Week 11: Strings in C

CIT-593, Spring 2022

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Penn Engineering

What are strings in C?

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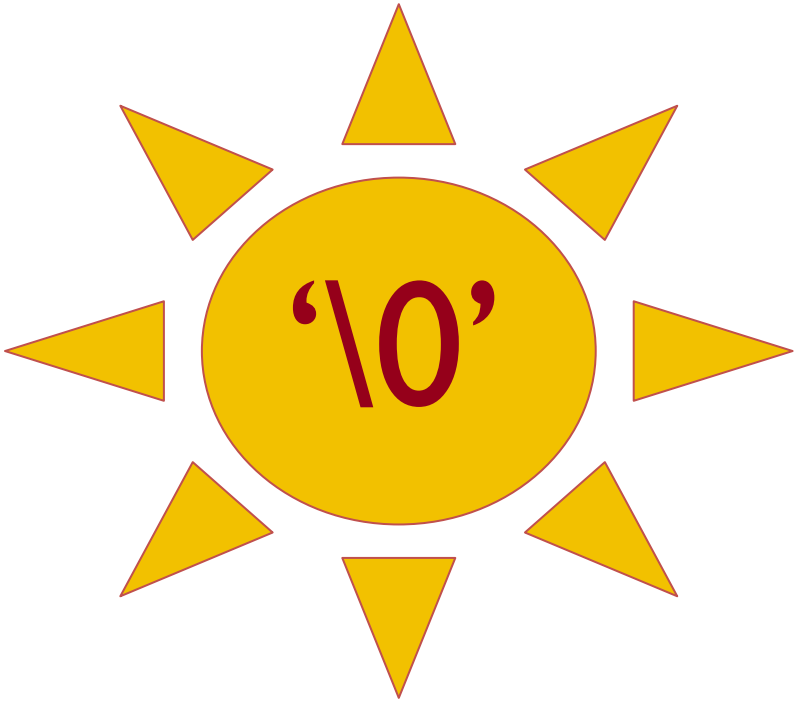
```
char not_string[6] = {'S', 'a','r','a','h','\0'}
```

null terminator - simply a 0 in memory that signifies end of a string

The null terminating char

The hero all strings deserve. Preventing segfaults since 1972.

Not all heroes wear capes. This one just wears a little backslash symbol.



If you have a string without a null terminating character, you are going to have a ~~bad time.~~ segfault or read/write error.

Adapted from slides by Katie Pizziketti/Ben Barba!

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- Character array initialized with string literal:
  - `char my_string[] = "Sarah";`
- Pointer to a string literal:
  - `char* strLit = "I'm literally a string literal."`
  - Declared with `char*` (pointer to global memory will be on the stack)
  - The string literal is stored *in global/static memory (**not the stack**).*
  - *READ-ONLY*

You cannot edit pointers to string literals!

You cannot edit a pointer to a string literal

```
char* strLit = "You literally cannot change me.";
strLit[0] = 'y';   // NOT ALLOWED. Literals are read-only
```

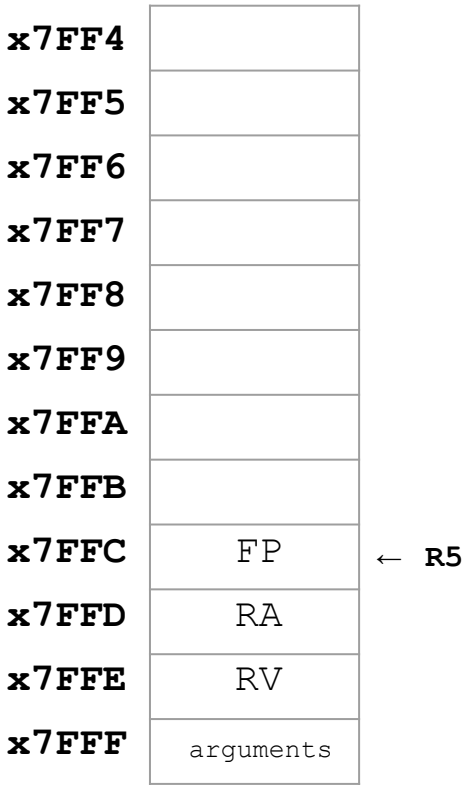
Editing a character array is completely fine

```
char[] myStr = "I'm not scared of change.";
myStr[0] = 'i';  // this is legal :)
```

