

Fundamentals of Computer Engineering

Homework One
Programming with c++

```
Enter two numbers:34
54
This is swapping using pointers: 54    34
This is swapping using reference: 34    54
```

1. Swapping two integers using pointers and reference methods :

- Swapping using Pointers : In this case, the integers are passed to the function by an address to the variable using & symbol. These pointer variables are then declared by new variables using * symbol in the function declaration.
- Swapping using reference : In this case, the integers are passed to the function as variables and are declared by new variables using & symbol in the function declaration.

The main difference between pointers and references is that, references to variables don't create any new memory space. References just point to the existing memory address of that variable. But pointers create new memory address.

2. Mirrored array:

```
Enter the length of the array:3
Enter the array:
12
32
4
Mirrored array:
4
32
12
```

```
Enter the length of the array:4
Enter the array:
34
5
33
45
Mirrored array:
45
33
5
34
```

Given an array of integers, the index of the values must be changed such that the resultant array looks exactly opposite or reversed to the original array. Since temporary arrays are not allowed, pointers are used to pass the array's memory address to the function mirror. Then for loop is executed for half the size of the array to swap the values of the array.

Temporary value is fixed as the i^{th} value of the array and the i^{th} value is changed to the value of the last index which is swapped with the temp value. This loop continues till $m/2$ times. This works for both odd and even lengths of arrays.

3. Student Info:

```
Enter the size of the class(number of students):
3
Enter the student Name and Grade (between 0 and 100):
Student 1
vf
34
Student 2
fg
99
Student 3
gh
45
List before sorting:
vf 34
fg 99
gh 45
List after sorting:
fg 99
gh 45
vf 34
Average of all the grades is: 59.3333
Median of all the grades is: 45
Maximum Grade is scored by fg - 99
Minimum Grade is scored by vf - 34
```

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- a. Ask the user to input the size of the class and create an array dynamically by using new operator and denote memory allocation in a heap whose address is then pointed to the variable declared (stud in this case).
 - b. Structure is declared with two variable types for student names and grades and a variable assigned to this struct is then declared for the dynamic array.
 - c. Quicksort algorithm is used to sort the values in descending order-
 - 1. Pivot value is fixed from the array, usually its chosen as the last value of the array
 - 2. To select a pivot index, partition function is called in which it is checked if the current value is greater than the pivot.
 - 3. If the value is greater then it is swapped and pivot index is incremented.
 - 4. If this is false, the loop continues from starting index of the array till the end.
 - 5. After swapping the values according to the pivot, pivot is swapped with the position where the loop is stopped.
 - 6. This ensures the division of the array into left and right sub-arrays with pivot in between them.
 - 7. This function call is recursive until the pivot has only one element in its sub-arrays and no more sorting is left.
 - d. Average and median is found using the size of the array. It's implemented for both odd and even sized arrays.
 - e. Maximum score of any student is the first value of the sorted array (since its descending order) and the minimum is the last value.