COMP1511 PROGRAMMING FUNDAMENTALS

LECTURE 6

I ❤ ARRAYS

LAST LECTURE...

ON MONDAY...

- Talked about good style/bad style
- Functions - what/how/why?

THIS LECTURE...

TODAY...

- Hopefully have some air con
- Look back at some functions
- Starting to look at arrays
    - MAYBE strings if we are doing good time :)

WHERE IS THE CODE?

Live lecture code can be found here:

HTTPS://CGI.CSE.UNSW.EDU.AU/~CS1511/23T1/LIVE/WEEK03/

FUNCTIONS RECAP

WHAT?

- A function is a block of statements that performs a specific task

FUNCTIONS RECAP

WHY?

- Improve readability of the code
- Improve reusability of the code
- Debugging is easier (you can narrow down which function is causing issues)
- Reduces size of code (you can reuse the functions as needed, wherever needed)

FUNCTIONS RECAP

HOW?

- Predefined standard library functions (built-in)
    - printf(), scanf() inside stdio.h
- User defined function with syntax:

```
return_type function_name (arguments (type name)) {
    BLOCK OF CODE (Set of instructions for the
    function)
}
```

- return_type - can be any data type such as int, double, char, etc (CAN'T BE ARRAY)
- function_name - whatever your heart desires, should be descriptive
- arguments - what are the inputs into the function
- Block of Code - set of instructions exercuted when call is made to the function

RECAP FUNCTIONS

return type: What type does this function return?

name of function: What will I name my function?

input/ arguments: What am I giving my function?

A function, which adds two numbers together and returns the result

```
int add (int number_one, int number_two) {
    int sum;
    sum = number_one + number_two;
    return sum;
}
```

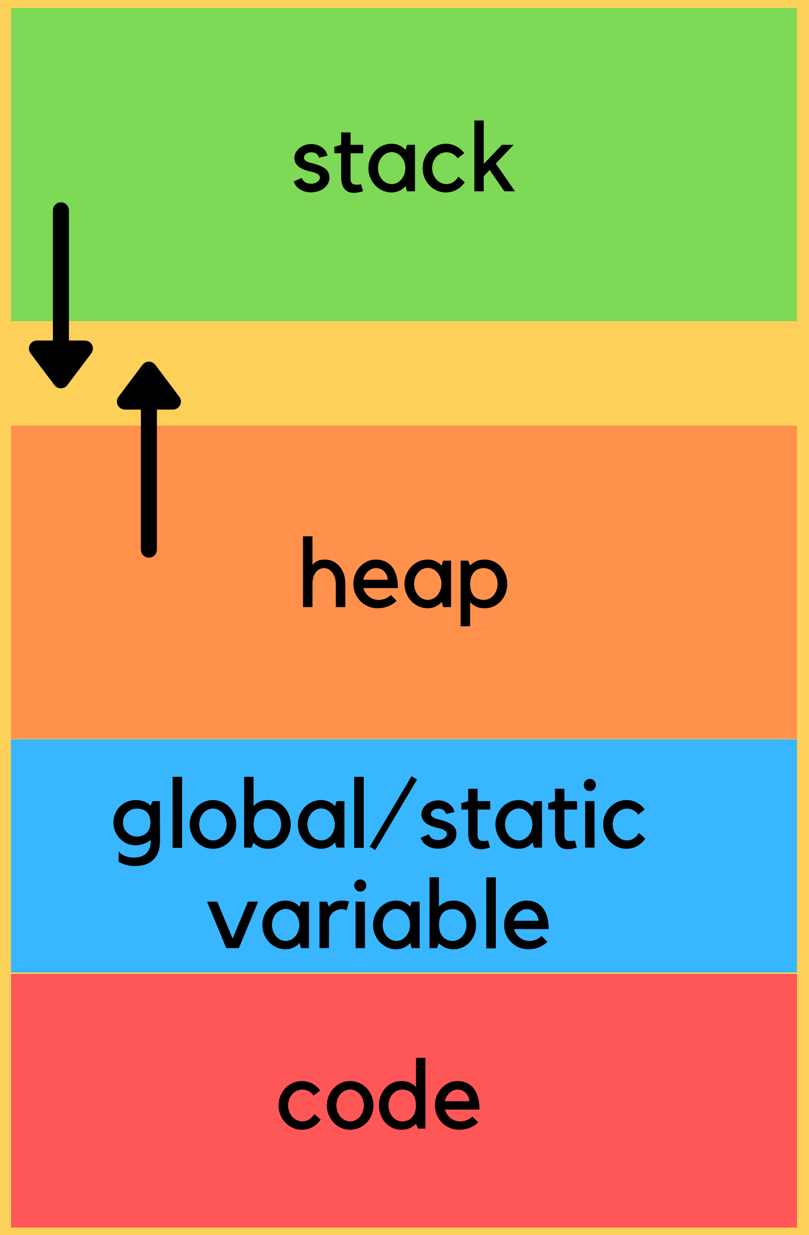
To finish I return an int (sum), which is what I said I would return when I wrote my function

