CS 380C Compilers — Spring 2014 **Programming Assignment #1**
Annotating LLVM Code **Due January 22, 2014**

The goal of this assignment is to familiarize you with the LLVM compiler by implementing a simple LLVM pass that outputs a .ll file with C-level source line numbers added as comments.

1 Your Assignment

1. Download and install the virtual machine provided on the class web page. It is a VirtualBox OVA file which can be imported into VirtualBox (and possibly other Virtual Machines). Find instructions for this here:

   `http://docs.oracle.com/cd/E26217_01/E26796/html/qs-import-vm.html`

   This virtual environment will be the canonical environment for the whole class. It provides a prebuilt LLVM 3.4 development environment. Most importantly all homework should be tested in this environment because this is the environment we will be using for grading. You are free to develop in whatever environment you like; however, you should test in the virtual environment and make sure you are using LLVM 3.4. For more help on LLVM build and development visit this page:

   `http://llvm.org/releases/3.4/docs/GettingStarted.html`

2. Read the documentation about "Writing an LLVM Pass," which can be found here:

   `http://llvm.org/releases/3.4/docs/WritingAnLLVMPass.html`

   In particular, read the sections "Introduction - What is a Pass?" and "Quick Start - Writing hello world," which provides an example of how you can write a pass that prints all the function names of a C file.

   However, do *not* build your pass in the LLVM source tree. Instead use the `skeleton` project in the virtual machine (and separately on the website). It uses a simple `Makefile` to build a pass without having to integrate with the LLVM build system.

3. Implement a new pass that writes the source line number that corresponds to each LLVM instruction. To understand how to get the source line number of an LLVM instruction, consult the document "Source Level Debugging with LLVM":

   `http://llvm.org/releases/3.4/docs/SourceLevelDebugging.html#c-c-front-end-specific-`

   In particular, you will want to read Subsection "C/C++ source file information" of the Section called "C/C++ front-end specific debug information."

   To add comments to an LLVM instruction, you will want to override the AssemblyAnnotationWriter class:

   `http://llvm.org/doxygen/AssemblyAnnotationWriter_8h_source.html`

   Make sure your pass works using the command: `clang -Xclang -load -Xclang assignment1.so`. The skeleton project has code to set this up and you can read more about it here:

   `http://homes.cs.washington.edu/˜asampson/blog/clangpass.html`

4. Use the turnin program to submit a single `tar.gz` or `tar.bz2` file that contains your source code in a directory with a `Makefile` that will build it. For this project please name the directory `assignment1`. Make sure that your code builds correctly on the provided virtual machine and does not depend on any files outside the code you submit.

   The build system is not the subject of this class so feel free to help each other with it or post useful variants of the `Makefile`.

2 Due Date

This assignment is due on Wednesday January 22nd before class.