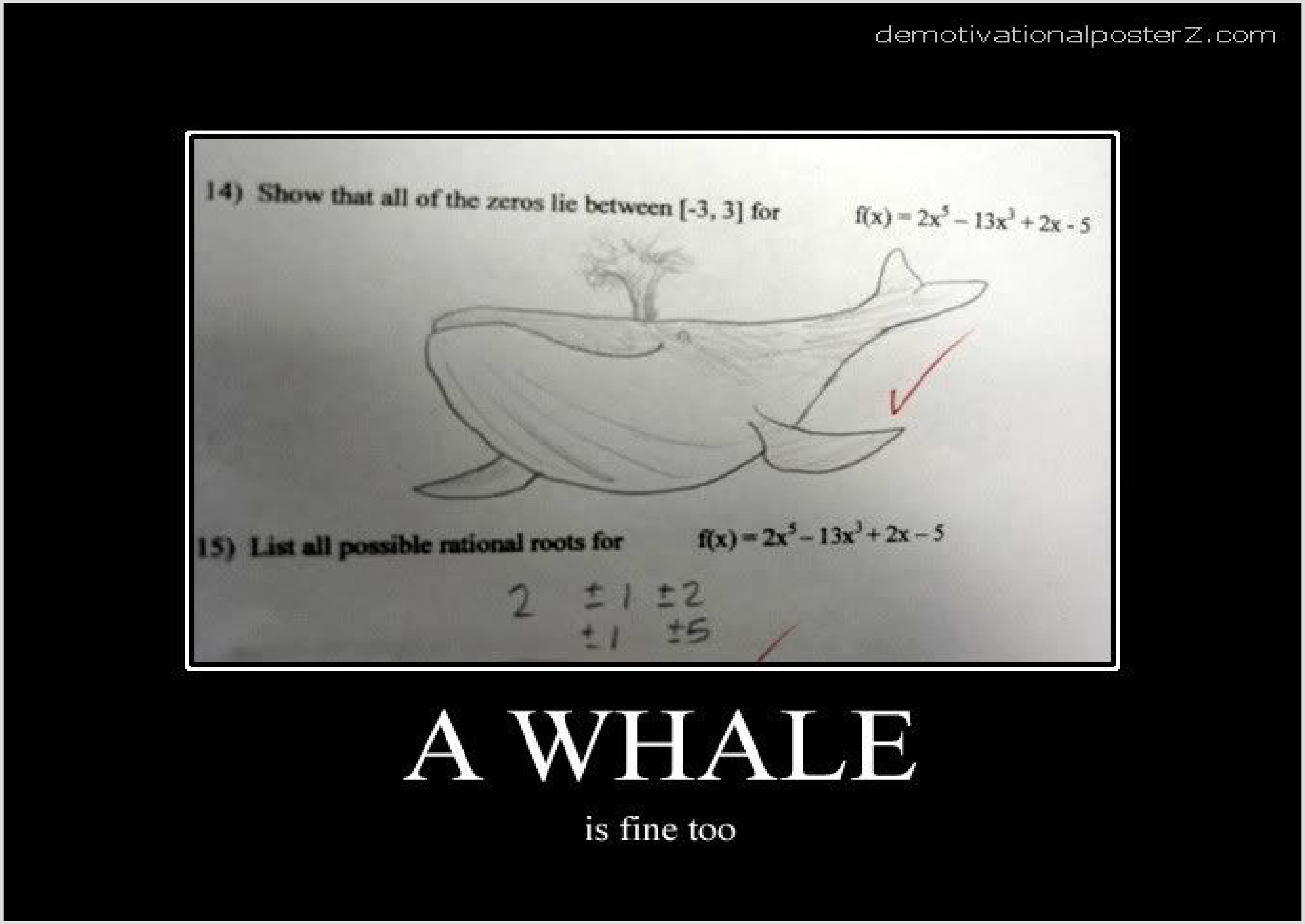
Midterm 2 Review


demotivationalposterZ.com
14) Show that all of the zeros lie between [-3, 3] for $f(x) = 2x^5 - 13x^3 + 2x - 5$
15) List all possible rational roots for $f(x) = 2x^5 - 13x^3 + 2x - 5$
2 ±1 ±2
±1 ±5
A WHALE
is fine too

