# Project 4

## Small C compiler for LLVM IR

The goal of our project this semester is to develop a prototype C compiler. This is done by compiling C programs into embedded platforms such as 68K, MIPS, ARM, or pseudo assemblies. In this class we will use LLVM IR (https://llvm.org/docs/LangRef.html) as the target codes. **The project is divided into several parts including language definition, lexical analyzer, C-grammar, symbol table handlings, parser, and code generation.** In the final assignment, you will need to choose proper language features which you want to develop in this course, and complete the whole compiler (including the code generator).

In your hand-in report, you need to have the following:

- **To define the subset of the language which you want to choose from C.**
- Give a set of testing programs and the generated LLVM-IR files, which can illustrate the features of your testing programs. (at least 3 test programs)
- Use the "**ANTLR**" to help you develop your compiler.
- You can use **C**, **C++**, or **Java** to write your compiler. (Java is recommended)
- Your C subset should at least contain the following features: (基本要求)
  - Integer data types: `int`
  - Statements for arithmetic computation. (e.g., `a=b+2*(100-1);`)
  - Comparison expression. (e.g., `a > b`)，comparison operation: >、>=、<、<=、==、!=
  - if-then / if-then-else program constructs.
  - `printf()` function with one/two parameters. (support types: `%d`)

    For example:
    - `printf("Number is %d\n", var);`
    - `printf("Hello\n");`

可擴充的其他功能:

- Nested if construct
- For-loop construct/ while-loop construct
- Switch-case construct
- Loop construct + if construct
- Floating point data type
- Structure data type
- Logical operation
- Function call
- …

完成基本要求，可獲得基本分數 80 分；若有進一步實作擴充的功能，則視功能的實作難易度，酌量加分。若有實作基本要求之外的部分，應該在 readme file 中詳述，以利作業批改。

Please turn in the following files to eCourse2:

- A file describes your language which is a subset of C language. (MS-WORD/PDF file)
- The source codes:
    - Your compiler
      (a) ANTLR grammar file, `myCompiler.g` or `myCompiler.g4`.
      (b) A program to call your parser, `myCompiler_test.java`.
    - Testing programs (.c) and the corresponding LLVM IR codes (.ll) generated by your compiler. (at least 3 programs)
- A readme file (pure text file) describes the features of your compiler and explains how to compile and execute your compiler.
- Makefile
- Any other required materials

請將上述的檔案打包壓縮存成 tar.xz 之格式，檔名為 prj4_<學號>.tar.xz 檔 (例如: **prj4_401234567.tar.xz**，上傳到 eCourse2。

**Due Date: June 10 (Tuesday), 24:00, 2025 (無法補交)**