RECAP FUNCTIONS

PROTOTYPE

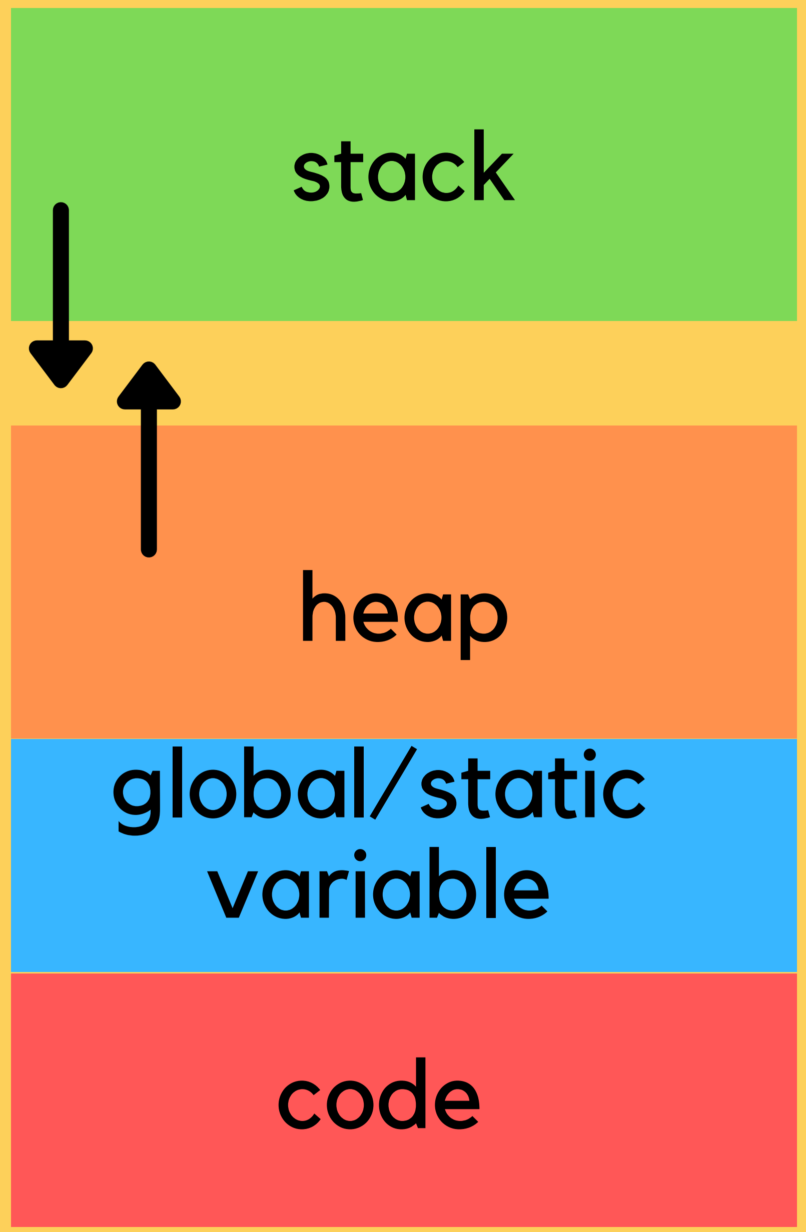
- You must have a prototype above your main to let everyone know the function is defined and is coming!

REVISITING MEMORY



- Our C file is stored on the hard drive
- Our Compiler compiles the code into another file that the computer can read
- When we execute code, the CPU will actually process the instructions and perform basic arithmetic, but the RAM will keep track of all the data needed in those instructions and operations, such as our variables.
- Reading and writing to variables will change the numbers in RAM
- Memory is divided into the stack and the heap
- The stack is an ordered stack and the heap is a random free for all - insert something where you can find space for it.

REVISITING MEMORY



- Stack memory is where relevant information about your program goes:
  - which functions are called,
  - what variables you created,
- Once your block of code finishes running {}, the function calls and variables will be removed from the stack (it's alive!)
- It means at compile time we can allocate stack memory space (not at run time)
- The stack is controlled by the program NOT BY THE developer
- The heap is controlled by the developer (more on this in a few weeks) and can be changed at run time

MEMORY IS IMPORTANT

WITHOUT MEMORY, WE CAN'T REALLY RUN ANYTHING

- Think of your own memory and what it allows you to do.
- Computer memory is important to consider when you are writing your code (we don’t focus on this in 1511, but you will in later courses)
- The more you waste memory, the slower your program gets… you will learn all about this in later computing courses! In 1511 we don’t mind the wastage :)

HOW DO WE EFFICIENTLY SOLVE PROBLEMS?

