Compiler Construction/Fall 2014/Homework 1

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Assigned Thursday 9/4/2014, due Thursday 9/11/2014 at 8am

Reading Assignments

- For lecture on 9/4/2014: Dragon book §§1.1–1.2 (12 pages).

- For lecture on 9/11/2014: Dragon book §§3.1–3.4, §§3.6–3.7 (50 pages), HACS handouts 1 and 2 (the H1 and H2 links on the course schedule).

Homework Assignments

The following assignments should be submitted[1] for a maximum of 24 points and 4 "bonus" points.

1   Language Processors

Question 1.1 (3 points). Compilers typically consist of a front-end (lexing, parsing, semantic analysis, IR generation) and a back-end (code generation). What advantage does this architectural separation into front-end *vs.* back-end bring?

Question 1.2 (3 points). Many compilers have multiple optimizers, at different stages in the compiler. Why is it useful to have multiple optimizers?

2   Compiler Phases

These questions are based on Figure 1.7 on Page 7 of the Dragon-book. Your task is to show the output of each of the compiler phases for the source code statement `celsius = (fahrenheit - 32) * (5/9)`.

Question 2.1 (3 points). What sequence of tokens does the lexical analyzer output?

Question 2.2 (3 points). What abstract syntax tree does the syntax analyzer output?

Question 2.3 (3 points). What is the abstract syntax tree after the semantic analyzer modifies it?

Question 2.4 (3 points). What sequence of three-address instructions does the IR generator output?

Question 2.5 (3 points). What sequence of three-address instructions does the optimizer output?

Question 2.6 (3 points). What sequence of machine instructions does the code generator output? You can improvise your own pseudo-assembler syntax for this question, as long as the overall idea is clear.

3   Programming

Question 3.1 (4 bonus points). Consider the programming language impoementations that you know. Which are implemented by an interpreter? Which are implemented with a compiler?

Each language has a specification document. How is the grammar described for each language? How is the meaning of each programming construct described for the language?

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[1]To submit homeworks, log into `home.nyu.edu`, go to Academic → NYU Classes → Compiler Construction → Assignments, and upload your PDF file with answers there. Don't forget to click "submit" before the deadline, just "upload" is not enough.