

# COMP1511

## Static arrays

### Week 3 Lecture 2

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### functions/procedures recap

- Reusable blocks of code
- Callable multiple times
- variables within a function are scoped to that function

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### PI function

Would be annoying to write this every time we need to calculate!

```
double pi() {  
    double sum = 0.0;  
    for (int i = 0; i < 1000;  
i++) {  
        sum += (-1.0) * pow(1.0 /  
2.0, i) / (i + 1);  
    }  
    return 4.0 * sum;  
}
```

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## Forward declaration

```
int main(void) {
    double calculated_pi = pi();
}

double pi() {
    double sum = 0.0;
    for (int i = 0; i < 1000; i++) {
        sum += (-1.0) * pow(1.0 / 2.0,
i) / (i + 1);
    }
    return 4.0 * sum;
}
```

^ problem! `main` doesn't know that `pi` exists yet!

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## Forward declaration

```
double pi();

int main(void) {
    double calculated_pi = pi();
}

double pi() {
    double sum = 0.0;
    for (int i = 0; i < 1000; i++) {
        sum += (-1.0) * pow(1.0 / 2.0,
i) / (i + 1);
    }
    return 4.0 * sum;
}
```

^ Solved! We forward declared `pi`!

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## Quick functions recap demo

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## **Arrays**

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**So far, we can store a  
single item in each  
variable**

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**What if you wanted to  
store many values?**

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### Number of ice creams eaten

```
int day_1 = 2;
int day_2 = 3;
int day_3 = 3;
int day_4 = 5;
int day_5 = 7;
int day_6 = 1;
int day_7 = 3;
// Any day with 3 or more scoops is
too much!
if (day_1 >= 3) {
    printf("Too much ice cream\n");
}
if (day_2 >= 3) {...
```

Seem repetitive?

- Many variables would clutter the program
- Many variables would not always be efficient

### Data structures

- Are common structures (not structs) used to store multiples of data
  - Usually (especially in COMP1511) of the same data type
- Can scale, easily storing a handful, up to thousands, or more elements of data!

## Data structures in COMP1511

We will look primarily at two data structures:

- arrays (today)
- linked lists (future)

These are very, very powerful data structures you will use forever

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## Arrays

- A collection of data, all of the same type. (homogenous)
- 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

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## Arrays

- We can read or modify individual elements
- It is a ***contiguous*** data structure

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## contigu-what?

### Let's visualise arrays

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### Static arrays have a set size

(which you specify)

index:	0	1	2	3	4
values:					

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### int array

index:	0	1	2	3	4
values:					

- This int array will store 5 integers
- $32\text{bit} * 5 \text{ elements} = 160 \text{ bits}$  of memory used

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## The array declaration syntax

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

index:	0	1	2	3	4	5	6
values:							

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## 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

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

Creates:

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

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## 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	5

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## Writing elements

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

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

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**arrays 🤝 loops**  
**The power of arrays**

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

```
// read each element
ice_cream_per_day[0];
ice_cream_per_day[1];
ice_cream_per_day[2];
ice_cream_per_day[3];
ice_cream_per_day[4];
ice_cream_per_day[5];
ice_cream_per_day[6];
```

^ Does this look repetitive?

If only we had a way to count :(

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#### Bad

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

// read each element
printf("%d\n",
ice_cream_per_day[0]);
printf("%d\n",
ice_cream_per_day[1]);
printf("%d\n",
ice_cream_per_day[2]);
printf("%d\n",
ice_cream_per_day[3]);
printf("%d\n",
ice_cream_per_day[4]);
printf("%d\n",
ice_cream_per_day[5]);
printf("%d\n",
ice_cream_per_day[6]);
```

#### Good

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

int i = 0;
while (i < 7) {
    printf("%d\n",
ice_cream_per_day[i]);
    i++; // i = i + 1;
}
```

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**Demo**

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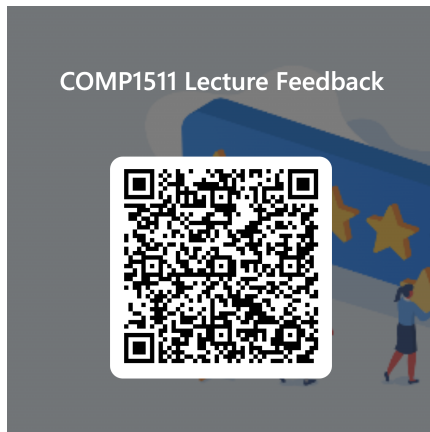
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## Feedback

<https://forms.office.com/r/K3PjvWebtD>



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