The goal of this project is to implement the abstract interpretation described in class. Arithmetic expressions will be evaluated to one of the abstract values Pos, Neg, Zero, AnyInt, and AnyFloat. Boolean expressions will be completely ignored; we will not look inside them and will not try to evaluate/check them or any of their subexpressions (i.e., in this project we will not use the techniques from slides 24-31 in the lecture notes).

Modify your code from Project 3 to implement this abstracted semantics. As part of this abstract interpretation, report checking errors if (1) the second operand of division is Zero, AnyInt, or AnyFloat; (2) an uninitialized variable is being used. That is, the implementation should follow the description in slides 1-23 and should use the “more conservative” version described there. Examples were provided in the slides to illustrate the desired behavior.

Set up
Copy your implementation from Project 3 into .../proj/p4 and do make clean

Restriction
As with Project 3, the following restriction will be imposed on all input programs: no two variables have the same name. This also applies to variables that are in different blocks. You do not have to check that this restriction is satisfied by the input program: just assume that it is and implement your interpreter under this assumption.

Details
The abstract semantics was described in class (slides 1-23). A few additional details:

1) readint and readfloat expressions evaluate to AnyInt and AnyFloat, respectively. You do not need to look in UNIX stdin since we are creating a static analysis that represents all possible executions for all possible program inputs, not for any particular program input. Thus, your code will never exit with error code EXIT_FAILED_STDIN_READ.

2) A print statement should be implemented using System.out.println(...). It should print the abstract value of the expression (this is useful for testing and debugging).

3) Static error “division by zero” should exit with error code EXIT_DIV_BY_ZERO_ERROR. Static error “use of uninitialized variable” should exit with error EXIT_UNINITIALIZED_VAR_ERROR.

Testing
Write many test cases and test your checker with them. Submit at least 5 test cases with your submission. The test cases you submit will not affect your score for the project. Put them in the same location as the provided file t1 and name them t2, …
Submission
After completing your project, do

cd p4
make clean
cd ..
tar -cvzf p4.tar.gz p4

Then submit p4.tar.gz in Carmen.

General rules (copied from the course syllabus)

1) Your submissions must be submitted electronically via Carmen by midnight on the due
date. The projects must compile and run on stdlinux. Some students prefer to implement the
projects on a different machine, and then port them to stdlinux. If you decide to use a different
machine, it is entirely your responsibility to make the code compile and run correctly on
stdlinux before the deadline. In the past many students have tried to port to stdlinux too close
to the deadline, leading to last-minute problems and missed deadlines.

2) Projects should be done independently. General high-level discussion of projects with other
students in the class is allowed, but you must do all design, programming, testing, and
debugging independently. Projects that show excessive similarities will be taken as evidence of
cheating and dealt with accordingly. Code plagiarism tools may be used to detect cheating. See
more details in the Syllabus under “Academic integrity”.

3) The projects are due by 11:59 pm on the due day. No exceptions will be made to this
deadline: if you submit at 12:00 am, your submission will be late. Please plan your time
carefully and do not submit in the last minute. You can submit up to 24 hours after the
deadline; if you do so, your project score will be reduced by 10%. If you submit more than 24
hours after the deadline, the submission will not be accepted, and you will receive zero points
for this project.

4) Accommodations for sickness and other special circumstances will be made based on
university guidelines. Please contact me ahead of time to arrange for such accommodations.