DIFFERENT PROBLEMS HAVE DIFFERENT OPTIMUM SOLUTIONS

- In this course we will learn about two pretty cool data structures:
  - Arrays (NOW!)
  - Linked Lists (after flexibility week)
- There are of course other data structures that you will learn about in further computing courses
- Choosing the right structure to house our data depends on what the problem is and what you are trying to achieve. Some structures lend themselves better to certain types of problems.

SO WITHOUT FURTHER ADO

THE ARRAY

- A PRETTY IMPORTANT DATA TYPE!
- A collection of variables all of the same type
  - Think about how this is very different to a struct
- We want to be able to deal with this collection as a whole entity, where we can:
  - Access any variable in this collection easily
  - Change any variable in this collection easily

SO WHAT KINDS OF PROBLEMS DO ARRAYS SOLVE?

NOTICE THAT EACH OF THESE COLLECTIONS HAS THE SAME TYPE OF VARIABLE I AM RECORDING

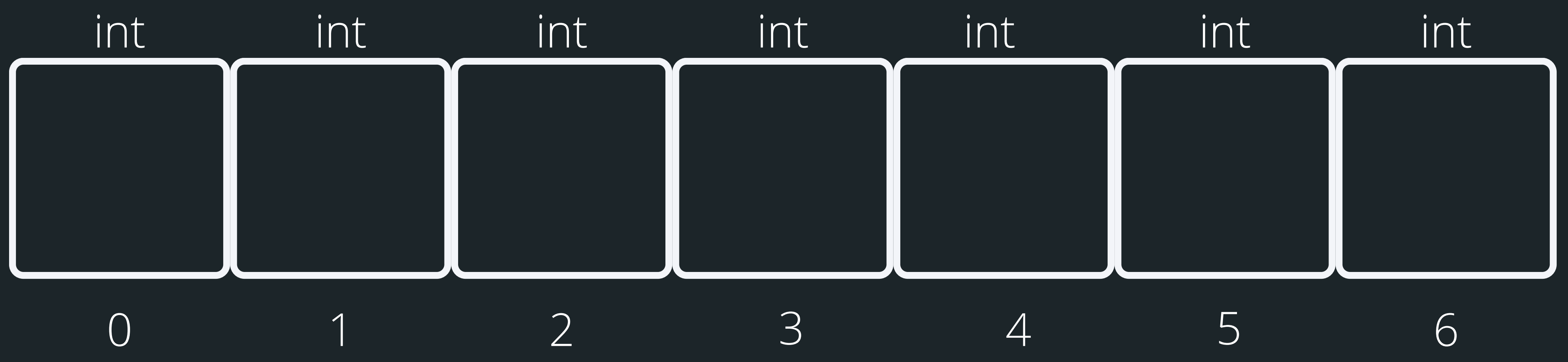
- Let's say I want to record the daily ice cream consumption for a week
- What about the daily temperatures for a year?
- The amount of time daily that I spend walking my dogs?

Can you think of other examples?

ARRAY (VISUALLY)

NOTE: ALL ELEMENTS OF AN ARRAY MUST BE OF THE SAME DATA TYPE (HOMOGENOUS)

- If we group our data type as a collection, for example a collection of integers:
- We can access them as a group(collection)
- We can loop through and access each individual element of that collection



this array holds 7 integers

You can access elements of an array by referring to their index

WHY DO WE NEED AN ARRAY?

LET'S LOOK AT AN EXAMPLE PROBLEM

- Let’s say I am tracking my ice cream consumption over a week (without arrays)

```
int mon = 2;
int tues = 3;
int wedn = 3;
int thur = 5;
int fri = 7;
int sat = 1;
int sun = 3;
// Any day with 3 or more scoops is too
much!
if (mon >= 3){
    printf("Too much ice cream\n");
}
if (tue >= 3) {.......
```

WHY DO WE NEED AN ARRAY?

LET'S LOOK AT AN EXAMPLE PROBLEM

- What if I am tracking this over the month or over a year?
  - Will I need 30 variables/365 variables?

THIS IS A GREAT PLACE TO USE AN ARRAY...

