A First Program

- Parallel block
  - block.c
  - Runs as many times as there are threads

- How many parallel executors? Which am I?
  - Common parallel programming idiom
  - Used to divide work

- Number of times block runs is determined by the environment
  - Not the program
(Aside) Compiler Optimization

- gcc/g++ has optimization flags
  - Must set to get good performance
- Optimization level –O*
  - -O0 (default) = Reduce compilation time and make debugging produce the expected results.
  - -O1 = simple optimizations that don’t take a lot of compile time
  - -O2 = rewrite loops, follow jump pointers, inline small functions, no time/space tradeoffs
  - -O3 = vectorize, inline functions, branch prediction

- When debugging, you want to use -O0 so the code makes sense
- For performance, -O3 to vectorize code to processors
Blocks (braces in C/C++)

- A block is a group of statements, separated by semicolons, enclosed in braces
- Big, important concept:
  - Scoping context for variables (see noscope.c)
  - Single entry/exit point
  - Statements in a block run sequentially
- The scoping is super-valuable in OpenMP
  - Variables from outside the block are shared among threads
  - Variables inside block are private to each block and, thus, thread
What’s an OpenMP Program

● Parallelization directive
   - `#pragma omp parallel`
   - that executes a block of C/C++/Fortan code in parallel
   - Not a language: all code written in C/C++

● Runtime libraries and routines
   - To access information about parallelization and state
   - Number of threads, thread identifier, etc.
   - Compiler directives turned into library calls for parallel execution

● Environmental variables
   - To configure parallelism

● See `block.c`
The Toolchain

- No toolchain
  - Add `-fopenmp` to gcc command line. This activates linker to libopenmp
  - `#include "omp.h"` to import symbols into your source code

- **Warning to MAC users**
  - clang has open mp support (which apparently just works)
  - May need to install Intel open-mp runtime
  - Or can install g++ through ports/brew