

03_01_A Tour of Computer Systems

first C program

```
#include <stdio.h>

int main(int argc, char **argv)
{
    printf("Welcome to CIS 2107.\n");
    return 0;
}
```

source file representation in computer

output from hexdump :

```
00000000 23 69 6e 63 6c 75 64 65 20 3c 73 74 64 69 6f 2e
00000010 68 3e 0a 0a 69 6e 74 20 6d 61 69 6e 28 69 6e 74
00000020 20 61 72 67 63 2c 20 63 68 61 72 20 2a 2a 61 72
00000030 67 76 29 0a 7b 0a 20 20 70 72 69 6e 74 66 28 22
00000040 57 65 6c 63 6f 6d 65 20 74 6f 20 43 49 53 20 32
00000050 31 30 37 2e 5c 6e 22 29 3b 0a 20 20 72 65 74 75
00000060 72 6e 20 30 3b 0a 7d 0a
00000068
```

source file representation in computer

output from hexdump -C

```
00000000  23 69 6e 63 6c 75 64 65 20 3c 73 74 64 69 6f 2e |#include <stdio.|
00000010  68 3e 0a 0a 69 6e 74 20 6d 61 69 6e 28 69 6e 74 |h>..int main(int|
00000020  20 61 72 67 63 2c 20 63 68 61 72 20 2a 2a 61 72 | argc, char **ar|
00000030  67 76 29 0a 7b 0a 20 20 70 72 69 6e 74 66 28 22 |gv){. printf("|
00000040  57 65 6c 63 6f 6d 65 20 74 6f 20 43 49 53 20 32 |Welcome to CIS 2|
00000050  31 30 37 2e 5c 6e 22 29 3b 0a 20 20 72 65 74 75 |107.\n");. retu|
00000060  72 6e 20 30 3b 0a 7d 0a                                |rn 0;}.|
00000068
```

compiling and running

```
$ gcc welcome.c  
$ ./a.out  
Welcome to CIS 2107.
```

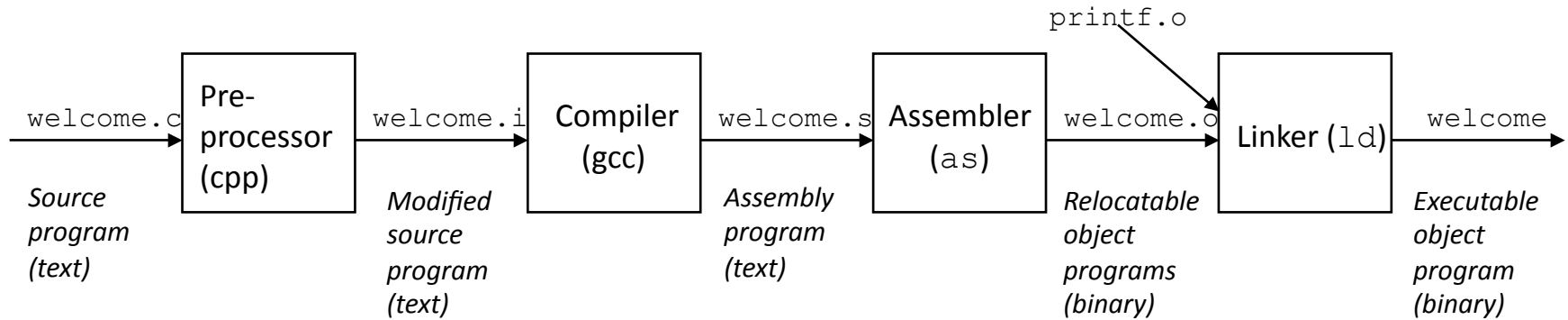
compiling and running

```
$ gcc welcome.c  
$ ./a.out  
Welcome to CIS 2107.
```

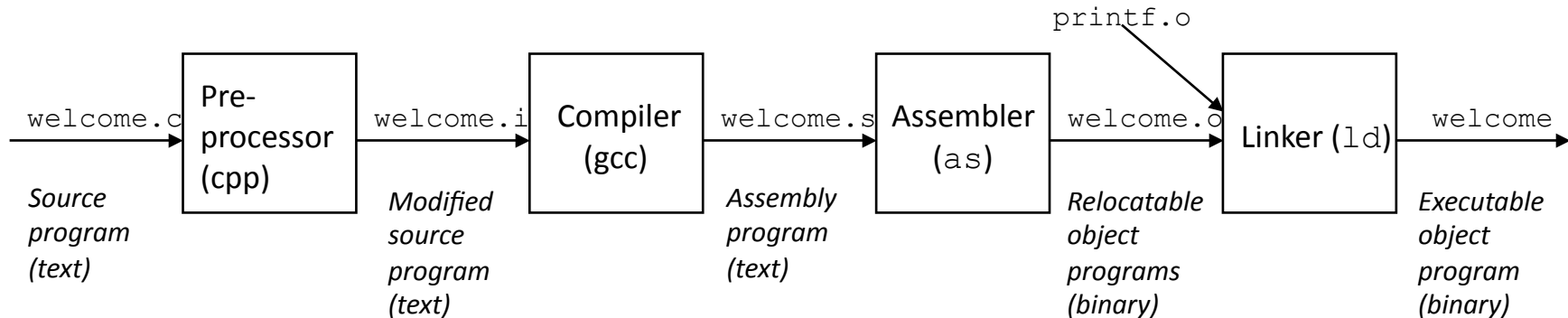
but I don't like the name a.out. instead:

```
$ gcc -o welcome welcome.c  
$ ./welcome  
Welcome to CIS 2107.
```

