

# 601.220 Intermediate Programming

Summer 2022, Meeting 3 (June 09th)

# Today's agenda

- Exercises 3-A, 3-B, 4 review
- “Day 5” material
  - Arrays and strings
  - Exercise 5
- “Day 6” material
  - File I/O, functions, command line arguments
  - Exercise 6

# Reminders

- HW0 should have been submitted yesterday at 11pm
- HW1 due ~~Wednesday~~, June 15th

Thursday

## Academic ethics for individual homeworks

- The individual homeworks (HW0, HW1, HW3, HW5, HW7) must be completed *individually*
- Do not look at anyone else's code
- Do not allow anyone (other than course staff) to look at your code
- Do not use code from the internet, students who have taken the course previously, etc.
- We will run a similarity comparison on submissions
- Violations will be reported to the student conduct office

## Exercise 3-A review

2023 - Summer - student - JHEDID.git

Personal repository setup:

```
git clone https://github.com/jhu-ip/2022-summer-student-JHEDID.git
cd 2022-summer-student-JHEDID
emacs README
git add README
git commit -m'added README to my personal repository'
git push
```

git commands that need to access the remote repository on Github (such as `git clone`, `git push`, `git pull`) will require your Github username and Personal Access Token to authenticate.

(Alternatively, you could create an ssh key and register it to your Github account.)

## Exercise 3-A review

Preparing a git log and zipfile (exercise and homework submission procedure):

```
git log > gitlog.txt
zip -9r ex03.zip README gitlog.txt
cd
mv 2022-summer-student-JHEDID/ex03.zip .
```

On your local computer (enter your ugrad account password when prompted):

```
scp USERNAME@ugradx.cs.jhu.edu:ex03.zip .
```

The zipfile `ex03.zip` will be on your local machine in whatever directory your command prompt was in (typically your local home directory).

At this point you could upload the zipfile to Gradescope.

## Exercise 3-B review

Create a clone of the course “public” repository:

```
git clone https://github.com/jhu-ip/cs220-summer23-public
```

Create a temporary directory and copy exercise starter files:

```
cd  
mkdir temp  
cd temp  
cp ~/cs220-summer22-students/exercises/ex02/* .
```

git pull

Compile and run the program:

```
gcc -std=c99 -Wall -Wextra -pedantic hello_world.c  
./a.out
```

## Exercise 3-B review

Make a copy of the program, modify it, compile and run the modified version:

```
cp hello_world.c hello_me.c
emacs hello_me.c
gcc -std=c99 -Wall -Wextra -pedantic hello_me.c
./a.out
```



## Exercise 4 review

Renaming your personal repository (to make it easier to access for future exercises, homework, etc.):

```
mv 2023-summer-student-JHEDID my220repo
```

Now you can refer to your personal repository as `~/my220repo`.

## Exercise 4 review

Starting an exercise (this general procedure will work for future exercises):

```
cd ~/my220repo
mkdir -p exercises/ex04
cd exercises/ex04
cp ~/cs220-summer22-public/exercises/ex04/* .
```

## Exercise 4 review

Writing a loop to read grade followed by number of credits:

```
char grade;
float num_credits;

while (scanf(" %c %f", &grade, &num_credits) == 2) {
    // tally grade and number of credits
    // ...
}
```

Note that

- The space before %c makes scanf skip whitespace characters before reading the grade character
  - Otherwise it could read a whitespace character instead of the letter grade
- If the user enters Control-D, that ends the input

## Exercise 4 review

Using a switch statement to match the grade:

```
switch (grade) {
case 'A': case 'a':
    quality_points += (num_credits * 4.0);
    break;

case 'B': case 'b':
    quality_points += (num_credits * 3.0);
    break;

// ...etc...

default:
    // invalid grade
}
```

## Day 5 review question

{ Arrays  
[ String

- 1 When we declare an array in C, what are the initial values?
- 2 What is the ASCII (Unicode) table?
- 3 What is a null terminator? What is its ASCII value?
- 4 Consider c-string "ab\0cd\0" - what is the reported string length?
- 5 How do we check if two C-strings are the same? In addition, are these two strings the same: "ab\0cd\0" and "ab\0"?

# 1. When we declare an array in C, what are the initial values?

Elements of an array are uninitialized by default. For example:

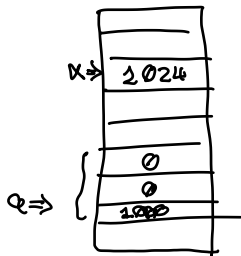
```
int a[3];  
printf("%d\n", a[0]); // undefined behavior
```

`int x;`

init on array

① for loop init

② `int a[3] = { 1, 2, 3 };`



## 2. What is the ASCII (Unicode) table?

Text characters are represented as integer “character codes”.

ASCII codes range from 0 to 127. Examples:

- “!” has the code 33
- “0” has the code 48
- “A” has the code 65
- “a” has the code 97

In C, a *character literal* (in single quotes) yields the ASCII code for that character. E.g., 'A' is the integer value 65.

Unicode: encoding scheme for (essentially) all characters in all human languages, plus symbols, emojis, etc.

'A' == 65 => true

### 3. What is a null terminator? What is its ASCII value?

In C, a character string is

- stored in an array of `char` elements, and
- is terminated by a “NUL” character, which is the character whose integer character code is 0

The NUL character can be written as `'\0'` or just `0`.

