

National Institute of Technology, Calicut
Department of Computer Science and Engineering
CS2094 – Data Structures Lab
Assignment-2(Advanced Batch)

Policies for Submission and Evaluation

You must submit your assignment in the moodle (Eduserver) course page, on or before the submission deadline. Also, ensure that your programs in the assignment must compile and execute without errors in Athena server. During evaluation your uploaded programs will be checked in Athena server only. Failure to execute programs in the assignment without compilation errors may lead to zero marks for that program.

Your submission will also be tested for plagiarism, by automated tools. In case your code fails to pass the test, you will be straightaway awarded zero marks for this assignment and considered by the examiner for awarding F grade in the course. Detection of ANY malpractice regarding the lab course will also lead to awarding an F grade.

Naming Conventions for Submission

Submit a single ZIP (.zip) file (do not submit in any other archived formats like .rar or .tar.gz). The name of this file must be ASSG<NUMBER>_<ROLLNO>_<FIRSTNAME>.zip (For example: ASSG2_BxyyyyCS_LAXMAN.zip). DO NOT add any other files (like temporary files, input files, etc.) except your source code, into the zip archive.

The source codes must be named as ASSG<NUMBER>_<ROLLNO>_<FIRSTNAME>_<PROGRAM-NUMBER>.<extension> (For example: ASSG2_BxyyyyCS_LAXMAN_1.c). If there is a part *a* and a part *b* for a particular question, then name the source files for each part separately as in ASSG2_BxyyyyCS_LAXMAN_1b.c.

If you do not conform to the above naming conventions, your submission might not be recognized by some automated tools, and hence will lead to a score of 0 for the submission. So, make sure that you follow the naming conventions.

Standard of Conduct

Violations of academic integrity will be severely penalized.

Each student is expected to adhere to high standards of ethical conduct, especially those related to cheating and plagiarism. Any submitted work **MUST BE** an individual effort. Any academic dishonesty will result in zero marks in the corresponding exam or evaluation and will be reported to the department council for record keeping and for permission to assign F grade in the course. The department policy on academic integrity can be found at:

<http://minerva.nitc.ac.in/cse/sites/default/files/attachments/news/Academic-Integrity.pdf>

Assignment Questions

1. Given an input binary file "in.txt" of integers, sort it using 3-way merge sort and write the output to file "out.txt".

in.txt

3 35 28 12 15 47

out.txt

3 12 15 28 35 47

2. Write a program to implement modified quick sort. A modified quick sort uses a modified partition method which always chooses median element of an array as a pivot in $O(n)$ time. Print the median values for **first 3 iterations** before printing the final sorted array.

Sample Input:

5

25 6 40 17 55

Sample Output:

25

6

40

6 17 25 40 55

Input Explanation:

First line reads number of integers to be sorted (N).

Second line reads N integers separated by single space.

Output Explanation:

First line shows median value at first iteration. Second and third line shows median values at second and third iteration respectively. Last line outputs N integers sorted in ascending order separated by single space.

Note: - For a sorted array of size n. If n is odd, **Floor($n/2$ th)** index element is median otherwise **[$n/2 - 1$]th** index element is median. Array index starts from 0.

3. Write a program to find Kth largest element in an unsorted array of size N in $O(N + K \log(N))$ time.

Sample Input:

5

11 22 13 40 55

3

Sample Output:

22

Input Explanation:

First line reads size of array (N).

Second line reads N integers separated by single space, content of array.

Third line reads value of K.

Output Explanation:

Kth largest element in the array.

4. a) Given an $M \times N$ matrix in which every row and column is sorted in increasing order. Write a program to find whether a given element K is present in matrix or not in $O(M+N)$. Print 1 if K is present in the matrix, otherwise print -1.

Sample Input:

```
3 4
10 20 30 40
15 25 35 45
27 29 37 48
29
```

Sample Output:

```
1
```

Input Explanation:

First line reads 2 integers M and N separated by a single space.
Next M lines read N integers separated by single space.

Last line reads K .

Output Explanation:

1 (if K is present) or -1 (otherwise)

4. b) Given a sorted rotated array of N distinct integers, search a given element in this array in $O(\log N)$. If found then print the index (starting from 0) otherwise print -1.

Sample Input:

```
7
```

18 24 33 5 8 7 11

25

Sample Output

-1

Input Explanation:

First line reads size of array (N).

Second line reads N integers separated by single space, content of array.

Third line reads value of K.

Output Explanation:

1 (if K is present) or -1 (otherwise)