33 15 76 63
Array After Sorting :-
4 11 15 22 24 33 35 54 55 63 65 76
nikhilbhanderi@Nikhils-MacBook-Air Experiment - 1 %
```

Time Complexity: $O(n^2)$

Space Complexity: $O(1)$

❖ Selection Sort

Code:

```
#include <iostream>
#include <vector>
using namespace std;
void Print_Array(vector<int> Array){
    for (int i = 0; i < Array.size(); i++){
        cout << Array[i] << " ";
    }
    cout << endl;
}
void Swap(int &x, int &y){
    int temp = x;
    x = y;
    y = temp;
}
void Selection_Sort(vector<int> &Array){
    for (int i = 0; i < Array.size(); i++){
        int min_index = i;
        for (int j = i + 1; j < Array.size(); j++){
            if (Array[j] < Array[min_index]){
                min_index = j;
            }
        }
        Swap(Array[i], Array[min_index]);
    }
    return;
}
```



Marwari University
Faculty of Technology
Department of Information and Communication Technology

Subject: Design and Analysis of Algorithms (01CT0512)

Aim: Implementing the Sorting Algorithms and understanding the time and space complexities

Experiment 1

Date: 03-08-2025

Enrollment No: 92301733054

```
int main()
{
    vector<int> Array = {22,4,5,3,32,4,34,54,23,87,22,54};
    cout << "Array Before Sorting :- " << endl;
    Print_Array(Array);
    Selection_Sort(Array);
    cout << "Array After Sorting :- " << endl;
    Print_Array(Array);
    return 0;
}
```

Output:

```
PROBLEMS  SPELL CHECKER  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS  GITLENS
cd "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/" && g++ Selection_Sort.cpp -o Selection_Sort && "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/"Selection_Sort
nikhilbhanderi@Nikhils-MacBook-Air Experiment - 1 % cd "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/" && g++ Selection_Sort.cpp -o Selection_Sort && "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/"Selection_Sort
Array Before Sorting :-
22 4 5 3 32 4 34 54 23 87 22 54
Array After Sorting :-
3 4 4 5 22 22 23 32 34 54 54 87
nikhilbhanderi@Nikhils-MacBook-Air Experiment - 1 %
```

Time Complexity: $O(n^2)$

Space Complexity: $O(1)$

❖ Counting Sort

Code:

```
#include <iostream>
#include <vector>
using namespace std;
void Print_Array(vector<int> Array)
{
    for (int i = 0; i < Array.size(); i++)
    {
        cout << Array[i] << " ";
    }
    cout << endl;
}
int Find_Max(vector<int> Array)
{

```

Subject: Design and Analysis of Algorithms (01CT0512)
Aim: Implementing the Sorting Algorithms and understanding the time and space complexities
Experiment 1
Date: 03-08-2025
Enrollment No: 92301733054

```

int max_num = Array[0];
for (int i = 1; i < Array.size(); i++)
{
    if (Array[i] > max_num)
    {
        max_num = Array[i];
    }
}
return max_num;
}

void Counting_Sort(vector<int> &Array)
{
    int max_num = Find_Max(Array);
    vector<int> count(max_num + 1, 0);


    for (int i = 0; i < Array.size(); i++)
    {
        count[Array[i]]++;
    }

    int index = 0;
    for (int i = 0; i <= max_num; i++){
        while (count[i] > 0){
            Array[index++] = i;
            count[i]--;
        }
    }

    return;
}

int main()
{
    vector<int> Array = { 11,3,35,55,76,34,24,2,42,67,45 };
    cout << "Array Before Sorting :- " << endl;
    Print_Array(Array);
    Counting_Sort(Array);
    cout << "Array After Sorting :- " << endl;
    Print_Array(Array);
    return 0;
}

```

 Marwadi University	Marwari University Faculty of Technology Department of Information and Communication Technology	
Subject: Design and Analysis of Algorithms (01CT0512)	Aim: Implementing the Sorting Algorithms and understanding the time and space complexities	
Experiment 1	Date: 03-08-2025	Enrollment No: 92301733054

Output:

```

PROBLEMS  SPELL CHECKER  OUTPUT  DEBUG CONSOLE  TERMINAL  PORTS  GITLENS
Code + -  [ ] [x] ... [ ] x

cd "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/" && g++ Counting_Sort.cpp -o Counting_Sort && "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/"Counting_Sort
nikhilbhanderi@Nikhils-MacBook-Air Experiment - 1 % cd "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/" && g++ Counting_Sort.cpp -o Counting_Sort && "/Users/nikhilbhanderi/Documents/Semester 5/DAA/Lab - Manual/Experiment - 1/"Counting_Sort
Array Before Sorting :-
11 3 35 55 76 34 24 2 42 67 45
Array After Sorting :-
2 3 11 24 34 35 42 45 55 67 76
nikhilbhanderi@Nikhils-MacBook-Air Experiment - 1 %

```

Time Complexity: $O(n + k)$
Space Complexity: $O(k + n)$