Strings
Or, arrays Pt 2

Call for research participants

- We are evaluating some new AI-powered tools
- We need your help!

Assignment 1

- Released Tuesday
- Watch the Assignment Walkthrough live stream
- Watch the Catchup-up video
- Submission in Week 7
- Worth 20%

Arrays recap

- A collection of data, all of the same type. (homogonous)
- We have a single identifier for the entire array
- It is a random access data structure, meaning we can access any element in the array at any time

The array declaration syntax

```
int ice_cream_per_day[7];
```

index:	0	1	2	3	4	5	6
values:							

Declare + initialise

```
int ice_cream_per_day[7] = {3, 2, 1,
2, 1, 3, 5};
```

^ Note you can only do this when you declare, not later!

```
int ice_cream_per_day[7] = {};
```

^ Will initialise all elements to 0

Some corrections

```
int my_data[] = {3, 2, 1, 2, 1, 3, 5};
```

^ Will create a 7-element array

```
int my_data[14] = {3, 2, 1, 2, 1, 3,
5};
```

^ Will create a 14-element array, with the first 7 elements then 7 0'd out

Accessing elements

```
int first_day_ice_creams =
ice_cream_per_day[0];
```

index:	0	1	2	3	4	5	6
values:	3	2	1	2	1	3	4

Writing elements

```
ice_cream_per_day[0] = 5;
```

index:	0	1	2	3	4	5	6
values:	5	2	1	2	1	3	4

Strings

Strings!

- Strings are multi-character words
- `"Jake Renzella"` -> is a string with 13 characters!
- Strings are great! They are everywhere!

Bad news

C doesn't have a string data type :(

Good news

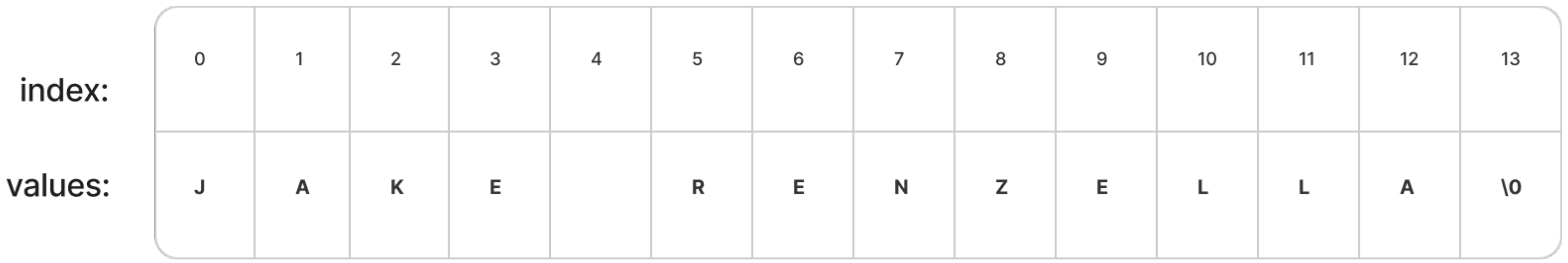
C has arrays! :)

An int array

```
int numbers[7] = {3, 2, 1, 2, 1, 3, 4}
```

index:	0	1	2	3	4	5	6
values:	3	2	1	2	1	3	4

A char array



index:	0	1	2	3	4	5	6	7	8	9	10	11	12	13
values:	J	A	K	E		R	E	N	Z	E	L	L	A	\0

We can build our own string type by using an array of chars!

Strings in C are char arrays

- A collection of characters
- C does know how to work with `char[]`s

```c
#include <stdio.h>

int main(void) {
    char name[3] = {'G', 'a', 'b'};
    // change name to Jake
    // :( can't, won't fit

    return 0;
}
```

```c
#include <stdio.h>
#define MAX_STR 50

int main(void) {
    char name[MAX_STR] = {'J', 'a',
'k', 'e'};

    return 0;
}
```

New problem

How does C know where the string ends?

```
char name[MAX_STR] = {'J', 'a', 'k', 'e'};
```

The null terminator

- Remember in C, we don't know when arrays end
- We have to keep track of the length ourselves
- We can't always do this with `char[]`...
- Instead, we place a special character called the null terminator at the end of our character arrays `\0`

`char[]`

index:	0	1	2	3	4	5	6	7	8	9	10	11	12	13
values:	J	A	K	E		R	E	N	Z	E	L	L	A	\0

Notice the `\0` at the end! This means that C will know when it reaches the end of the array

How to use strings in C

- Because strings are character arrays, the type is `char[]`
- There are two ways to declare a string, here's one:

```
char word[] = {'h', 'e', 'l', 'l',
'o', '\0'};
```

Anyone think that's annoying?

Strings are very common

So there are easier ways to use them:

```c
char word[] = "hello";
```

- This is exactly the same as the previous example
- It includes the null terminator!

String literals

```
"Jake!"
```

– uses double quotes `"` to wrap the string literal

– single quote for characters!

– Used to assign strings to `char[]` easily:

```
char name[] = "Jake Renzella";
```

Using strings

- printing: `printf` or `fputs`
- scanning: `fgets`
- Both included in `<stdio.h>`

`fgets`

- Reads a string from the terminal
- `fgets(array[], length, stream)`
  - **array[] ->** The array that the string will be stored
  - **length ->** The number of characters that can be read in
  - **stream ->** The origin of the string (we always use `stdin`)

`fgets` usage

```c
// Declare the array which will
contain the string. Note, we don't
know how big the string will be, so
let's come up with a maximum.
char my_string[MAX_LENGTH]

// read the string in
fgets(my_string, MAX_LENGTH, stdin);
```

Reading strings in a loop

- We can read until `CTRL+D` is entered in the terminal by calling `fgets` in a loop
- `fgets()` stops reading when either length-1 characters are read, newline character is read or an end of file is reached, whichever comes first

Reading strings in a loop

```c
#include <stdio.h>

// I know my string will never need to be more than 15 chars
#define MAX_LENGTH 15

int main(void) {
    char name[MAX_LENGTH];
    printf("Enter your name: ");

    // fgets reads the entire string, including the newline character
    while (fgets(name, MAX_LENGTH, stdin) != NULL) {
        // every time this runs, we update `name`!
    }
}
```

Printing strings

```
fputs(array[], stream)
```

- **array[]** -> the character array to be printed
- **stream** -> the location to print, always use `stdout` in COMP1511

Printing strings

```
char name[] = "Jake"
fputs(name, stdout)
```

^ Why doesn't fputs need the LENGTH, like `fget`?

Other useful string functions

- `strlen()` -> gives us the length of the string (excluding the `\0`).
- `strcpy()` -> copy the contents of one string to another
- `strcat()` -> join one string to the end of another (concatenate)
- `strcmp()` -> compare two strings
- `strchr()` -> find the first occurrence of a character

note: some of these may require `#include <string.h>`

Demo

Feedback

https://forms.office.com/r/Ze4admEWnR