E.g.:

```
char s[4] = "foo";  
assert(s[0] == 'f');  
assert(s[1] == 'o');  
assert(s[2] == 'o');  
assert(s[3] == 0);
```



4. Consider c-string "ab\0cd\0" - what is the reported string length?

Note that \0 in a string literal means a literal NUL character.

The `strlen` function determines the length of a string, which is the number of characters preceding the NUL terminator marking the end of the string.

So:

```
assert(strlen("ab\0cd\0") == 2);
```

5. How do we check if two C-strings are the same? In addition, are these two strings the same: "ab\0cd\0" and "ab\0"?

The `strcmp` function returns 0 if the two strings passed as arguments consist of the same sequence of characters.

So:

```
assert(strcmp("ab", "ab\0cd") == 0);  
assert(strcmp("ab", "abc") != 0);
```

## Exercise 5

↳ alias in linux

- Enhanced `.bashrc` and `.bash_profile` startup scripts
- Working with character arrays and strings
- Small demo of `alias` keyword.

Breakout rooms 1–10 are “social”, breakout rooms 11+ are for individual or small group work.

## Day 6 recap questions

- ❶ Is `fprintf(stdout, "xxx")` the same as `printf("xxx")`?
- ❷ When should we use assertions instead of an *if* statement?
- ❸ What will happen if you pass an `int` variable to a function that takes a `double` as its parameter? What will happen if a `double` is passed to an `int` parameter?
- ❹ What is “pass by value”?
- ❺ How do you change the *main* function so that it can accept command-line arguments?

1. Is `fprintf(stdout, "xxx")` the same as `printf("xxx")`?

Yes.

`fprintf` (            ,       "      " )  
          ↑  
          FILE \*  
          stdout

## 2. When should we use assertions instead of an *if* statement?

An assertion (use of the `assert` macro) means “this condition must be true, or else we have proved that there is a bug in the program.”

Assertions are useful for checking *invariants*. They are also useful for *unit testing*. A unit test is an automated test for a small “unit” of the program, typically a single function. Assertions are used in a unit test to verify that the code being tested behaved correctly.

Assertions should *never* be used to check for conditions that could be true in the normal operation of the program. For example, it would be incorrect to use an assertion to check whether a file was opened successfully.

3. What will happen if you pass an `int` variable to a function that takes a `double` as its parameter? What will happen if a `double` is passed to an `int` parameter?

An `int` value can be freely converted to a `double` with no loss of information. The `double` value will be numerically the same as the original `int` value.

If a `double` is converted to an `int`, it is *truncated*, i.e., the fractional part is discarded.

`double x = 5; ~> 5.0`

`int y = 5.6; ~> 5`

# Conversions

```
// conversions.c:
#include <stdio.h>
#include <assert.h>

int as_int(int x) { return x; }
double as_double(double x) { return x; }

int main(void) {
    assert(as_double(3) == 3.0); => 3.0
    assert(as_int(6.79) == 6); =>
    printf("tests passed\n");
    return 0;
}

$ gcc -std=c99 -Wall -Wextra -pedantic conversions.c
$ ./a.out
tests passed
```



## 4. What is “pass by value”?

“Pass by value” means that a parameter is a variable that is distinct from any other variable in the program. Changing the value of a parameter does not change the value of any other variable in the program.

C uses pass-by-value for all parameters except for array parameters.

## Pass by value example

```
// pbv.c:
#include <stdio.h>

void f(int x) {
    x = 42;
    printf("x=%d\n", x);
}

int main(void) {
    int y = 17;
    f(y);
    printf("y=%d\n", y);
    return 0;
}

$ gcc -std=c99 -Wall -Wextra -pedantic pbv.c
$ ./a.out
x=42
y=17
```

5. How do you change the *main* function so that it can accept command-line arguments?

Declare it like this:

```
int main(int argc, char *argv[]) {  
    // ...  
}
```

```
int main (Void) } NO  
int main ( ) } CLI  
                  arg
```

`argc` is one greater than the number of command line arguments.

`argv` is an array of strings, where the strings are the command line arguments. (Note that `argv[0]` is always the name of the program.)

`argv[0] =>`

## Command line arguments example

```
// cmdargs.c:
#include <stdio.h>

int main(int argc, char *argv[]) {
    for (int i = 0; i < argc; i++) {
        printf("argv[%d] is '%s'\n", i, argv[i]);
    }
    return 0;
}
```

```
$ gcc -std=c99 -Wall -Wextra -pedantic cmdargs.c
```

```
$ ./a.out C is a "fun language"
```

```
argv[0] is './a.out'
```

```
argv[1] is 'C'
```

```
argv[2] is 'is'
```

```
argv[3] is 'a'
```

```
argv[4] is 'fun language'
```

→ don't rely on this value too much.

## A quick synopsis of C file I/O

|| r+ ||

|| w+ ||

- The FILE\* type represents an open file (for reading or writing)
- Opening a file for reading:  
`FILE *in; in = fopen(filename, "r");`
- Opening a file for writing:  
`FILE *out; out = fopen(filename, "w");` => This will overwrite
- If `fopen` returns NULL, it means the file wasn't opened successfully
- Use `fscanf` to read from a file, `fprintf` to write to a file
- When the program is done with a file, use `fclose` to close it

```
FILE *in = fopen( );
```

## Exercise 6

Compound interest (← click for formulas to calculate)

Breakout rooms 1–10 are “social”, breakout rooms 11+ are for individual or small group work.

# Notes

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