HOW DO WE DECLARE AN ARRAY

Type of data stored in array

Name of the array

Number of items in the array

```
// 1. Declaring an array
int ice_cream_consum[7];


// 2. Declaring and Initialise the array
// Note that once you declare an array,
// you can't initialise it in this way
int ice_cream_consum[7] = {3, 2, 1, ...};
```

To initialise, open curly bracket and separate values by comma. If you have empty {}, it means to intialise the whole array to 0

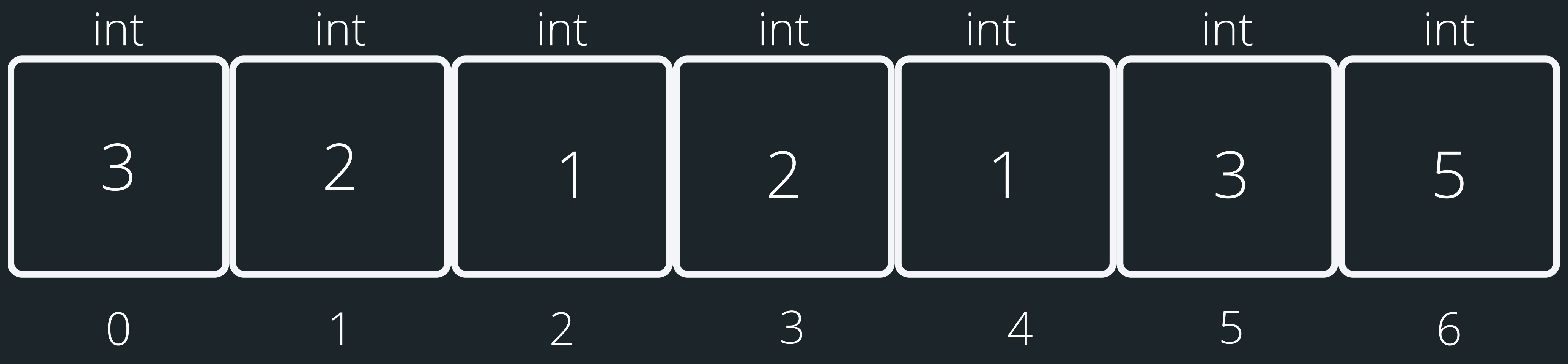
ARRAY (VISUALLY)

DECLARING AND INITIALISING AN ARRAY

- So let's say we have this declared and initialised:

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

- This is what it looks like visually:



this array holds 7 integers

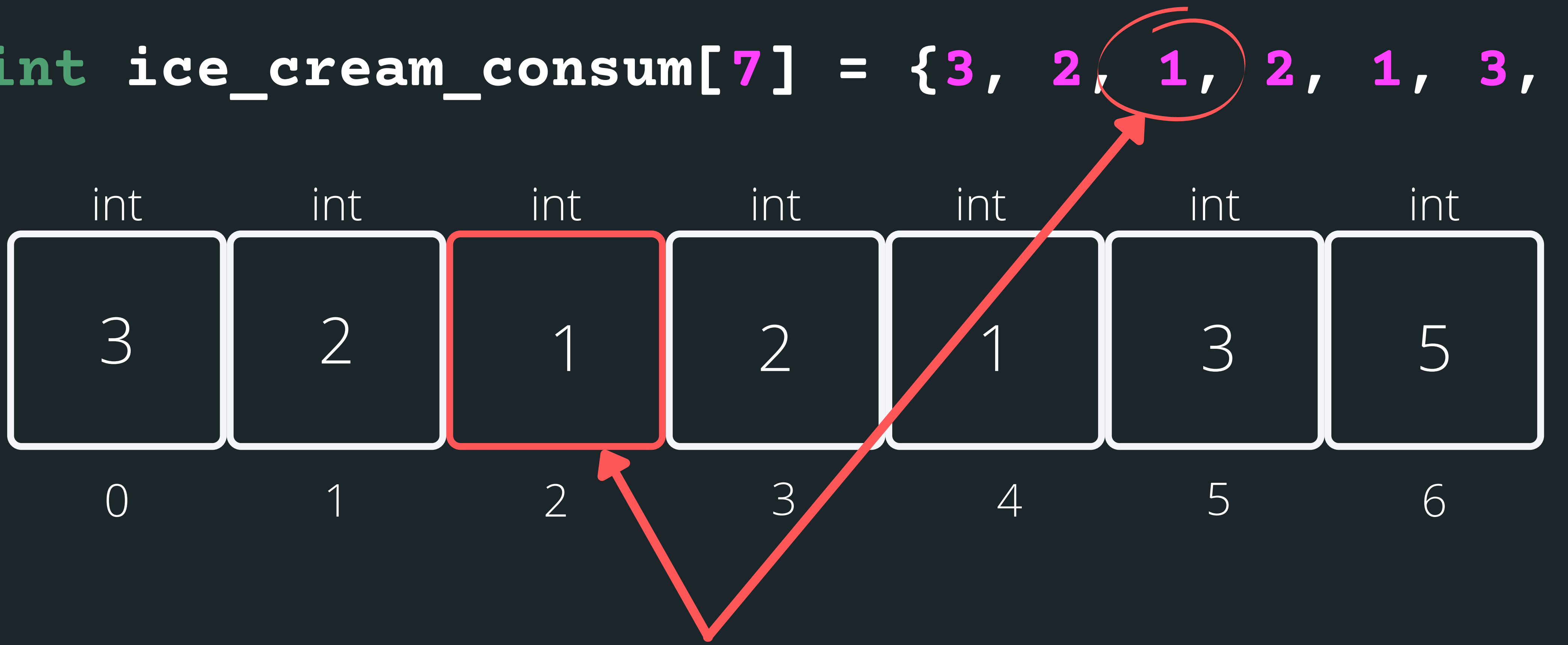
Note that indexing starts at 0

ARRAY (VISUALLY)

ACCESSING ARRAY ELEMENTS

- You can access any element of the array by referencing its index
- Note, that indexes start from 0
- Trying to access an index that does not exist, will result in an error

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



If I wanted the third element of the array

The index would be 2, so to access it:

ice_cream_consum[2]

USING ARRAYS

CLOSER LOOK

- You can’t printf() a whole array, but you can print individual elements (consider how you could go through the array to print out every element…)
- You can’t scanf() a whole array, i.e. a line of user input test into an array, but you can can scanf() individual elements (think how to do every element in an array…)

USING ARRAYS

CLOSER LOOK

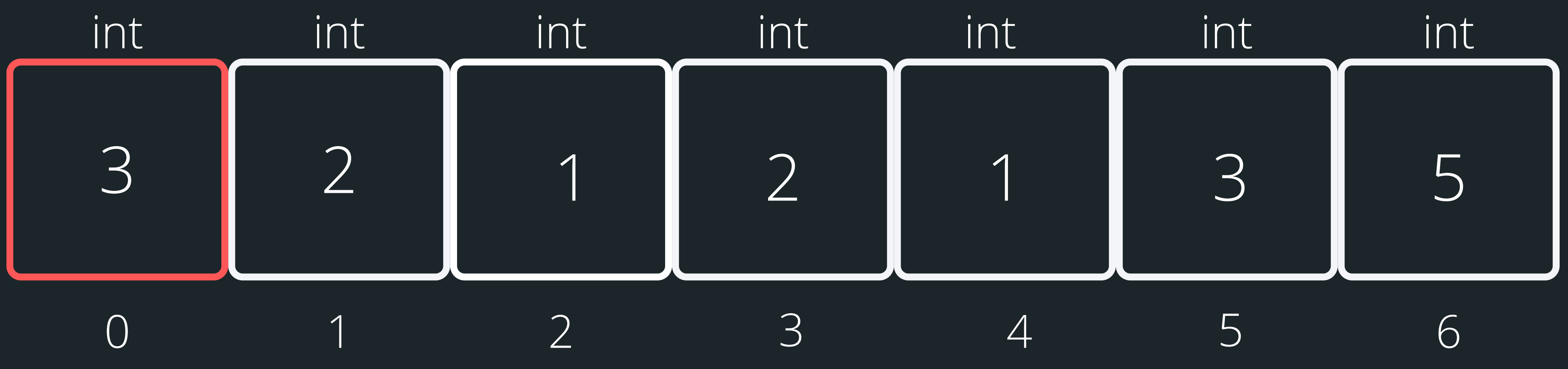
```c
int ice_cream_consum[7] = {3, 2, 1, 2, 1, 3, 5};

int i = 0;
while (i < 7){
    printf("%d ", ice cream_consum[i]);
    i++;
}
```

Start at index 0 (first entry into while loop)

ice_cream_consum[0]

