TEST DRIVEN DEVELOPMENT MAKEFILES

Problem Solving with Computers-I

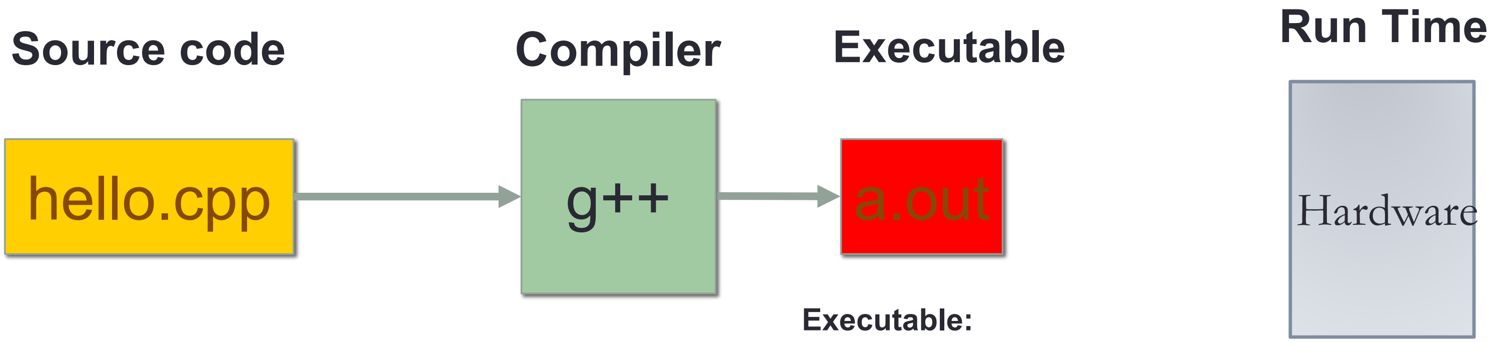
```
#include <iostream>
using namespace std;

int main(){
    cout<<"Hola Facebook\n";
    return 0;
}
```

Announcements

- Midterm next week Oct 24:
  For more info see: https://ucsb-cs16.github.io/f19/exam/e01/
- Lectures 1-8
- Homeworks 1-4
- Labs 0-2

- You may bring 1 sheet of notes (double sided) printed or handwritten

The compilation process



Executable:
Program in machine code
+Data in binary

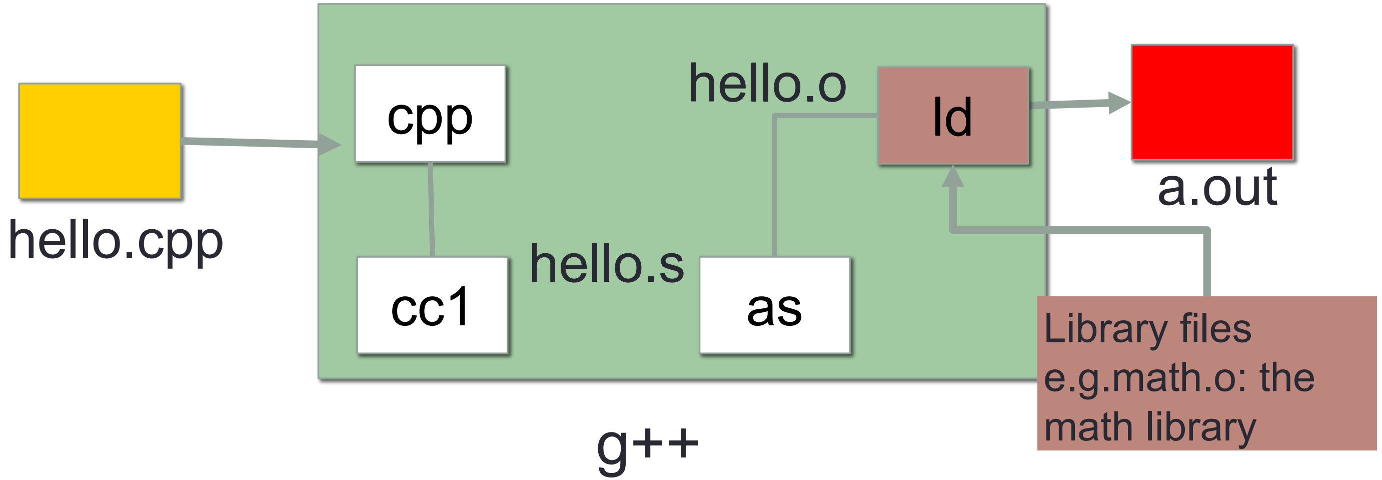
Source code:
Text file stored on computers hard disk or some secondary storage

```
10001100011000100000000000000000
10001100111100100000000000000100
10101100111100100000000000000000
10101100011000100000000000000100
```

