CS6140: Advanced Programming Lab

Course Instructor : Chester Rebeiro, Assistant Professor, IIT Madras

Q Slot (Tuesdays 14:00 to 16:40)

Location: DCF, Department of Computer Sc. and Engg., IIT Madras

Teaching Assistants

- MUHAMMAD ARSATH KF (CS16S035)
- HIMANSHI JAIN (CS16S014)
- AJAY SHARMA (CS17M008)
- HIMANSHU GAUR (CS17M016)
- MONIKA AHIRWAR (CS17M025)
- MONIKA CHAUHAN (CS17M026)
- MURALI KRISHNA G (CS17M027)
- ABHINAB GHOSH (CS17M061)
- OM PRAKASH JAKHAR (CS17M057)
- SIDDHARTH AGARWAL (CS17M012)

Course Objectives

This is a 9 credit core course to be taken by all MTech students. The objective of the course is to teach students advanced problem solving through programming. It aims to train students in realizing computer algorithms with efficient C/C++ programs.

Learning Outcomes

- Given a computational problem, identify and abstract the programming task involved.
- Approach the programming tasks using techniques learned and write pseudo-code.
- Choose the right data representation formats based on the requirements of the problem.
- Select the right algorithmic paradigm (such as greedy, dynamic programming, divide and conquer etc.).
- Write the program on a computer, edit, compile, debug, correct, recompile and run it.
- Identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.

Course prerequisite(s)

None

Classroom Mode

The assignments will be partially done in the lab and partially will be take home.

TextBooks

Introduction to Algorithms (3rd Edition).
Authors: Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
Publisher: MIT Press

Course Requirements

Assignment Submissions

- There would be around 12 assignments. Except for the first assignment, each assignment would have a lab component and a take home component.
- The lab component should be submitted by the end of the day. Since, the lab is scheduled every Tuesday afternoon, the lab component of the assignment must be submitted by 11:59PM on that Tuesday.
- The take home component, should be submitted by the end of the week (corresponding Saturday 11:59PM). These are hard deadlines no extensions will be given.
- Submissions must be done through HackerRank. Occassionally, when a report needs to be submitted, moodle (https://courses.iitm.ac.in) shall be used.

Coding

- C is prefered. C++ is also fine. Template libraries such as boost and stl cannot be used.
- The code should have appropriate comments and well formatted. These would carry marks.
    - Every .c or .h file should start with a comment header.
    - Important functions should have a preamble providing details about the function.
    - Similarly, global variables should be appropriately commented.
    - Additional comments should be added wherever felt appropriate.

      An example is shown below:

```
/************************
Filename : qsort.c
Assignment: Lab 1
Author: John Doe (CS18M100)
Date: Aug 2nd, 2018
Description: This file implements the quick sort algorithm.
************************/


uint32_t array[256];   /* stores the array that has to be sorted */


/* compares the inputs a and b.
   Returns 0 if a = b; 1 if a > b;
   or -1 if a \ne b
*/
int compare(uint32_t a, uint32_t b){
```

- Makefiles should be used for compilation.
- All programs should be compilable for Linux with the gcc compiler.

Programming Tools

- Students are encouraged to use debugging tools such as gdb, valgrind (for memory utilization), gprof, performance monitoring tools, etc. A few of the assignments may mandate some of these tools to be used.

Planned Syllabus

The following is the tentative plan for the assignments (not necessarily in this order).

- Primality testing
- Recursive algorithms
- Sorting algorithms
- Divide and Conquer algorithms
- Heaps, priority queues, and binary search trees
- Red-black trees
- Dynamic programming based algorithms
- Greedy algorithms
- Graph based algorithms
- String matching algorithms

Tentative Grading Policy

Assignments 60%; Mid Semester Exam 20%; End Semester Exam 20%

Assignment Grading

- Top 10 assignment marks out of 12 assignments will be considered for evaluation
- The weightage for the lab component and the take home component will be specified on a per assignment basis.
- Marks will be given based on (a) test cases passed by the program (b) logic, and (c) coding style, appropriate formatting etc.

Exam Dates

- Mid Semester Exam: September 25th, 2018
- End Semester Exam: November 10th, 2018

Academic Honesty

Academic honesty is expected from each student participating in the course. NO sharing (willing, unwilling, knowing, unknowing) of assignment code between students, submission of downloaded code (from the Internet, Campus LAN, or anywhere else) is allowed.

Academic violations will be handled by IITM Senate Discipline and Welfare (DISCO) Committee. Typically, the first violation instance will result in ZERO marks for the corresponding component of the Course Grade and a drop of one- penalty in overall course grade. The second instance of code copying will result in a 'U' Course Grade and/or other penalties. The DISCO Committee can also impose additional penalties.

Please protect your Moodle account password. Do not share it with ANYONE. Do not share your academic disk drive space on the Campus LAN.