print what is inside index 0



USING ARRAYS

CLOSER LOOK

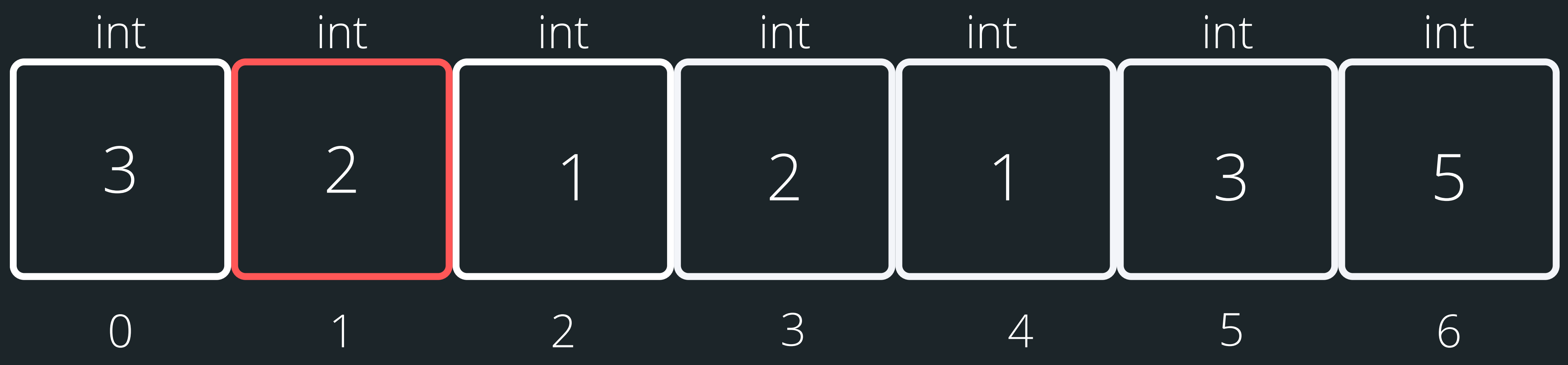
```c
int ice_cream_consum[7] = {3, 2, 1, 2, 1, 3, 5};

int i = 0;
while (i < 7){
    printf("%d ", ice cream_consum[i]);
    i++;
}
```

increase index by 1

ice_cream_consum[1]

print what is inside index 1



USING ARRAYS

CLOSER LOOK

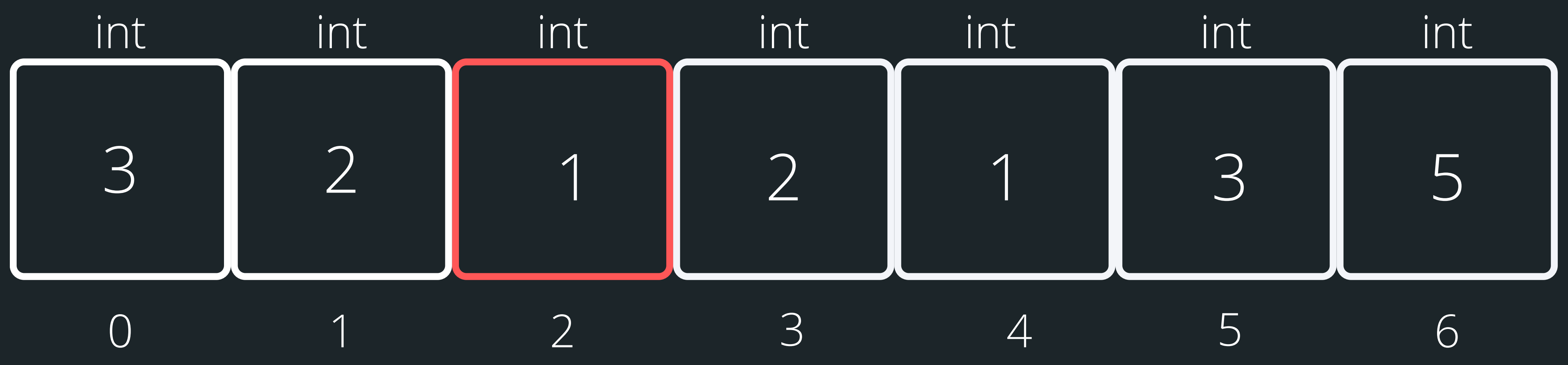
```
int ice_cream_consum[7] = {3, 2, 1, 2, 1, 3, 5};

int i = 0;
while (i < 7){
    printf("%d ", ice cream_consum[i]);
    i++;
}
```

increase index by 1

ice_cream_consum[2]

