Compilers

A Brief Introduction to the Course

Salahaddin University
College of Engineering
Software Engineering Department
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http://www.amanj.me/wiki/doku.php?id=teaching:su:compilers

Who am I?

- 27 years old.
- M.Sc. in Computer Science, Uppsala University 2011.
- B.Sc. in Software Engineering, Salahaddin University 2006.
- I am a free and open source software advocate.
- I have some activities against copyright infringement.
- My research interest is type systems.

The Course Organization

- The course consists of 22 lectures and 4 mandatory assignments.
- Each assignment weighs 10 marks, and they altogether weigh 6 bonus points for the final mark.
- The passing mark is 50 out of 100.
- The highest mark is 100, the lowest is 0 (if you get 0 you deserve 0).
- Cheating (even helping a friend to cheat), results in 0 for the doer(s).

The Course Organization, *Cont'd*

- The assignments help you collect bonus points:
  - Full mark → 1.5 bonus points.
  - 9 → 1 bonus point.
  - 8 → 0.5 bonus points.
  - 7, 6, 5 → pass (but 0 bonus points).
  - 4, 3, 2, 1, 0 → resubmit the assignment and 0 bonus points.

Guidelines for Assignments

- Respect the deadlines, no assignment after the deadline can receive a bonus point.
- The applied assignment should be in a non-proprietary format:
  - PDF, plain text, ODF, HTML or any other plain text based formats.
  - But not in doc, docx, ppt, pptx or any other Microsoft Office formats.

Marking System

- 6 marks that you collect from the assignments (the bonus points).
- 17 marks for the mid-term exam.
- 17 marks for the 2nd term exam.
- 60 marks for the final exam.

Formalities

- I prefer you to call me Amanj (not mamosta Amanj or kak Amanj).
- There is no absence system, it is your responsibility to help yourself to learn.
- The course is taught in English, but you can ask questions in Kurdish and Arabic.

What is a Compiler

- The Compiler is a tool that converts human readable programs to machine executable programs.
- Like converting C, Python or Java programs to binary executables.
- In this course we will go through basics for compilation of imperative/procedural languages (C).

Why Study Compilers?

- Classic computer science:
  - Theory: description of programming languages
  - Practice: implementation of programming languages on machines improves your understanding of how things work.
- Non-trivial programming exercise:
  - Lots of data structures and algorithms involved -you become better programmers-.

Why Study Compilers? *Cont'd*

- Compiler technology used in many areas:
  - Web browsers (parse, analyze, and execute HTML).
  - Domain-specific languages (VHDL, UML, Erlang).
  - Script language interpreters (Shell, Perl).
  - Program analysis and transformation tools (security, conformance, refactoring, translation).
  - Interface descriptions for connecting different systems.

Why Study Compilers? *Cont'd*

- Dynamic code generation (at runtime):
  - Just-in-time compilers (Java, graphics).
  - Computer virtualisation (VirtualBox, Xen, VMWare).
  - Computer emulation (Qemu, Simics).
  - Code instrumentation and analysis (valgrind, pin, acumem) Job security.

Related Areas

- Formal specification languages for programming languages, tools for executing/compiling such specifications.
- Runtime systems:
  - Standard library procedures (I/O, math, data structures).
  - Memory management procedures (malloc, garbage collection).
  - Exception support procedures (unwinding call stacks).
  - Thread support procedures (management, synchronisation).

Related Areas, *Cont'd*

- Operating systems kernels:
  - Low-level support for I/O, memory management, threads, and processes.
- System tools:
  - Assembler, linker, "make", editor, IDE.
  - Processor design (e.g. Xelerated's programmable network processors).

Course Literature

- Purple Dragon Book (Aho, Lam, Sethi, Ullman, “Compilers principles, techniques and tools”, 2007 edition).
- Red Dragon Book (Aho, Sethi, Ullman, “Compilers principles, techniques and tools”, 1986 edition).
- Appel's Tiger Book (Andrew W. Appel, “Modern Compiler Implementation in C”, 1998 edition).

Finally

- Lecture notes on course webpages.
- Assignment specifications on course webpages.
- The course webpage:
  - http://www.amanj.me/wiki/doku.php?id=teaching:su:compilers