Assignment 1

a. Sort the sequence 3, 7, 4, 1, 5, 2, 8, 6, 9 using Insertion sort (show the steps on your paper)
b. Please write C program for Insertion sort, using sequence of question a as input. Please show the running time of this program

Assignment 2

a. Sort the following array using Merge Sort (show the steps on your paper)

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
13	77	49	35	61	48	73	23	95	3	89	37	57	99	17	32	94	28	15	55	7	51	88	97	62

b. Please write C program for Merge sort, using sequence of question a as input. Please show the running time of this program

c. Please modify the program of question b as following:

- In practical, if the sub-lists are less than some threshold length (for example 10), use an algorithm like insertion sort to sort the lists
- Otherwise, use Merge sort, again

d. Compare the running time of program of question b and running time of question c by using the sequence of Assignment 1 as input for both programs.

Assignment 3

a. Sort the following array using Quick Sort (show the steps on your paper)

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
13	77	49	35	61	48	73	23	95	3	89	37	57	99	17	32	94	28	15	55	7	51	88	97	62

b. Please write C program for Quick sort with random pivot, using sequence of question a as input. Please show the running time of this program. Compare the running time of this program with Merger Sort program.

c. Please modify program of question b with median-of-three pivot.

d. Please modify the program of question b as following:

- In practical, if the sub-lists are less than some threshold length (for example 10), use an algorithm like insertion sort to sort the lists
- Otherwise, use Quick sort, again

e. Compare the running time of program of question b and running time of question c by using the sequence of Assignment 1 as input for both programs.

Assignment 4

a. Sort an array of 0's, 1's and 2's: Given an array A[] consisting of 0's, 1's and 2's, give an algorithm for sorting *A*[]. The algorithm should put all 0's first, then all 1's and all 2's last.
Example: Input = {0,1,1,0,1,2,1,2,0,0,0,1}, Output = {0,0,0,0,0,1,1,1,1,1,2,2}

b. Is there any other way of solving question a with the same time complexity.

Assignment 5

a. Write a program to allow user input size of a 1D-array of student and after that, enter all information of these students. A worker consists of 4 kind of information: student_id (int), full_name(string), age (int), gpa (float).
b. Sort this array by gpa of the student in descending order using Insertion Sort, and Quick Sort with median-of-three

Assignment 6

Given an array $A[0...n-1]$ of n numbers containing the repetition of some number. Give an algorithm for checking whether there are repeated elements or not. Assume that we are not allowed to use additional space but we can use recursive algorithm. (We can use few temporary variables and recursive function)