Functions

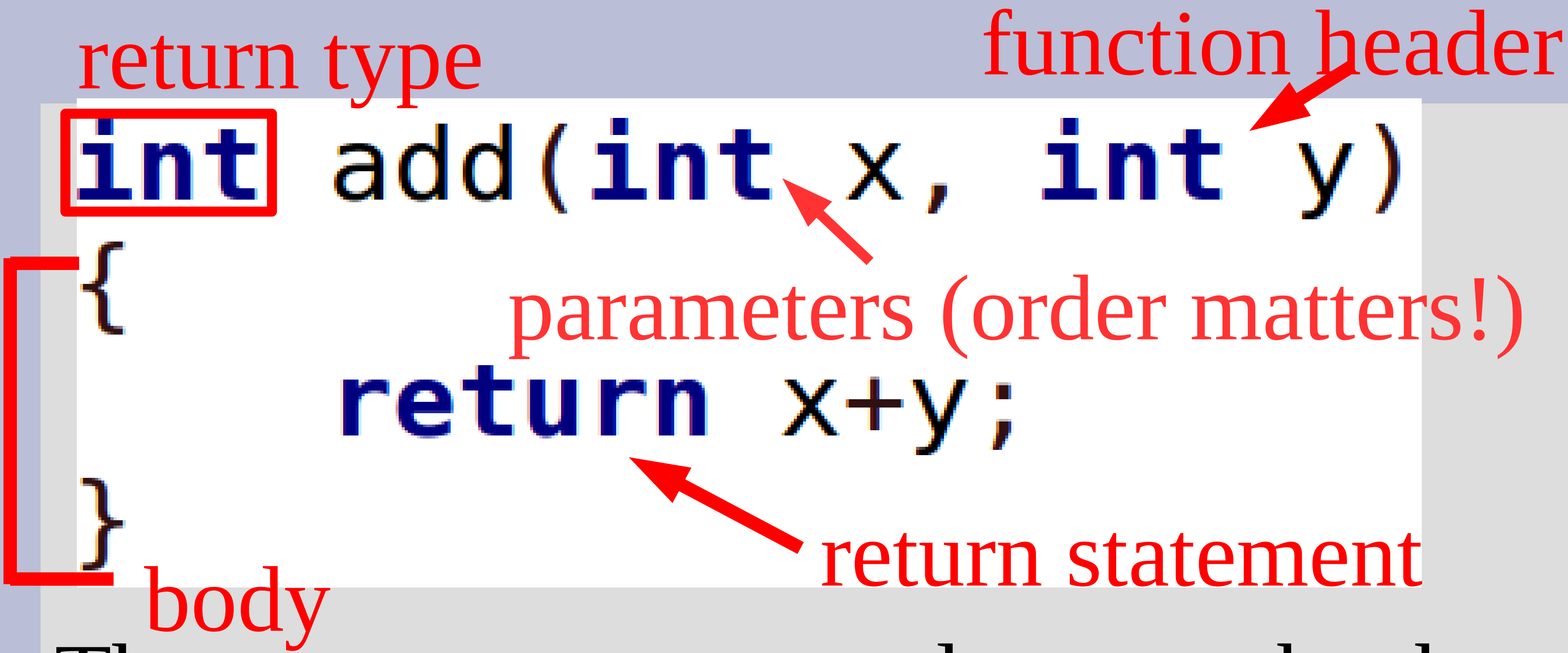
<u>Functions</u> allow you to reuse pieces of code (either your own or someone else's)

Every function has a <u>return type</u>, specifically the type of object returned

sqrt(2) returns a double, as the number will probably have a fractional part

The “2” is an <u>argument</u> to the sqrt function

Functions



```
int add(int x, int y)
{
        return x+y;
}
```

The return statement value must be the same as the return type (or convertible)

```
int x = add(3,5);
```

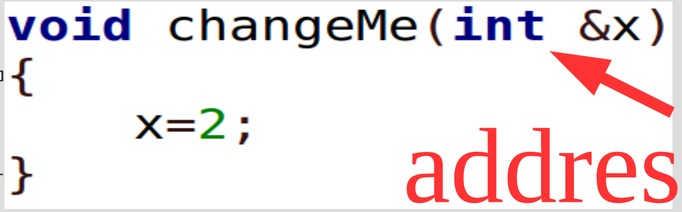
3 to x, 5 to y... value 8 returned and stored in x