the same in multiple steps



the same in multiple steps



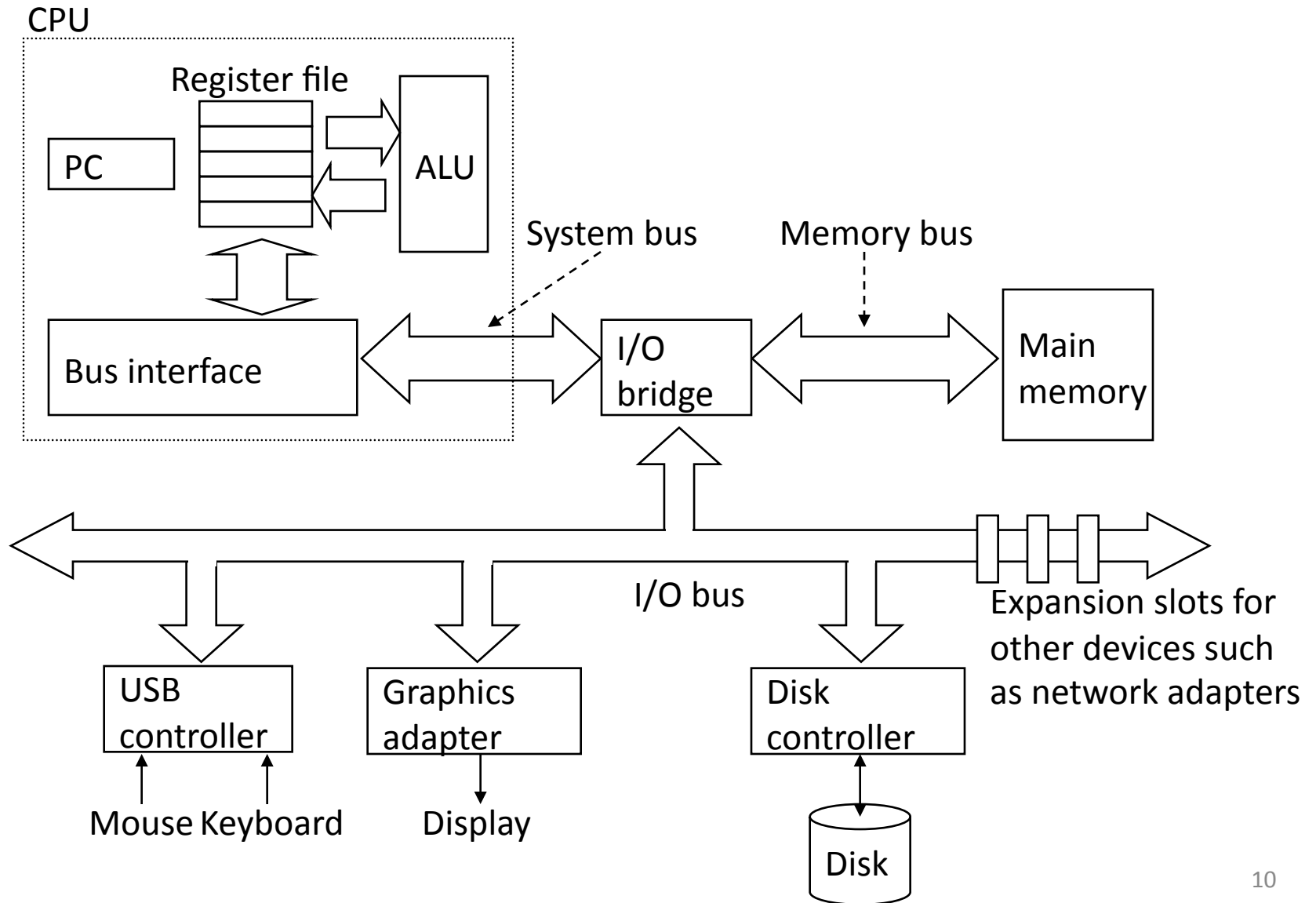
- **Preprocessing:** `gcc -E -o welcome.i welcome.c`
- **Compiling:** `gcc -S -o welcome.s welcome.i`
- **Assembling:** `gcc -c -o welcome.o welcome.s`
- **Linking:** `gcc -o welcome welcome.o`

