

## Day 9 (Fri 02/11)

- Exercise 8 review
- Day 9 recap questions
- Exercise 9

## Reminders:



- HW1 due \*this evening\* by 11pm
- HW2 due Friday, Feb 18th by 11pm
- late submissions not allowed!

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## Exercise 8 review

Checking whether result capacity is sufficient:

```
int word1_len = strlen(word1);  
int word2_len = strlen(word2);  
if (word1_len + word2_len + 1 > result_capacity) {  
    return 0;  
}
```

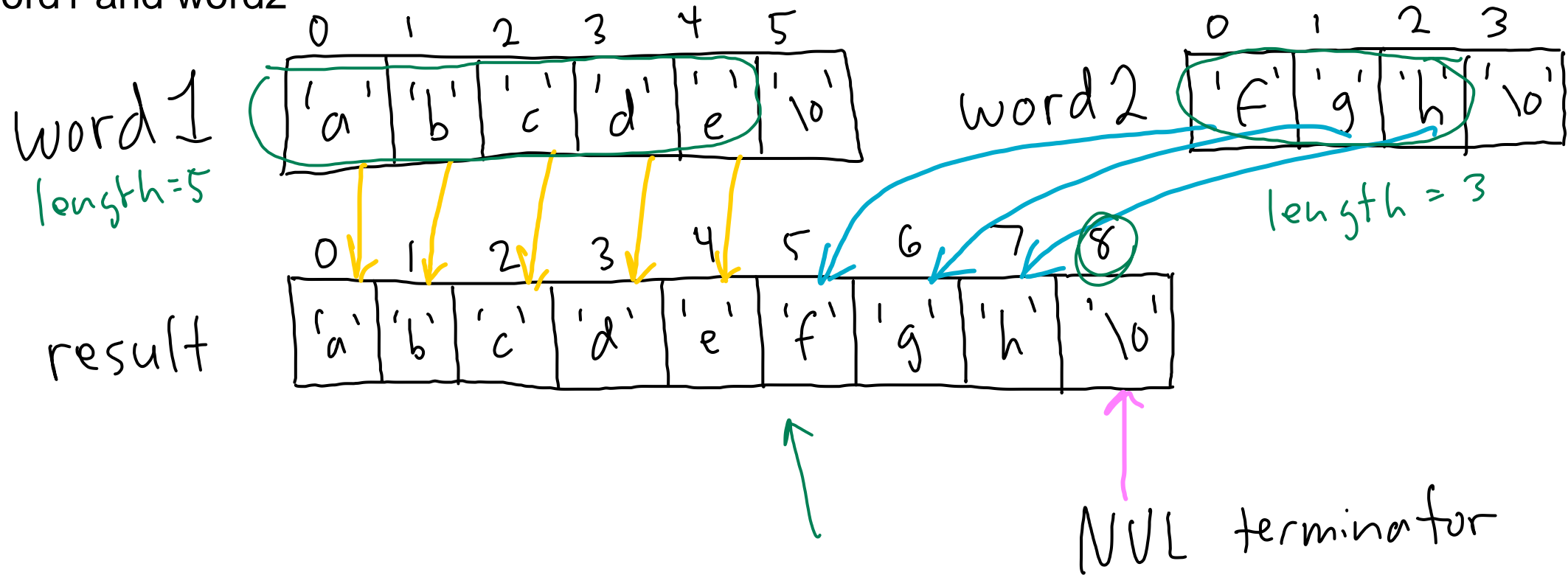
amount of space  
available in the  
result array

amount of space required  
for concatenation of word1 & word2

## Exercise 8 review (continued)

Concatenating word1 and word2, placing concatenation in result

- copy all characters from word1 into result
- copy all characters from word2 into result
- place NUL terminator after all of the characters from word1 and word2



## Exercise 8 review (continued)

### Modularizing the program

main function goes in run\_concat.c

concat function goes in string\_functions.c

*concat*  
function declaration goes in string\_functions.h

it should look like this:

```
#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
```

header guard

C source file:  
collection of func. defs

C header file:  
func. declarations  
#define  
struct types.

function declaration  
for the concat function

## Exercise 8 review (continued)

Both `run_concat.c` and `string_functions.c` should

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

Why? This allows the compiler to check that function definitions are consistent with their declarations

Example scenario: you add a parameter to the `concat` function in `string_functions.c`, but forget to add the parameter to the declaration in `string_functions.h`. Now all of the calls to `concat` are wrong (they pass the wrong number of arguments), but the compiler won't warn you about it.

## Editing the Makefile

*string\_functions.o : string\_functions.c  
string\_functions.h*

*gcc ...*  
The Makefile is already set up correctly. All that should be needed is to edit the file names.

If it's working correctly and you run "make" for the first time, it should run the following commands:

```
gcc -std=c99 -pedantic -Wall -Wextra -c run_concat.c
gcc -std=c99 -pedantic -Wall -Wextra -c string_functions.c
gcc -o run_concat run_concat.o string_functions.o
```

One suggested improvement: change

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

to

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

*include debug symbols  
so debugging the program  
in gdb works correctly*

What happens when the user enters more than 10 characters for a string?

scanf will store characters past the end of the array. This is undefined behavior, and will generally corrupt other variables in the program.

If the overrun is large enough, the main function's return address will be corrupted, and the program will (likely) segfault when it tries to return.

Soon: we will use valgrind to detect this type of error.

## Day 9 recap questions

1. How do you declare a multi-dimensional array and pass it to a function?
2. How do you initialize a multi-dimensional array using array initialization?
3. What is the compile flag needed to compile a program such that we can debug it using gdb?
4. How do you set a break point using gdb and check the call stack?
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`.





1. E.g. a two dimensional array:

```
int chessboard[8][8];
```

For 2-D arrays, first dimension is "rows" and second dimension is "columns".

Passing to a function:

```
int is_checkmate(int board[8][8]) {  
    // ...code...  
}
```

*can omit*

*must be explicit*

Note that the size of the first array dimension can be omitted, but the sizes of the other array dimensions are required.

print

name of var

2. E.g.:

// assume 0=empty, 1=pawn, 2=rook, 3=knight, 4=bishop, 5=king, 6=queen  
// note that we should really have #define constants or an enum  
// type so that these values can have meaningful names

```
int chessboard[8][8] = {  
    { 2, 3, 4, 6, 5, 4, 3, 2 },  
    { 1, 1, 1, 1, 1, 1, 1, 1 },  
    { 0, 0, 0, 0, 0, 0, 0, 0 },  
    // etc. for other rows  
};
```

row 0 (chessboard[0][0], chessboard[0][1], etc...)  
row 1 (chessboard[1][0], chessboard[1][1], etc...)

3. -g: is required when compiling, but not required when linking

gdb myprog

4. break name\_of\_function  
break source\_filename.c:N (N is the line number)

(gdb) command

backtrace

5. display name\_of\_variable