Functions

Function call stack (after returning, start from where the previous function called it)

Overloading - same function name, different arguments (typically similar)

Call-by-reference (not copy)



```
void changeMe(int &x)
{
    x=2;
}
```

addresses share

Functions should be minimal

Functions

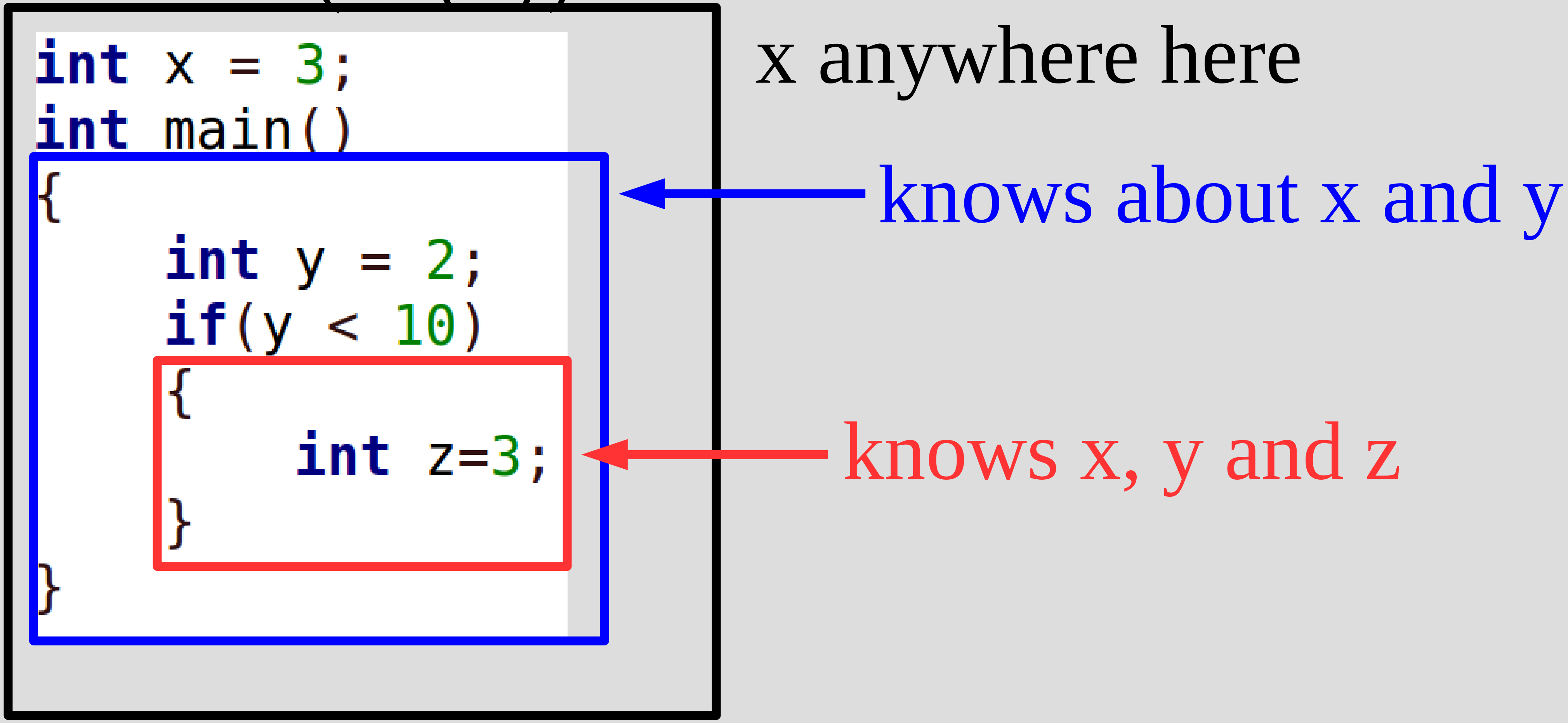
Q1: Write a function that takes in a probability and returns true if the that percent of the time

Q2: Write another function that takes in a probability and an integer, k. This should simulate the probability k times and tell how many times the probability happened.

