



## Assignment 2

### Familiarisation with Compiler Framework

This assignment series is intended to deepen your understanding of the compiler construction framework to be used throughout the course.

#### Assignment 2.1: Compiler Construction Framework: code transformation

Implement a compiler traversal that implements an optimisation called *strength reduction*. Some processor architectures implement addition more efficiently than multiplication, thus giving rise to the following code transformations:

```
2*k -> k+k  
k*2 -> k+k  
3*k -> k+k+k  
k*3 -> k+k+k
```

for any variable  $k$ . As a bonus extend your traversal such that the maximum value of the constant factor to apply strength reduction becomes a new to be introduced command line parameter.

#### Assignment 2.2: Compiler Construction Framework: collecting information

Implement a compiler traversal that counts the number of occurrences of each of the five arithmetic operators. The `info` structure shall be used to collect the information. The use of global variables is not permitted.

Unlike in the toy traversal provided, the information shall be stored in the root node of the syntax tree at the end of the traversal. For this purpose add a dedicated root node (named *module*) to your syntax tree. This root node shall contain a sequence of statements (as already given) plus the corresponding attributes to store the inferred information.

Extend the pretty print traversal such that it produces appropriate output for the new root node, including the inferred information.

#### Note:

Add the compiler traversals of the assignments as additional compiler phases to the nucleus compiler coming with the compiler framework.

**Note:**

To help us with grading you must submit the first assignment in the following format:

- All CiviC programs must be in one directory in the root of the framework: `framework/civic_progs`
- The submission must be a clean tar-file that unpacks as `framework/...`
- Assuming the framework is in directory `<path>/framework`, you can create this tar-file with the following commands:
  - `<path>/framework$ make clean`
  - `<path>/framework$ cd ..`
  - `<path>/ $ tar cvzf framework.tgz framework`

This tar-file should now contain your CiviC programs in `civic_progs/` and the traversal assignments. You may add extras such as test scripts in the sources.

**Note:**

Assignment 2 must be submitted individually.

**Assignment due date: Monday, November 20, 2023**