

# Software libraries

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# 1. Don't reinvent the wheel: use a library

Many things you want to program have been thought of before:  
see if there is a library for it.

Library: 'program without main':  
you supply the main, functionality comes from library

## 2. External libraries: usage

Suppose the 'fancy' library does what you need.

1. Include a header file
2. Then use the functions defined there.

```
#include "fancylib.h"
```

```
int main() {  
    x = fancyfunction(y);  
}
```

### 3. External libraries: compile

1. Compiler needs to know where the header is:

```
icpc -c yourprogram.cxx -I/usr/include/fancylib
```

2. You may need to link a library file:

```
icpc -o yourprogram yourprogram.o \  
-L/usr/lib/fancylib -lfancy
```

(not for 'header only' libraries)

## 4. Where to find libraries

Search . . . There is a lot of stuff on github.

# Commandline arguments

## 5. Traditional commandline parsing

Code:

```
cout << "Program name: " << argv[0]
    << "\n";
for (int iarg=1; iarg<argc; iarg++)
    cout << "arg " << iarg
        << " of " << argc << ": "
        << argv[iarg] << " => "
        << atoi( argv[iarg] ) << "\n";
```

Output

[args] argcv:

```
./argcv 5 12
Program name: ./argcv
arg 1: 5 => 5
arg 2: 12 => 12
./argcv abc 3.14 foo
Program name: ./argcv
arg 1: abc => 0
arg 2: 3.14 => 3
arg 3: foo => 0
```

Can you imagine coding

```
myprog --debug -f "input.txt" -n 10,20,40
```

?

## 6. Example: cxxopts

`https://github.com/jarro2783/cxxopts`

Find the 2.2.1 release.

Use `wget` or `curl` to download straight to the class machine.

Unpack it.



## 7. Cmake based installation

The cxxopts-2.2.1 directory has a file CMakeLists.txt

```
mkdir build
cd build
cmake -D CMAKE_INSTALL_PREFIX:PATH=${HOME}/mylibs \
    ..
make
make install
```

(This is an 'in-source' build. I don't like it: prefer to have the build directory elsewhere to keep the source untouched.)

## 8. Let's use this library

```
#include "cxxopts.hpp"
int main() {
    cxxopts::Options
        options("programname", "Program description");
}
```

compile

```
icpc -o program source.cpp \
    -I/path/to//cxxopts/installdir/include
```

Can you compile and run this?

## 9. Commandline options

```
options.add_options()  
    ("h,help","usage information")  
    ("n,nsiz", "size of the thing",  
     cxxopts::value<int>()->default_value("4096"))  
    // et cetera  
;  
auto result = options.parse(argc, argv);  
if (result.count("help")>0) {  
    std::cout << options.help() << std::endl;  
    return 0;  
}  
int array_size = result["nsiz"].as<int>();
```

Write code to test this.

Can you add more types of options?