(See: functionQ.cpp)

Scope

Variables exist in the braces where it is declared (in { })



```
int x = 3;
int main()
{
    int y = 2;
    if(y < 10)
    {
        int z=3;
    }
}
```

Scope

```
int add(int x, int y);
```

```
int main()
{
    int x = add(2, 4);
}
```

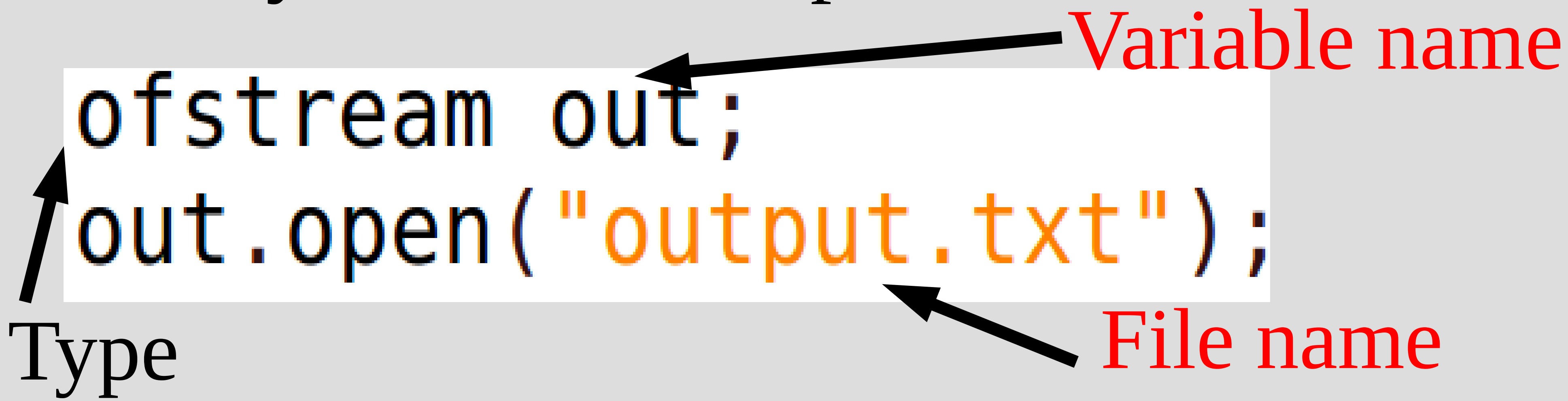
main()'s x lives here

```
int add(int x, int y)
{
    int z = x+y;
    return z;
}
```

add() has a different x, which along with y and z exist in here

File I/O

For files you must first open them:



```
ofstream out;
out.open("output.txt");
```

Then you use “out” instead of “cout” or “cin” depending on if it is an ostream of istream

Also close when done:

```
out.close();
```

File I/O

Can check to see if the program is correctly sending/receiving to/from file:

```
if(out.fail())
{
    exit(1); // non-zero for an error state
}
```

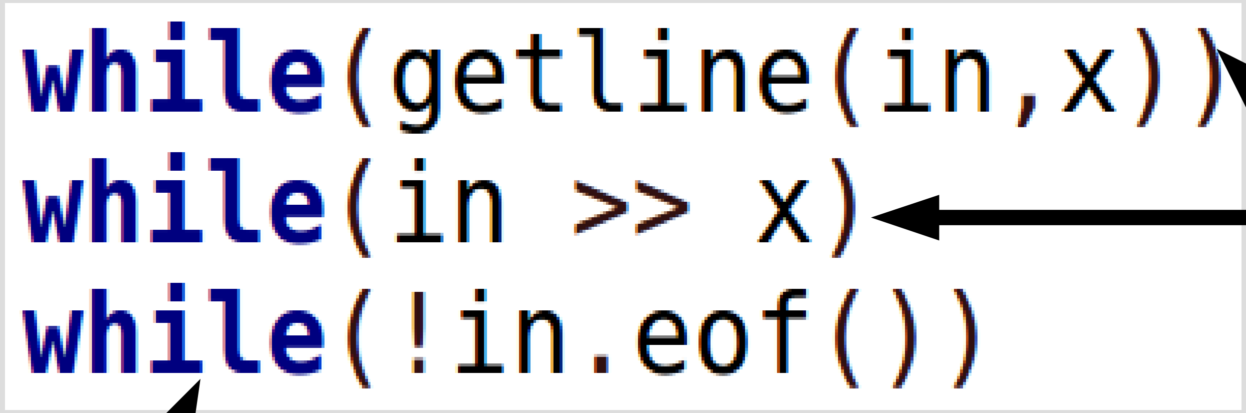
If you want to add to the file instead of replacing it, you have to specify when opening

```
out.open("output.txt", ios::app);
```

