	Bansilal Ramnath Agarwal Charitable Trust's Vishwakarma Institute of Information Technology **Department of** **Artificial Intelligence and Data Science**

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Class: SY	Division: B	Roll No: 272028
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Subject Name & Code: Data Structure, ADUA21202		
Title of Assignment: Sort the data in ascending order using Quick sort (Display corresponding list in each pass).		

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DS Assignment - 10

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Aim: Implement Quick sort to sort the given list of number. Display corresponding list in each pass.

Theory: like Merge sort, Quick sort is a Divide and conquer algorithm. It picks element as a pivot and Partition the given array around the picked pivot. There are many different version of quicksort that pick pivot in different way.

- Always pick the first element as pivot
- Always pick the last element as a ~~pov~~ pivot
- Pick a random element as a pivot
- pick median as the pivot

The key process is quick sort is a partition(). The target of Partition is, given an array and an element ~~of~~ x of an array as the pivot, put x at its correct position in a sorted array and put all smaller element before x, and put all greater element after x. All this should be done in linear time.

Partition Algorithm:→

There can be many way to do partition, following pseudo-code adopts the method given in the CLRS book. The logic simple, we start from the leftmost element and keep track of the index of smaller element as i. While traversing, if we find a smaller element, we swap the current element with arr[i]. Otherwise, we ignore the current element.

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Conclusion: Thus, we have successfully understand the implementation of quick sort to sort the given list of numbers.

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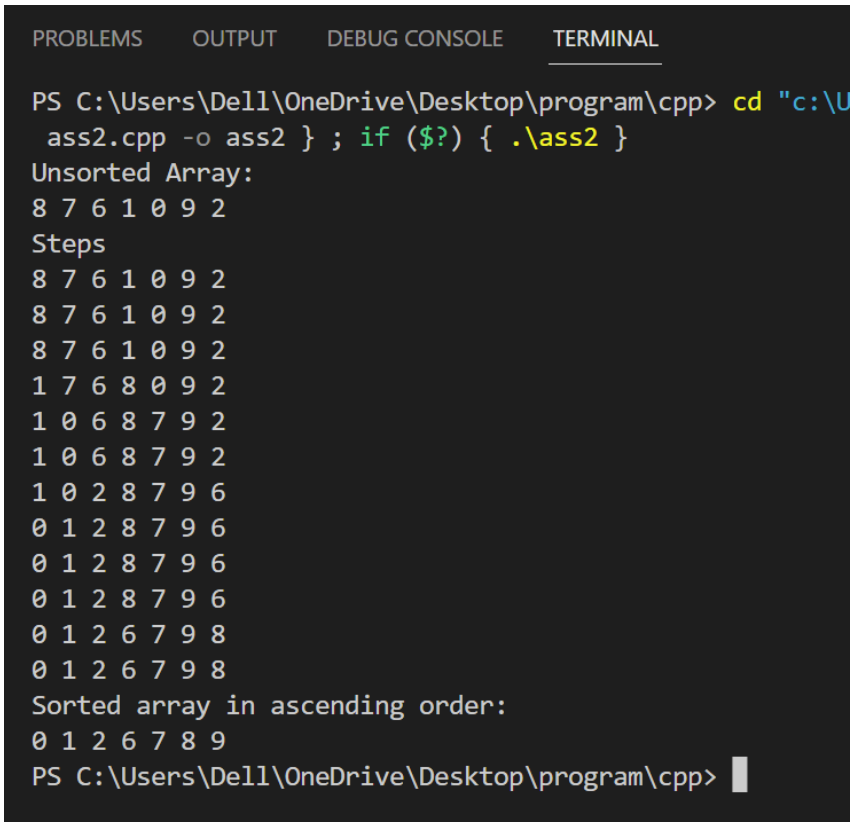
Ashwini

Program:

```
// Quick sort in C++

#include <iostream>
using namespace std;

int data[] = {8, 7, 6, 1, 0, 9, 2};
int n = sizeof(data) / sizeof(data[0]);
// function to swap elements
void swap(int *a, int *b) {
  int t = *a;
  *a = *b;
  *b = t;
}

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

// function to rearrange array (find the partition point)
int partition(int array[], int low, int high) {

  // select the rightmost element as pivot
  int pivot = array[high];

  // pointer for greater element
  int i = (low - 1);

  // traverse each element of the array
  // compare them with the pivot
  for (int j = low; j < high; j++) {
    if (array[j] <= pivot) {

      // if element smaller than pivot is found
      // swap it with the greater element pointed by i
      i++;

      // swap element at i with element at j
      swap(&array[i], &array[j]);
    }
    printArray(data,n);
  }
```

```
  // swap pivot with the greater element at i
  swap(&array[i + 1], &array[high]);

  // return the partition point
  return (i + 1);
}

void quickSort(int array[], int low, int high) {
  if (low < high) {


    // find the pivot element such that
    // elements smaller than pivot are on left of pivot
    // elements greater than pivot are on righ of pivot
    int pi = partition(array, low, high);


    // recursive call on the left of pivot
    quickSort(array, low, pi - 1);

    // recursive call on the right of pivot
    quickSort(array, pi + 1, high);
  }
}

// Driver code
int main() {
  //int data[] = {8, 7, 6, 1, 0, 9, 2};
  //int n = sizeof(data) / sizeof(data[0]);

  cout << "Unsorted Array: \n";
  printArray(data, n);

  cout<<"Steps"<<endl;
  // perform quicksort on data
  quickSort(data, 0, n - 1);

  cout << "Sorted array in ascending order: \n";
  printArray(data, n);
}
```

Output:


PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
PS C:\Users\Dell\OneDrive\Desktop\program\cpp> cd "c:\U
ass2.cpp -o ass2 } ; if ($?) { .\ass2 }
Unsorted Array:
8 7 6 1 0 9 2
Steps
8 7 6 1 0 9 2
8 7 6 1 0 9 2
8 7 6 1 0 9 2
1 7 6 8 0 9 2
1 0 6 8 7 9 2
1 0 6 8 7 9 2
1 0 2 8 7 9 6
0 1 2 8 7 9 6
0 1 2 8 7 9 6
0 1 2 8 7 9 6
0 1 2 6 7 9 8
0 1 2 6 7 9 8
Sorted array in ascending order:
0 1 2 6 7 8 9
PS C:\Users\Dell\OneDrive\Desktop\program\cpp>