How to Run C/C++ on HPC

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Some Basics

C is compiled. (R is interpreted.) To run C code:

- Compilation:
  a compiler + source code $\Rightarrow$ object code file (binary version of the source code, not directly executable)
- Linking:
  a linker + object code files (object code file of your source code and pre-compiled library files) $\Rightarrow$ an executable file

Some Basics: An Example

ex1.cpp

```
#include <cstdio>
int main (void) {
    printf("Hello, World!\n");
    return 0;
}
```

To compile:

```
$ g++ -c ex1.cpp
```

To link:

```
$ g++ ex1.o -o ex1
```

Or to compile and link:

```
$ g++ ex1.cpp -o ex1
```

To execute:

```
$ ./ex1
Hello, World!
```

How to Use External Libraries

The GNU Scientific Library (GSL) is a numerical library for C and C++ programmers. It offers a very comprehensive collection of rigorously developed and tested functions for applied scientific computing under a widely-used and well-understood Open Source license.

How to Use External Libraries

To compile, link and execute:

```
$ gcc -c [source code] -I[directory1]
$ gcc [object code] -L[directory2] -l[library1] -l[
    libary2] -o [executable file]
$ ./[executable file]
```

- `-I[directory1]`: add directory1 to the list of directories to be searched for header files.
- `-l[library1] -l[libary2]`: Search the library named `library1` and `libary2` when linking.
- `-L[directory2]`: add directory2 to the list of directories to be searched for -l.

How to Run C/C++ on HPC

In a job submission file, after specifying the sources you requested, write

```
$ module load gcc
$ module load gsl
$ gcc -c -I$HPC_GSL_INC HW1_C.c
$ gcc HW1_C.o -L$HPC_GSL_LIB -lgsl -lgslcblas -lrt -lm
    -o aaa
$ ./aaa
```

How to find the directories we need?

```
$ module spider gsl
```