End of file (EOF)

When there is nothing left in a file to read, we call it end of file

C++ is fairly nice about handling EOF, and you can detect it in 3 ways:



```
while(getline(in,x))
while(in >> x)
while(!in.eof())
```

reads from file

does not read from file (just tells if at end)

File I/O

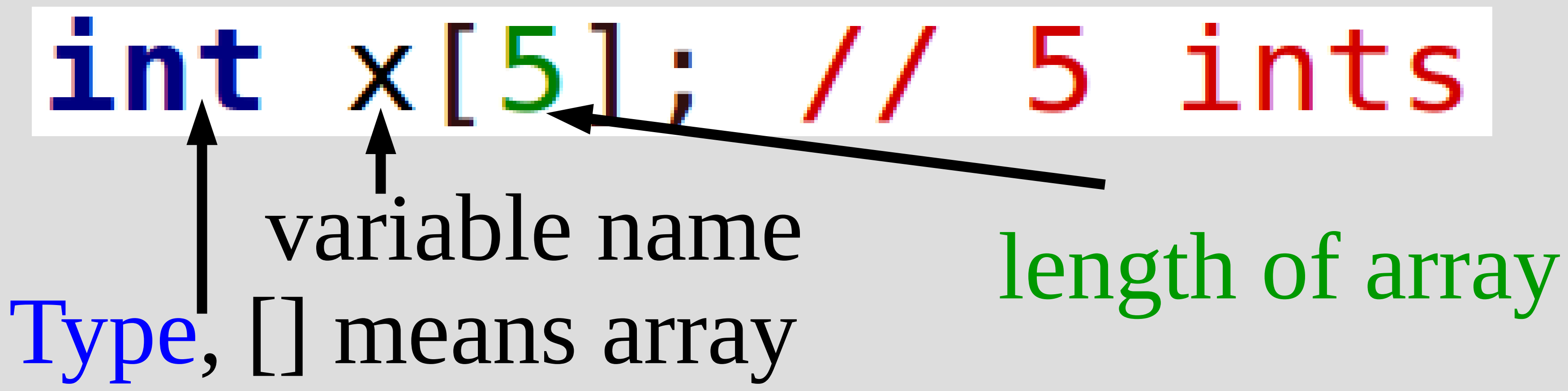
Q3: Read all the numbers from “numbers.txt” and put their sum in “sum.txt”

If you cannot read “numbers.txt”, put “NaN” into “sum.txt”
(you can get this by doing 0.0/0.0)
(technically the above is -NaN...)

(see: fileQ.cpp)