[Click here for GSS Commands Options Summary](#)

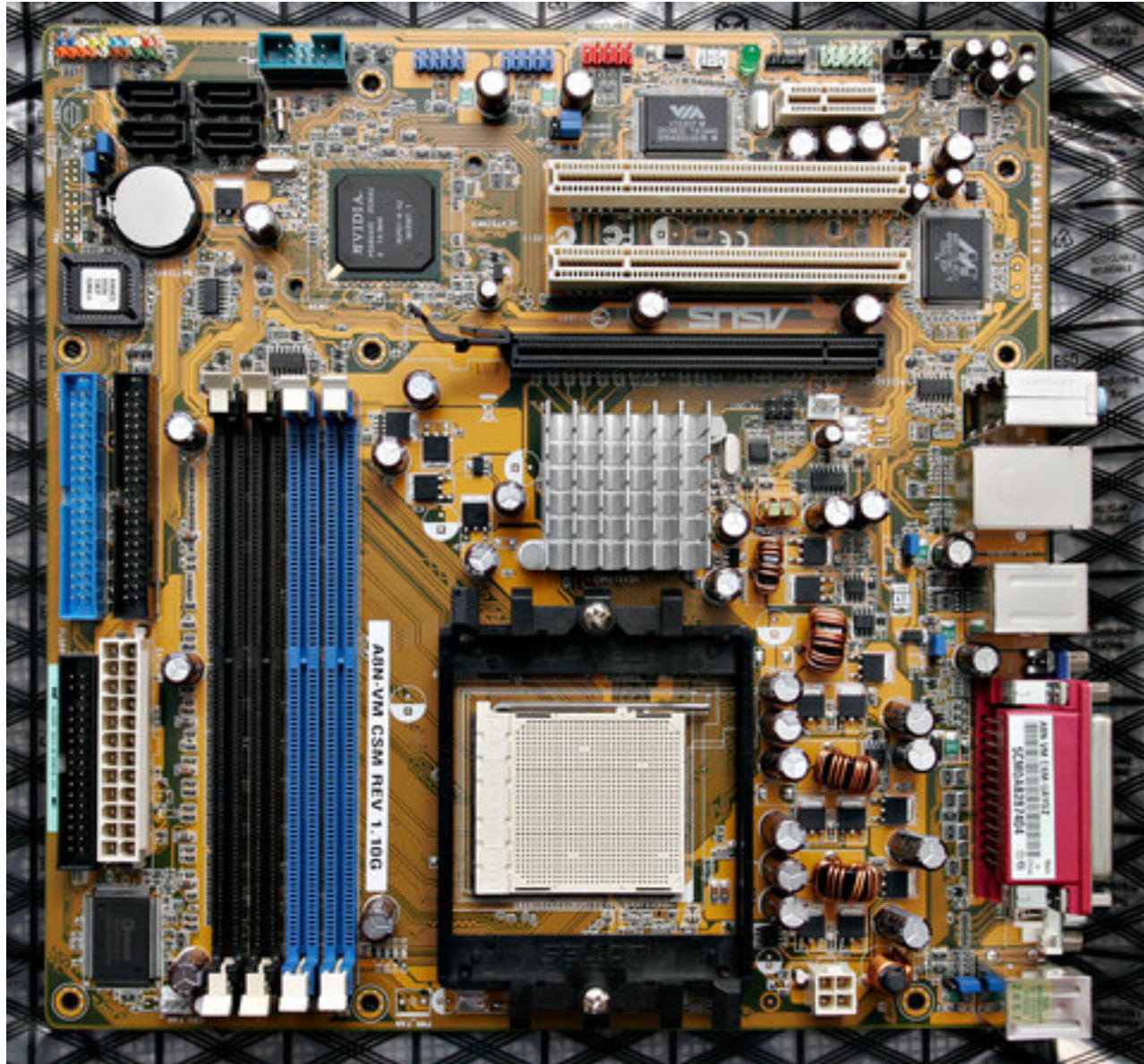
what's in each file?