print what is inside index 2



USING ARRAYS

CLOSER LOOK

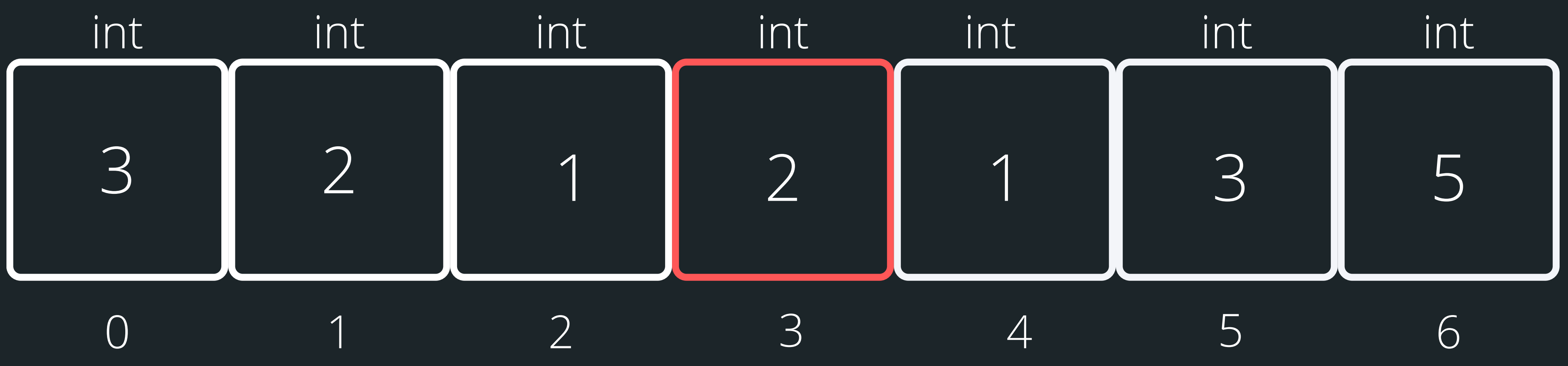
```
int ice_cream_consum[7] = {3, 2, 1, 2, 1, 3, 5};

int i = 0;
while (i < 7){
    printf("%d ", ice cream_consum[i]);
    i++;
}
```

increase index by 1

ice_cream_consum[3]

print what is inside index 3



USING ARRAYS

CLOSER LOOK

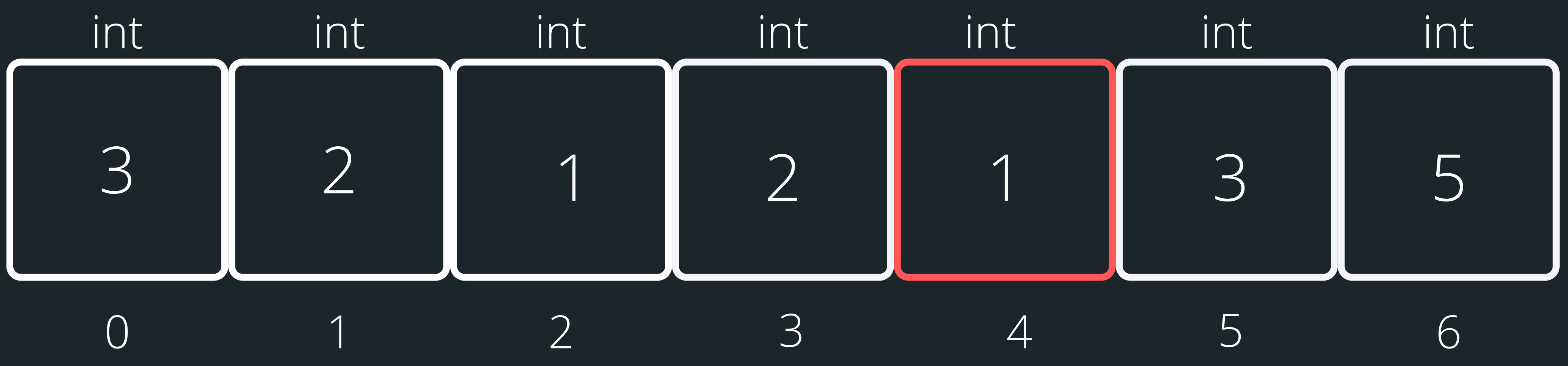
```c
int ice_cream_consum[7] = {3, 2, 1, 2, 1, 3, 5};

int i = 0;
while (i < 7){
    printf("%d ", ice cream_consum[i]);
    i++;
}
```

increase index by 1

ice_cream_consum[4]

