

601.220 Intermediate Programming

Spring 2023, Day 9 (February 10th)

Today's agenda

- Exercise 8 review
- Multidimensional arrays, gdb
- Exercise 9

Reminders

- HW1 due *today*
- HW2 due Friday, Feb 17th
 - “Written” assignment (on Gradescope), late submissions will not be accepted

Exercise 8 review

```
int concat(const char word1[], const char word2[],
           char result[], int result_capacity){
    int word1_len = strlen(word1);
    int word2_len = strlen(word2);
    if (word1_len + word2_len + 1 > result_capacity) {
        return 1; // not enough room in result array
    }
    int pos = 0;
    for (int i = 0; i < word1_len; i++) {
        result[pos] = word1[i];
        pos++;
    }
    for (int i = 0; i < word2_len; i++) {
        result[pos] = word2[i];
        pos++;
    }
    result[pos] = 0;
    return 0;
}
```

Exercise 8 review

string_functions.h:

```
#ifndef STRING_FUNCTIONS_H
```

```
#define STRING_FUNCTIONS_H
```

```
int concat(const char word1[], const char word2[],  
           char result[], int result_capacity);
```

```
#endif // STRING_FUNCTIONS_H
```

Exercise 8 review

string_functions.c:

```
#include <string.h>
```

```
#include "string_functions.h"
```

```
int concat(const char word1[], const char word2[],  
           char result[], int result_capacity){  
    // ...code omitted...  
}
```

Exercise 8 review

run_concat.c:

```
#include <stdio.h>
#include <string.h>
#include "string_functions.h"

int main() {
    // ...code omitted...
}
```

Exercise 8 review

```
# Makefile
CC = gcc
CFLAGS = -std=c99 -pedantic -Wall -Wextra

run_concat: run_concat.o string_functions.o
    $(CC) -o run_concat run_concat.o string_functions.o

run_concat.o: run_concat.c string_functions.h
    $(CC) $(CFLAGS) -c run_concat.c

string_functions.o: string_functions.c string_functions.h
    $(CC) $(CFLAGS) -c string_functions.c

clean:
    rm -f *.o run_concat
```


Day 9 recap questions

- ❶ How do you declare a multi-dimensional array and pass it to a function?
- ❷ How do you initialize a multi-dimensional array using array initialization?
- ❸ What is the compile flag needed to compile a program such that we can debug it using gdb?
- ❹ How do you set a break point using gdb and check the call stack?
- ❺ Check the gdb cheat sheet and find the command to print the content of a variable per step, instead of only printing it once using `print`.

1. How do you declare a multi-dimensional array and pass it to a function?

Declaring a two-dimensional array:

```
char board[3][3];
```

Accessing an element:

```
board[0][2] = 'X';
```

Note that by convention, the first index is “rows” and the second index is “columns”.

2-D array as parameter

```
void print_board(char board[3][3]) {  
    for (int i = 0; i < 3; i++) {  
        for (int j = 0; j < 3; j++) {  
            printf("%c", board[i][j]);  
        }  
        printf("\n");  
    }  
}
```

Note that the first dimension can be omitted, but the other dimensions are required.

2. How do you initialize a multi-dimensional array using array initialization?

Example:

```
char board[3][3] = {  
    {'O', 'X', 'X'},  
    {'X', 'O', 'O'},  
    {'X', 'X', 'O'},  
};
```

3. What is the compile flag needed to compile a program such that we can debug it using gdb?

The `-g` option causes the compiler to generate debug information.

Strongly recommended for all Makefiles for C programs:

```
CFLAGS = -g -std=c99 -pedantic -Wall -Wextra
```

4. How do you set a break point using gdb and check the call stack?

Set breakpoint at beginning of function:

```
break main  
break bsearch
```

Set breakpoint at specific source line:

```
break functions.c:74
```

Print call stack (all of these are equivalent):

```
where  
backtrace  
bt
```

5. Check the gdb cheat sheet and find the command to print the content of a variable per step, instead of only printing it once using `print`.

`display`

Exercise 9

- Two-dimensional arrays
- Debugging using gdb
- Talk to us if you have questions!