CS738 Advanced Compiler Optimizations

Objectives:

This course aims to teach topics in program analysis and compiler optimizations.

The course would cover material from recent and past research papers on topics such as data flow analysis for bit-vector and non-bit-vector frameworks, interprocedural analysis, and alias analysis.

Course contents:

The course will mainly cover topics from the following list (not necessarily in the same order). Not all items listed below will be covered, and depending on class feedback, new topics may be added.

- Introduction, compiler architecture, intermediate representations
- Control flow analysis, control-flow graphs, basic blocks
- Dataflow analysis
- SSA form
- Classical optimizations (constant folding, CSE, PRE)
- Pointer and alias analysis
- Interprocedural analysis
- Advanced Topics:
  - Garbage Collection
  - Program Synthesis
  - Program Testing and Debugging
  - Types and Programming

Course material and webpage:

All notices and course material for the course will be made available at the URL: http://www.cse.iitk.ac.in/~karkare/Courses/cs738/.

Time and Venue:

Prerequisites And Co-Requisites:

None.

It is desirable to have a good understanding of Compilers and a willingness to work with large code bases.

Evaluation components:

The below information is tentative and can be changed depending on the number of registered students.

a. **Examinations**: There will be one mid-semester examination of a maximum of two hours and an end-semester examination of a maximum of three hours. It will be held during the prescribed examination period. There will be no make-up for the mid-semester examination, and marks will NOT be prorated unless the absence is due to a medical emergency.
b. **Assignments**: The assignments For students to master the material covered in the class.
c. **Project**: There will be a project requiring an analysis of reasonably large software. A team of two or three students will work together on the project.

Evaluation Scheme:

Item	Weight
Class Participation and Quizzes	**05%**
Assignments	**10%**
Mid Semester Exam	**20%**
End Semester Exam	**30%**
Project Proposal	**05%**
Project Implementation	**20%**
Project Report and Presentation	**10%**

Academic honesty:

Any report/program/assignment you submit must **clearly distinguish** your contribution from others (webpages, software, report, discussions with other students). The penalty for copying in any form will be severe.

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