print what is inside index 4



USING ARRAYS

CLOSER LOOK

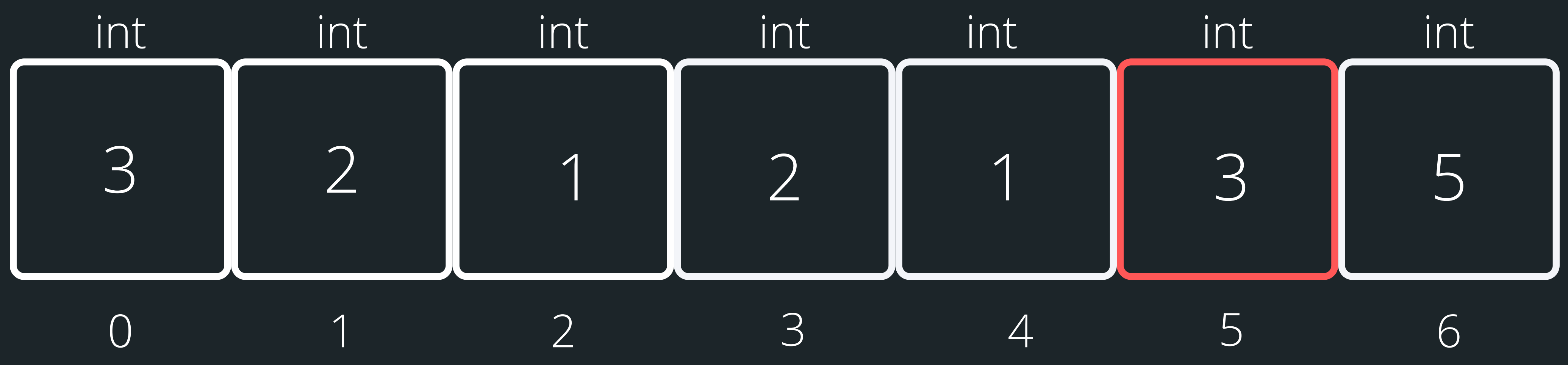
```
int ice_cream_consum[7] = {3, 2, 1, 2, 1, 3, 5};

int i = 0;
while (i < 7){
    printf("%d ", ice cream_consum[i]);
    i++;
}
```

increase index by 1

ice_cream_consum[5]

print what is inside index 5



USING ARRAYS

CLOSER LOOK

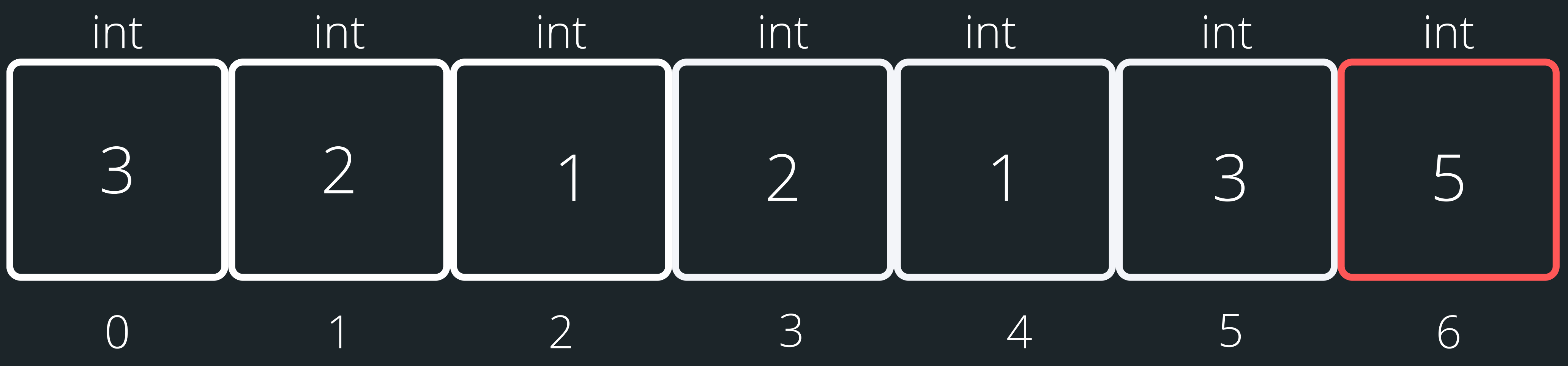
```
int ice_cream_consum[7] = {3, 2, 1, 2, 1, 3, 5};

int i = 0;
while (i < 7){
    printf("%d ", ice cream_consum[i]);
    i++;
}
```

increase index by 1

ice_cream_consum[6]

print what is inside index 6



BREAK TIME

TIME TO STRETCH

You have two eggs in a 100-story building. You want to find out what floor the egg will break on, using the least number of drops.

PROBLEM SOLVING TIME

HOORAY!

- Some basic arrays to give you a feel for them!

`numbers.c`

PROBLEM SOLVING TIME

HOORAY!

- I have a bad habit of watching bad tv shows, and would like to break this habit… I want to be able to track the number of hours I watch trash tv in any given week.

`trashy_tv.c`

Feedback please!

I value your feedback and use to pace the lectures and improve your overall learning experience. If you have any feedback from today's lecture, please follow the link below. Please remember to keep your feedback constructive, so I can action it and improve the learning experience.

https://www.menti.com/al3zoiv2p7oh

WHAT DID WE LEARN TODAY?

FUNCTIONS RECAP

functions_recap.c

EXPLORING ARRAYS

numbers.c

trashy_tv.c

REACH OUT

CONTENT RELATED QUESTIONS

Check out the forum

ADMIN QUESTIONS

cs1511@unsw.edu.au