CSE 6329: Special Topics in Advanced Software Engineering
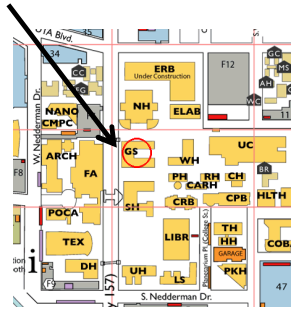
Fall 2008
Monday, Wednesday, 4 - 5:20 pm, GS 109

Instructor: Christoph Csallner
Nedderman Hall 306, 817-272-3334,
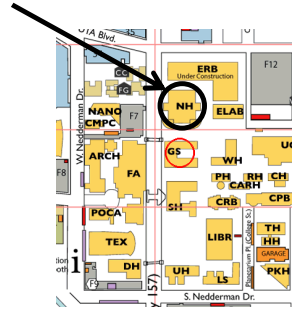csallner@uta.edu

Office hours: Monday, Wednesday 5:30 - 6:30 pm
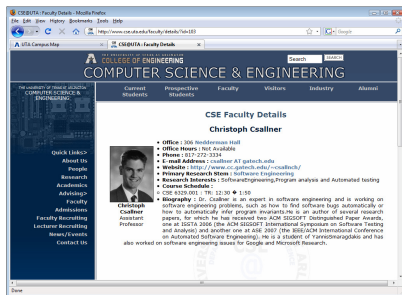

Office

Class

Class Meetings in GS 109

http://www.uta.edu/maps/map?id=GS

CSE 6329 Intro (2)

Office hours in NH 306, after class

http://www.uta.edu/maps/map?id=GS

CSE 6329 Intro (3)

Instructor: Christoph Csallner

http://www.cse.uta.edu/faculty/details/?id=103

CSE 6329 Intro (4)

CSE 6329: Special Topics in Advanced Software Engineering

Which special topics?
Program Analysis!

Why Program Analysis?
Need to analyze programs!

Need to analyze programs

- How can I make my program run faster?
  - How to optimize a compiler?
  - GCC, Microsoft Visual Studio, Java Virtual Machine

Need to analyze software

- How can I make my program run faster?
- How can I integrate it with software X?
- How can I add feature Y that my client wants?
  - Program understanding and reverse-engineering

Need to analyze software

- How can I make my program run faster?
- How can I integrate it with software X?
- How can I add feature Y that my client wants?
- How can I refactor my software?
  - Automatic refactoring support in integrated development environments, e.g., Eclipse for Java
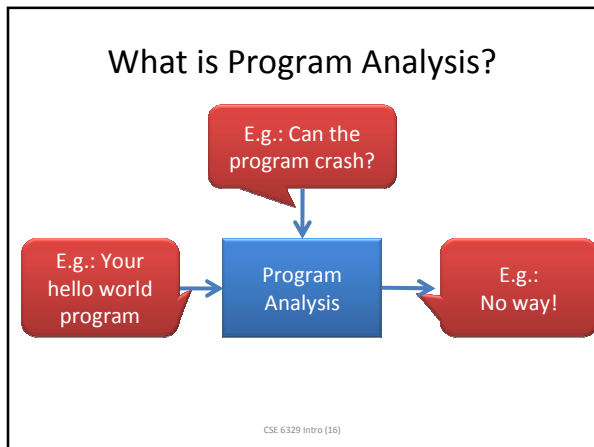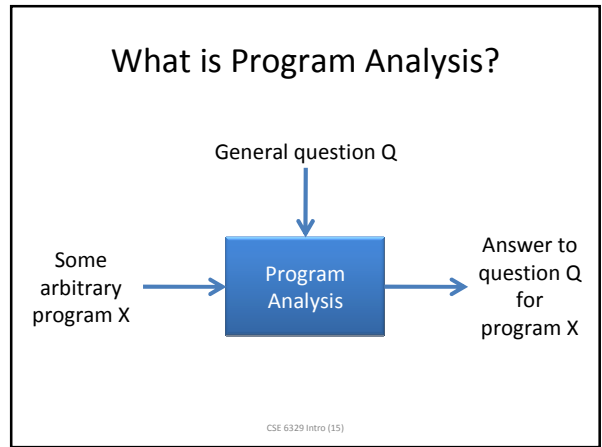
Need to analyze software

- How can I make my program run faster?
- How can I integrate it with software X?
- How can I add feature Y that my client wants?
- How can I refactor my software?
- Does my program satisfy requirement Z?
- How can I find bugs in my program automatically, before shipping it?

Software is everywhere

Bugs could be fatal

What is Program Analysis?

What is Program Analysis?

General question Q

Some arbitrary program X → **Program Analysis** → Answer to question Q for program X

What is Program Analysis?

E.g.: Can the program crash?

E.g.: Your hello world program → **Program Analysis** → E.g.: No way!

## Syllabus

Upon completion of this course, you will be able to

- Identify the basic problems addressed by program analysis
- Describe and compare basic program analysis techniques, including
  - Static program analysis, dynamic program analysis, and their combinations
- Apply basic program analysis techniques and explain the results obtained

Textbook

SOFTWARE TESTING AND ANALYSIS
PROCESS, PRINCIPLES, AND TECHNIQUES
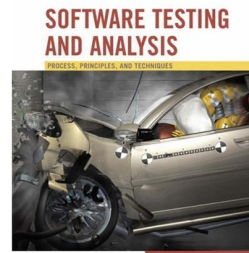
Mauro Pezzè
Michal Young

Tentative course outline

- Program analysis intro   Textbook chap 1 – 3
- OO refresher   Textbook chap 15
- Static analysis: CFG   Textbook chap 5
- Static analysis: Dataflow Textbook chap 6
- Dynamic analysis: JCrasher, Daikon
- Symbolic execution: Textbook chap 7
- Latest and greatest: Research papers

Grading

- 6000 level course
- Focus on concepts and research
  - Be a responsible research citizen
  - Not a spectator sport
  - Exams to help you learn basic concepts
  - Small homework projects designed to help you get started with research in program analysis
  - Paper presentation for you to practice academic conference-style presentation

Exams

- Program analysis intro   Textbook chap 1 – 3
- OO refresher   Textbook chap 15
- Static analysis: CFG   Textbook chap 5
- Static analysis: Dataflow Textbook chap 6
  - Midterm
- Dynamic analysis: JCrasher, Daikon
- Symbolic execution: Textbook chap 7
  - Final
- Latest and greatest: Research papers

Small homework projects

- Experiment with cutting-edge research tools
  - Gaining acceptance in industry
    - FindBugs (Univ Maryland): Java bug finding
    - Daikon (MIT) in the form of Agitar: Reverse engineering
  - Likely to become important in industry, once released
    - Pex (Microsoft Research): Both
- Have not worked out the details yet

Research paper presentations

- I will provide a list of research papers
  - Pick one
  - 1:1 mapping between student and paper
- Even better: find your own paper
  - I recommend you discuss your pick with me
- For 27 students, we will probably take 2.5 weeks for presentations
  - 14 min for presentation + 2 minutes for questions
  - Ask questions to help class participation grade

Questions

For Wednesday

- If you wonder how all this relates to the software development process, read chapter 1
- Otherwise, skim chapter 1

For Wednesday

- Read chapter 2
  - Focus on the **basic problem of undecidability** and how program analysis addresses it
  - Expect to be confused (by the terminology, ..)
    - During first read, during first re-read, ..
  - Wikipedia entries surprisingly helpful
  - Ask me questions in class, afterwards, etc.
  - Goal of entire course is to better understand these basic problems and how program analysis addresses them