

# Model Checking Homework 12

Deadline: June 30, 2022, 4:00 pm  
Send solution to [modelchecking@iaik.tugraz.at](mailto:modelchecking@iaik.tugraz.at)

We discussed different strategies for bounded model checking of software. The following C-program will be used to explore these encodings.

```
int x;
if (x > 0 && x < 10) {
  while (x != 0) {
    if (x%2 == 0 && x > 3) {
      x = x-3;
    } else {
      x = x-1;
    }
  }
}
```

**Task 12a. [2 points]** Draw the control-flow graph of the program depicted above.

**Task 12b [3 points]** Use the monolithic encoding and unroll the program for 10 instructions (assignments and branching). You can use the optimized version and only encode the reachable transitions at each time step, this is determined only by the structure of the CFG and not by the concrete values. Write the unrolled program in SSA form.

**Task 12c [3 points]** Use loop-unrolling and unroll the program for 2 iterations. Write the unrolled program in SSA form.

**Task 12d [2 points]** We want to add assertion to our program. The assertion `assert(x>=0)`; is added at two different locations: after the assignment `x=x-1` and after the while loop. How many verification conditions need to be added and how do they look. Use your unrolled program from Task 10c as basis.