

# INDIAN STATISTICAL INSTITUTE

M. Tech (CS) - I Year, 2016-2017 (Semester - II)

*Design and Analysis of Algorithms*

## Assignment-1: Programming Assignment

**Submission:** The assignment is being uploaded on 02.02.2017. You have to submit the assignments by e-mail to `algo2017mtech@gmail.com` by 10.02.2017. The subject line of the e-mail should be *Assignment 1*. If you are submitting a multfile program, submit a *zip* or *tar ball* having all the files with the following naming convention. As an example, if you are an M Tech (CS) student whose name is Shyam Mondal, your file names should be `mtech-shyam-***`. If you are a JRF whose name is Shyama Mondal, your file names should be `jrf-shyama-***`. Ideally, we would prefer a shell script in your folder, so that while checking the assignments, we can run only the shell script.

**Note:** Implementations need to be in C/C++. For plotting purposes, you can use `gnuplot`.

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(Q1) Write recursive and iterative implementations for sorting an array with  $n$  numbers using the following algorithms:

- mergesort
- heapsort
- quicksort

(Q2) Vary  $n$  from small numbers to as large as possible numbers and compare the machine run times of

- recursive mergesort vs iterative mergesort
- recursive heapsort vs iterative heapsort
- recursive quicksort vs iterative quicksort

and generate a plot where  $n$  is in the  $x$ -axis and time is in the  $y$ -axis. For each  $n$ , generate the inputs of the  $n$ -sized array in a random fashion and take the result for a particular  $n$  averaged over a few runs.

(Q3) Vary  $n$  from small numbers to as large as possible numbers and compare the machine run times of

- recursive mergesort vs recursive heapsort vs recursive quicksort
- iterative mergesort vs iterative heapsort vs iterative quicksort

and generate a plot where  $n$  is in the  $x$ -axis and time is in the  $y$ -axis. For each  $n$ , generate the inputs of the  $n$ -sized array in a random fashion and take the result for a particular  $n$  averaged over a few runs.