Arrays

Arrays store multiple things of the same type



```
int x[5]; // 5 ints
```

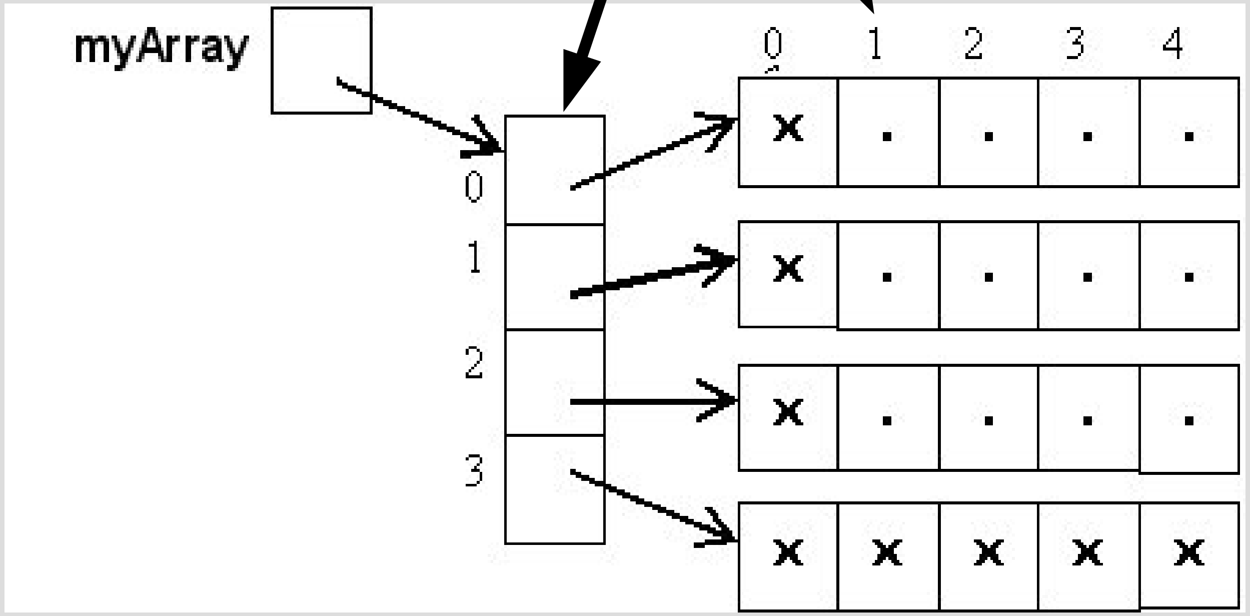
After declaration **any use of [ ]** is interpreted as element indexing

Arrays are memory addresses, shares with functions (cannot call-by-reference)

Multidimensional Arrays

```
string myArray[4][5];
```

four rows five columns



Must specify (some parts of) size when using as argument in function

Arrays

Q4: Write a function that takes two int arrays of length 11 as input. Return true if the first array has more larger numbers when compared to the second element by element:

first = [1, 2, 3, 4], second = [90, 0, 0, 0],
then function would return true as first array has 3 larger elements and 1 smaller:
1 < 90, 2 > 0, 3 > 0, 4 > 0
(see: arrayQ.cpp)

Recursion

There are two important parts of recursion:

-A <u>stopping</u> case that ends the recursion

-A <u>reduction</u> case that reduces the problem

Identify the problem sub-structure, then move inputs towards the base case

$$F_n = F_{n-1} + F_{n-2},$$

$$0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, \ldots$$

You can assume your function works as you want it to (and it will if you do it properly!)

Recursion

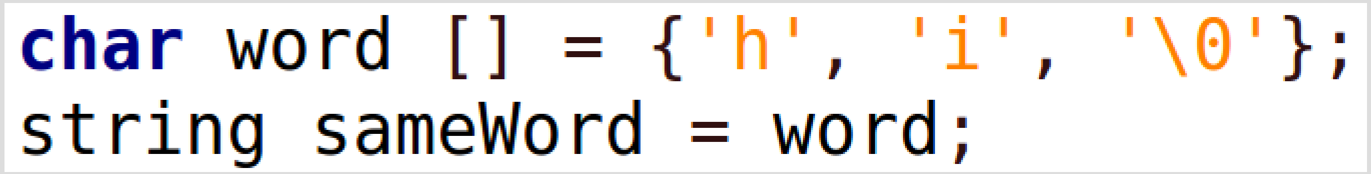
Q5: Write a recursive function that keeps asking if the user wants to stop.
When the character 'q' is pressed, stop and **return** how many inputs other than q they entered

Example input: aabeq
Example output: 4 other numbers

(see: recursionQ.cpp)

C-Strings and strings

c-string uses <u>null character</u> to tell when to end



```
char word [] = {'h', 'i', '\0'};
string sameWord = word;
```

(c++) string is a class (which is a type) and is newer and has many functions:
- find(), substr(), at() or [ ], etc.

Essential for dealing with more than one char at a time

C-Strings and strings

Q6: Write a function that takes a c-string (char array) as input (and its length) and changes it to display half as much
(i.e. “cookies” -> “cook” or “coo”)
(see: cstringQ.cpp)
Q7: Make a word game that repeatedly reads in words until the user repeats a word they have already entered. At this point tell the user they have lost
(see: wordGame.cpp)