

Princeton University

COS 217: Introduction to Programming Systems

Building C Programs

```
#include <stdio.h>
/* Write "hello, world\n" to the standard
   output stream. Return 0. */
int main(void)
{
    printf("hello, world\n");
    return 0;
}
```

hello.c
Source code
C language
Contains preprocessor
directives

C Preprocessor

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 declaration of printf() function
Missing definition of printf() function

C Compiler

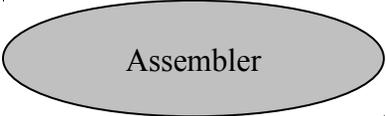
Compile

gcc217 -S hello.i

Continued on next page

```
.section .rodata
cGreeting:
.asciz "hello, world\n"
.section .text
.globl main
.type main,@function
main:
pushl %ebp
movl %esp, %ebp
pushl $cGreeting
call printf
addl $4, %esp
movl $0, %eax
movl %ebp, %esp
popl %ebp
ret
```

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



Assemble
gcc217 -c hello.s

```
100101000110100100100...
```

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

```
11110010000010100100110...
```

libc.a
Library containing
machine language definition
of printf() function (and many
others)



Link
gcc217 hello.o -o hello

```
001010000101000000111110...
```

hello
Executable code
Machine language

```
Shortcut:
gcc217 hello.c -o hello
```

```
gcc217
is an abbreviation for
gcc -g -Wall -Wextra -Wno-unused-parameter -ansi
-pedantic -m32 -march=i386
```