Representation in Memory

How is this string represented in memory?

```
char my_string[6] = "Hello";
```



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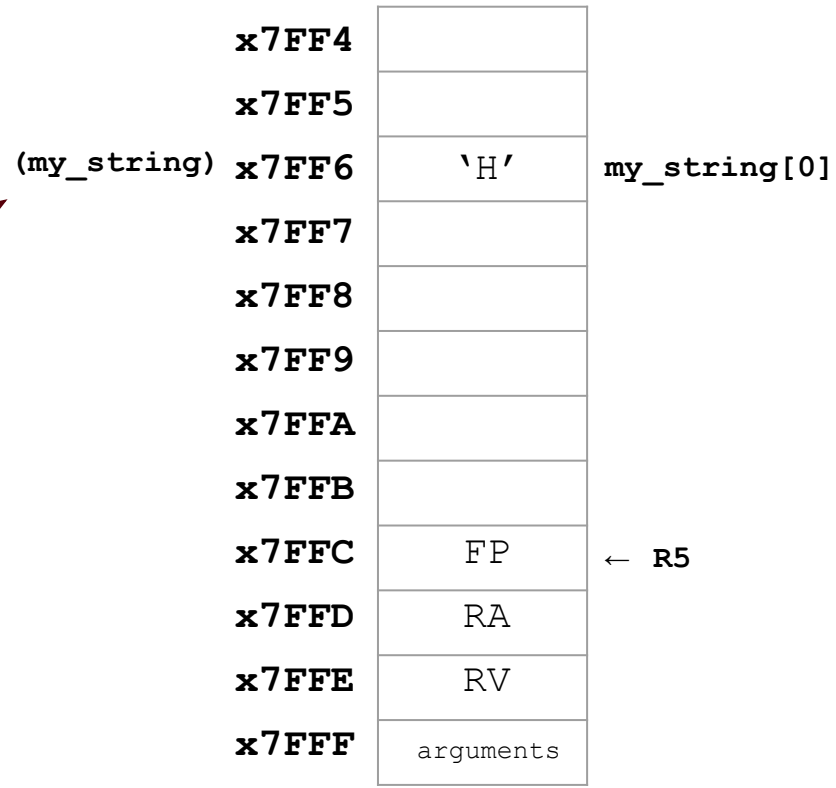
- The name of the string becomes a label for the starting address



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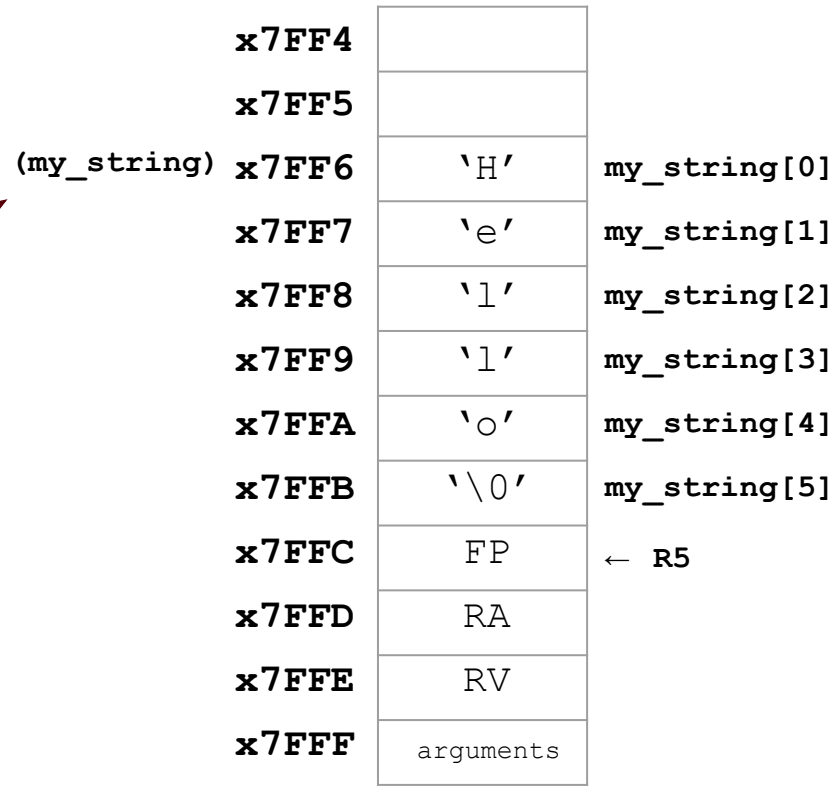

Pointer syntax

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char myString[] = "Hello";
char* stringPntr = NULL;
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char myString[] = “Hello”;
char* stringPntr = NULL; //these are the same!
char *stringPntr = NULL; //these are the same!
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char** doublePntr = &stringPntr;
//a double pointer is a pointer to a pointer.
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*doublePntr is equivalent to stringPntr which is equivalent to myString
**doublePntr is equivalent to *stringPntr which is equivalent to myString[0]
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```

Pointers need to have a type.

- Otherwise, the computer will not know how to interpret the value returned when dereferencing the pointer.
- Also needed for pointer arithmetic

A void pointer (void*) needs to be cast to a type before you can dereference it.

```
int num = *(int*)aVoidPtr
```

```
*doublePntr is equivalent to stringPntr which is equivalent to myString
**doublePntr is equivalent to *stringPntr which is equivalent to myString[0]
```

Pointers vs Arrays

An array is a label for a memory address.

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-

Array:

-

Pointer to array:

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*pntr;	array; OR array[0];

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- Can use pointer arithmetic, such as incrementing the pointer, which will set the pointer contents to address + 1.

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- Can access elements in array using brackets: array[0]

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*(pntr +1);	array[1];
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- **Can be returned from a function**

Array:

- Can't be dereferenced, but elements can be directly accessed by their index
- Can access elements in array using brackets: array[0]
- Can't be incremented to access a different element
- **Can't be returned from a function, but CAN be passed as an argument to a function**

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Debugging practice

String Functions (time-permitting)

Walk through function signatures and expected functionality:

- https://www.tutorialspoint.com/c_standard_library/c_function_strlen.htm
- https://www.tutorialspoint.com/c_standard_library/c_function_strcpy.htm
- https://www.tutorialspoint.com/c_standard_library/c_function_strchr.htm
- https://www.tutorialspoint.com/c_standard_library/c_function_strcat.htm
- https://www.tutorialspoint.com/c_standard_library/c_function_strcmp.htm