- welcome.c
 - welcome.i
 - welcome.s
 - welcome.o
 - welcome
-
- Can examine binaries with:
 - `objdump -d` (-d to disassemble)

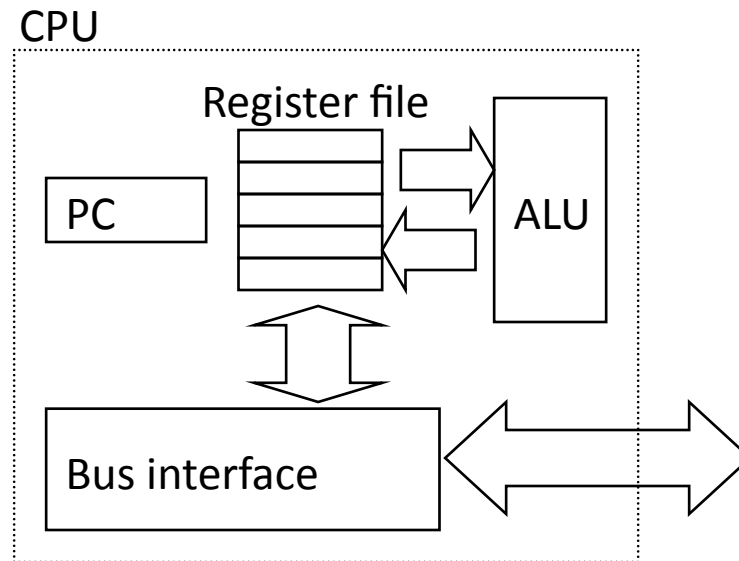
hardware



motherboard

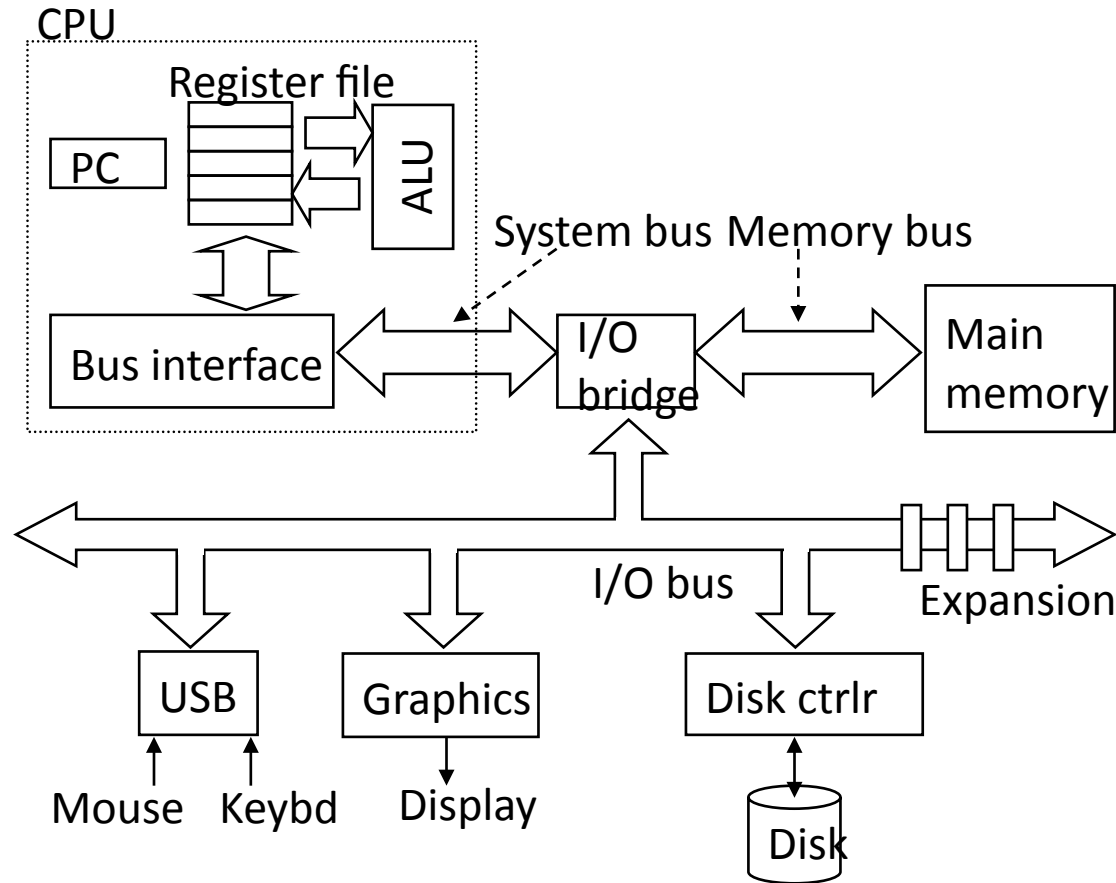


hardware – the CPU



e.g., Pentium, Sparc, Athlon, PowerPC, ARM, Cell

welcome program in hardware



What happens?

- editing?
- running binary?