↑ machine code

g++ is composed of a number of smaller programs

- Code written by others (libraries) can be included
- ld (linkage editor) merges one or more object files with the relevant libraries to produce a single executable



Steps in gcc

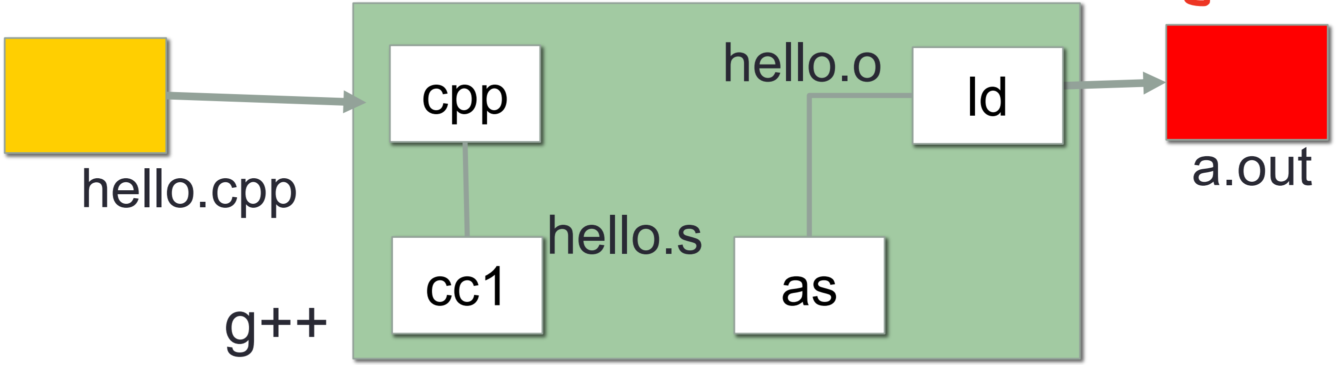
- Ask compiler to show temporary files:

```
$ g++ –S hello.cpp
```
generates hello.s that contains the program in Assembly Language

```
$ g++ –c hello.o
```
cpp generates object file

```
$ g++ –o hello hello.cpp
```
generates named executable

```
$ g++ functions.o main.o –o myhello
```
links multiple object files to a single executable.



Make and makefiles

- The unix make program automates the compilation process as specified in a Makefile
- Specifies how the different pieces of a program in different files fit together to make a complete program
- In the makefile you provide a recipe for compilation
- When you run make it will use that recipe to compile the program

```
$ make
g++ testShapes.o shapes.o tdd.o –o testShapes
```

Specifying a recipe in the makefile

- **Comments** start with a #
- **Definitions** typically are a variable in all caps followed by an equals sign and a string, such as:

```
CXX=g++
CXXFLAGS=-Wall

BINARIES=proj1
```

```
# testShapes is the target - it is what we want to produce
# To produce the executable testShapes we need all the .o files
# Everything to the right of ":" is a dependency for testShapes

testShapes: testShapes.o shapes.o tdd.o
     #The recipe for producing the target (testshapes) is below
     g++ testShapes.o shapes.o tdd.o -o testShapes
```

Demo

- Basics of code compilation in C++ (review)
- Makefiles (used to automate compilation of medium to large projects) consisting of many files
- We will start by using a makefile to compile just a single program
- Extend to the case where your program is split between multiple files
- Understand what each of the following are and how they are used in program compilation
  - Header file (.h)
  - Source file (.cpp)
  - Object file (.o)
  - Executable
  - Makefile
  - Compile-time errors
  - Link-time errors

Writing code that works - its not magic :)

Write a function that RETURNS a string representing

an isosceles triangle with a given width

```
s = drawTriangle(5);
cout<<s;

  *
 ***
*****
```

Next time

- Files