1 Code Generation Conventions and Tips

These are a collection of non-mandatory tips which will most likely make it easier to write your code generator.

- All expressions should store their result in $3. This will make it much easier to combine small expressions into larger ones.
- When evaluating expressions, store any intermediate results on the stack rather than in registers. This is easier to reason about and makes it much harder to make mistakes.
- Define some helper functions that return segments of code that you will need to generate often. In particular, you may want functions which generate MIPS code for push and pop.
- Store the value 4 in $4 and 1 in $11, or some other suitable registers. You’ll use these constants on a regular basis and it helps to have them consistently available.
- Output comments as part of your assembly code. It is extremely difficult to debug generated assembly, and even comments such as “addition starts/ends” or similar will help with debugging.

2 Pre- and Post-Increment Code Generation

Recall that C and C++ have the pre- and post-increment operators ++i and i++. Suppose we added the following rules to the WLP4 grammar:

\[
\text{factor} \rightarrow \text{PLUS PLUS lvalue} \\
\text{factor} \rightarrow \text{lvalue PLUS PLUS}
\]

We will assume that scanning, parsing, and semantic analysis all work out, and that these operators can only be used on INT types. Write pseudocode to generate the correct MIPS output for each of these grammar rules.

3 Switch Statement Code Generation

Recall that C and C++ also have switch statements. Suppose we wished to add a similar statement with a slightly different syntax to WLP4:
switch(expr) {
    case(expr) {
        statements
    }
    case(expr) {
        statements
    }
    ...
    default {
        statements
    }
}

Here, case statements don’t fall through, and the default case is mandatory. Furthermore, each case can contain an arbitrary expression rather than a constant. Write pseudocode to generate MIPS assembly code for the following production rules, once again assuming that all of scanning, parsing and semantic analysis are already handled.

\[
\begin{align*}
\text{statement} & \rightarrow \text{SWITCH} \ \text{LPAREN} \ expr \ \text{RPAREN} \ \text{LBRACE} \ cases \ \text{default} \ \text{RBRACE} \\
\text{cases} & \rightarrow \ cases \ \text{case} \\
\text{cases} & \rightarrow \ \epsilon \\
\text{case} & \rightarrow \ \text{CASE} \ \text{LPAREN} \ expr \ \text{RPAREN} \ \text{LBRACE} \ statements \ \text{RBRACE} \\
\text{default} & \rightarrow \ \text{DEFAULT} \ \text{LBRACE} \ statements \ \text{RBRACE}
\end{align*}
\]