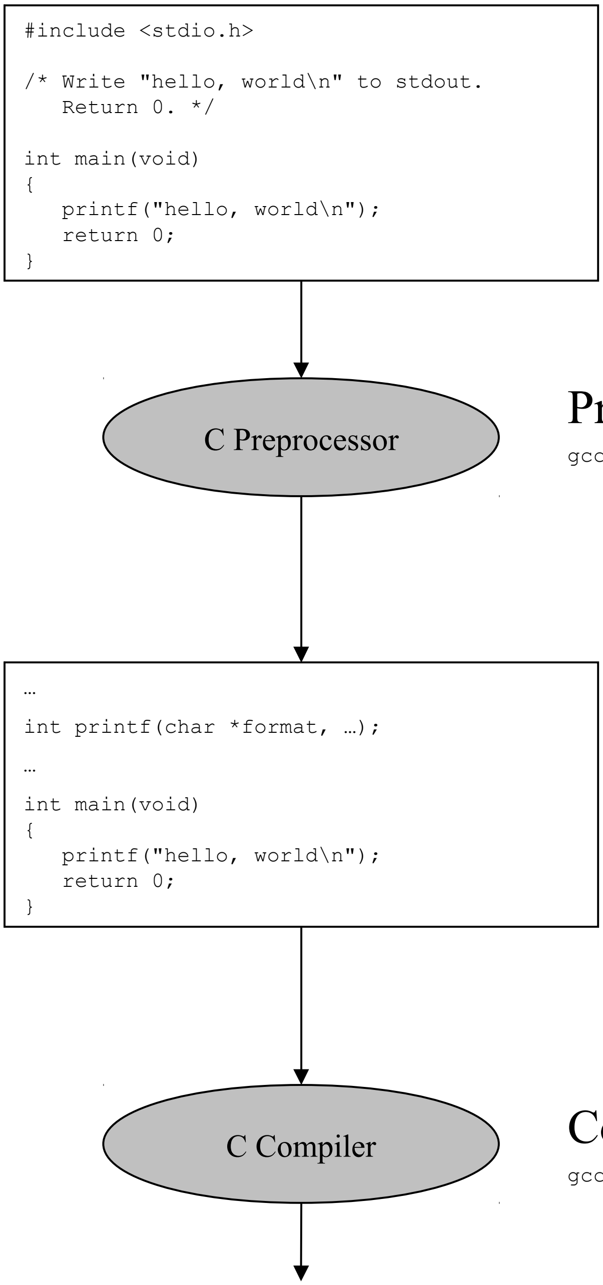
Princeton University
COS 217: Introduction to Programming Systems
Building C Programs



```
#include <stdio.h>

/* Write "hello, world\n" to stdout.
   Return 0. */

int main(void)
{
   printf("hello, world\n");
   return 0;
}
```

hello.c
Source code
C language
Contains preprocessor directives

Preprocess

```
gcc217 -E hello.c > hello.i
```

```
…

int printf(char *format, …);

…

int main(void)
{
   printf("hello, world\n");
   return 0;
}
```

hello.i
Source code
C language
Contains *declarations* of `printf()` and many other functions
Missing *definition* of `printf()`

Compile

```
gcc217 -S hello.i
```

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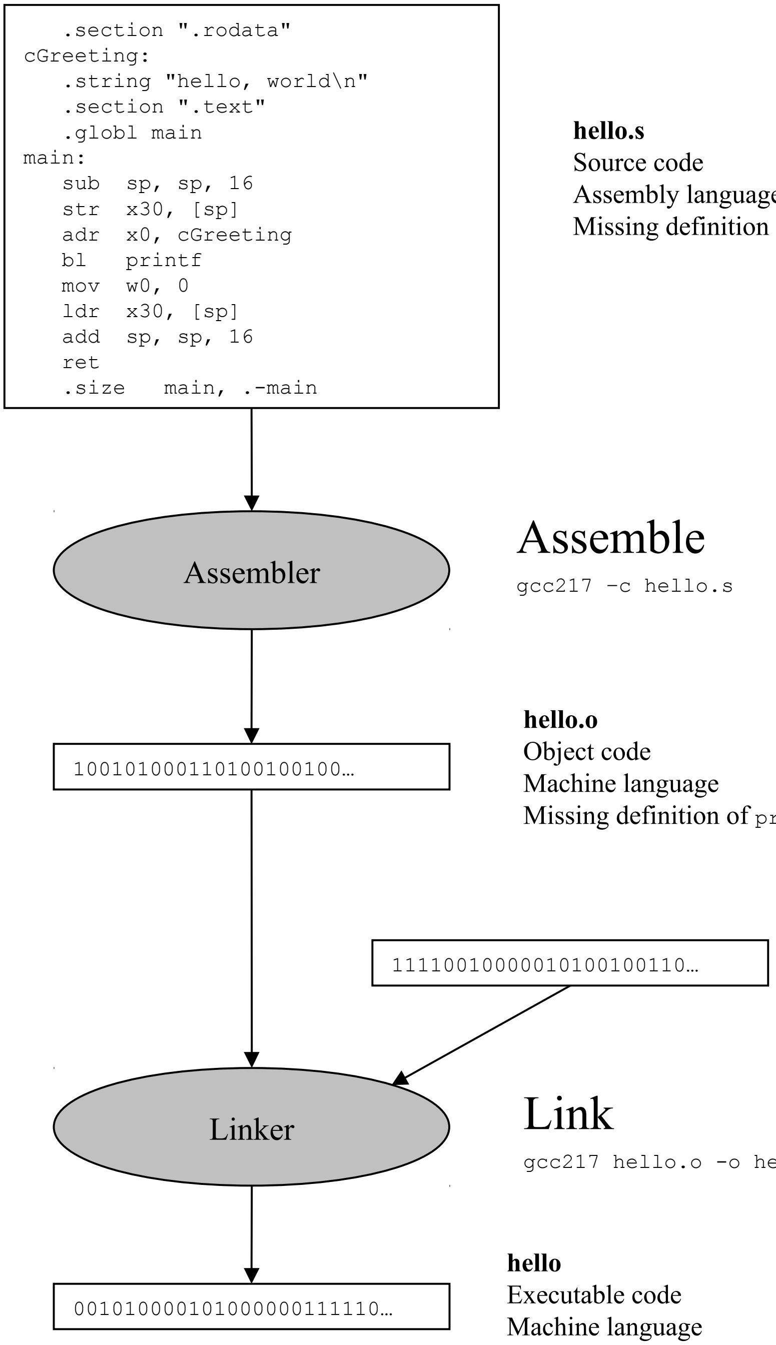

```
   .section ".rodata"
cGreeting:
   .string "hello, world\n"
   .section ".text"
   .globl main
main:
   sub  sp, sp, 16
   str  x30, [sp]
   adr  x0, cGreeting
   bl   printf
   mov  w0, 0
   ldr  x30, [sp]
   add  sp, sp, 16
   ret
   .size   main, .-main
```

hello.s
Source code
Assembly language
Missing definition of `printf()`

Assemble

`gcc217 -c hello.s`

hello.o
Object code
Machine language
Missing definition of `printf()`

libc.a
Library containing
machine language definitions
of `printf()` and many
other functions

Link

`gcc217 hello.o -o hello`

hello
Executable code
Machine language
Contains definition of `printf()`

Shortcut:

`gcc217 hello.c -o hello`

`gcc217`

is an abbreviation for

```
gcc -Wall -Wextra -Wno-unused-parameter
   -ansi -pedantic
```