Today's plan

- Announcement:
  - Homework 3 is extended to due on Feb 24 at 11pm.
  - Homework 4 is alive on Gradescope.
  - Find your mid-term project partner and register your team on Piazza.
- Review
- Ex 5-2

Ex 5-1 - `struct`

- You have practiced how to write `struct`s in C, pass it into a function using pointers/arrays.
- What is the output of the following program?

```
1   #include <stdio.h>
2   #include <stdlib.h>
3   #include <string.h>
4
5   typedef struct Foo {
6       char* data;
7   } Foo;
8
9   int main() {
10      Foo temp = { malloc(10) };
11      strcpy(temp.data, "0");
12      Foo test = temp;
13      strcpy(test.data, "220");
14      printf("%s, %s\n", temp.data, test.data);
15      free(temp.data);
16
17      return 0;
18  }
```

A 0, 0;

B 0, 220

C 220, 0

D 220, 220

E Unpredictable.

Ex 5-1 - struct

- What is the output of the following program?

```
1   #include <stdio.h>
2   #include <stdlib.h>
3   #include <string.h>
4
5   typedef struct Foo {
6       char data[10];
7   } Foo;
8
9   int main() {
10      Foo temp;
11      strcpy(temp.data, "0");
12      Foo test = temp;
13      strcpy(test.data, "220");
14      printf("%s, %s\n", temp.data, test.data);
15
16      return 0;
17  }
```

A 0, 0

B 0, 220

C 220, 0

D 220, 220

E Unpredictable.

Ex 5-1 - `struct`

- What is the output of the following program?

```
1   #include <stdio.h>
2
3   typedef struct Foo {
4       char data[10];
5       struct Foo *ptr;
6   } Foo;
7
8   int main() {
9       Foo foo[] = {
10          { "CS", foo + 1 },
11          { "220", foo + 2 },
12          { "fun!", foo}
13      };
14
15      for (int i = 0; i < 3; ++i)
16          printf("%s ", foo[i].ptr->data);
17
18      return 0;
19  }
```

A CS 220 fun!

B 220 fun! CS

C fun CS 220

D 220 CS fun!

E Unpredictable.

Binary file I/O

- Open with `"b"`, and use `fread` and `fwrite` to read and write in bytes.
- What does this program do? Please type your answers in the chat.

```c
#include <stdio.h>
#include <stdlib.h>
typedef struct Data {
    char* data;
    size_t len;
} Data;

Data readAll(const char* filename) {
    FILE* fp = fopen(filename, "rb");
    Data result;
    rewind(fp);
    fseek(fp, 0L, SEEK_END);
    result.len = ftell(fp);
    result.data = malloc(result.len);
    rewind(fp);
    fread(result.data, result.len, 1, fp);
    fclose(fp);
    return result;
}
void writeAll(const char* filename, Data d) {
    FILE* fp = fopen(filename, "wb");
    fwrite(d.data, d.len, 1, fp);
    fclose(fp);
}
```

```c
int main() {
    Data foo = readAll("foo.txt");
    Data bar = readAll("bar.txt");
    writeAll("foo.txt", bar);
    writeAll("bar.txt", foo);
    free(foo.data);
    free(bar.data);
    return 0;
}
```

Bitwise operations

- What is the result of `(15 >> 2) || 7`?
  - A 7
  - B 15
  - C 0
  - D 1
  - E 8

Bitwise operations

- What is the result of `(15 >> 2) | 7`?
  - A 7
  - B 15
  - C 0
  - D 1
  - E 8

Bitwise operations

- Which of the following is true?
  - A a XOR b in C is written as: "`a ^ b`".
  - B In C, "`2 & 3`" is a legal statement and is evaluated as "2".
  - C In C, "`2. & 3.`" is a legal statement and is evaluated as "2.".
  - D In C, "`'2' & '3'`" is a legal statement and is evaluated as "'2'".
  - E In C, "`2 ^ 3`" is a legal statement and is evaluated as "1".

Class exercises

Ex 5-2