ECE 466 Syllabus

Course: ECE 466

Credit Hours: 3

Course Title: Compiler Optimization and Scheduling

Course Description:

Provide insight into current compiler designs dealing with present and future generations of high performance processors and embedded systems. Investigate dataflow analysis and memory disambiguation, classical and parallelism enhancing optimizations, scheduling and speculative execution, and register allocation. Review of techniques used in current research compilers.

Prerequisite(s): ECE 209 or competence in any machine language programming, CSC 316 or competence with programming data structures and programming ability in C or C++/Java.

Textbook(s) and/or other required material:

1.Cooper and Torczon, Engineering a Compiler, Morgan-Kauffman: NY, 2004.2.Instructor course notes.

Course objectives. By the end of this course, the student should be able to (use demonstrative verbs):

1.describe the fundamental concepts of compiler functions2.identify the fundamental elements of compiler optimization3.discuss some of the technical challenges encountered in the areas of scalar optimization, dataflow analysis, scheduling and register allocation.4.apply these fundamentals in compiler design.5.practice these fundamentals by programming three parts of a working compiler.6.calculate the performance of code before and after optimization.

Topics covered:

1.Introduction: Overview and history of compilers.2.Survey of scanning and parsing. (4)3.Program representation. (3)4.Dataflow analysis. (3)5.Static single assignment form. (2)6.Scalar code optimization. (6)7.Register allocation. (3)8.Brief survey of microarchitecture (2)9.Instruction scheduling (5)

Class/laboratory schedule (sessions per week and duration of each session):

Two 75-minutes lectures per week.

Contribution of course to meeting the requirements of Criterion 5 - other:

Contribution of course to meeting the requirements of Criterion 5 - math and basic sciences:

Contribution of course to meeting the requirements of Criterion 5 - engineering topics:

3.0 Hours.

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Contribution of course to meeting the requirements of Criterion 5 - general education:

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
Outcome A	Major	Students learn about code performance and dataflow analysis and how to apply these principles for designing an optimizing compiler and for hand-optimizing code.
Outcome B	Major	Students implement three experimental projects in which they build a compiler front end, build a small code optimizer and build an instruction scheduler.
Outcome C	Major	Students design compiler components with the goal of achieving optimal or near-optimal performance and robust behavior across varying input programs considering cost/complexity/performance trade-offs.
Outcome D	Intermediate	Students build complex software systems in teams of two. They learn efficient task partitioning and continuous communication to ensure correct operation and timely project completion.
Outcome E	Major	Students analyze a simulator specification and apply their knowledge from the course to implement the simulator.
Outcome F	N/A	
Outcome G	Intermediate	Students write comprehensive reports to explain their compiler

Relationship of this course to program learning outcomes:

Learning Outcome	Level of Instruction	Related Course Content
		component designs, describe their implementations and present/discuss their experimental findings.
Outcome H	Basic	Students are exposed to software efficiency and its impact on society.
Outcome I	Basic	Students are exposed to rapid technology evolution to appreciate life-long education. Students learn how to keep up with latest technology through conference/journal papers.
Outcome J	Basic	Students study code generation techniques for state-of-the-art processors recently manufactured.
Outcome K	Major	Students write large programs and use debuggers in three course projects.

Person who last prepared this description and date of preparation:

- Tuck, James (jtuck) - Sep 21st, 2009 (12:36pm)