

183 Discussion

Week 3 – Diana Gage

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Agenda

- Announcements
- More on cin
- Introduction to functions, RME's
- Explanation of scope
- Practice problems
- Discussion 2 Challenge!
- Looking ahead: conditionals

Announcements

- Project 1 due TONIGHT by 11:59:59pm!
- Last minute questions?
- ** Submit projects by Wednesday night for 5% extra credit, by Thursday night for 2.5%
- Incentive for starting early 😊
- Assignment 2 due a week from today!

More on cin

Using the **extraction operator** >>

- Ignores **leading** whitespace – whitespace is read in but not stored anywhere
- Ex. user types “ 2” instead of “2” → this is okay! “2” still stored in variable
- Reads in char by char
- Converts char(s) to specified data type (type variable expects)
- Stops reading **when it hits** whitespace, or a character of an unacceptable data type
- Will only **successfully** read in if the data type read in can fit into desired data type

getline()

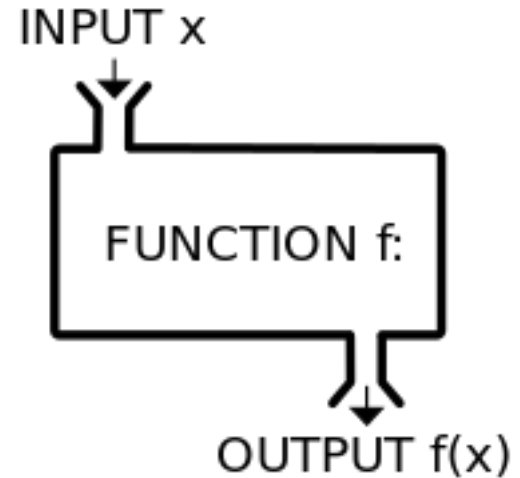
- Use `getline(cin, my_var);` //my_var is a defined variable of the expected input type
- Use `getline()` to get a full line of input, such as first and last name
- What would happen if you just used `cin` to read the name Johnny Appleseed?

getline()

- Syntax: `getline(cin, my_var);` //my_var is a defined variable of the expected input type
- Use `getline()` to get a full line of input, such as first and last name
- What would happen if you just used `cin` to read the name Johnny Appleseed?
- Only Johnny would be stored in the variable because `cin` reads only up to whitespace

Moving onto functions...

- **Definition:** list of statements that can be executed by calling its name → `int main()` is a function!
- A **function** is a block of code with a *specific task* within a program → essentially a **mini program**
- Functions often take in input values, do some work, and return a **single value** that will be used by whoever called the current function (i.e. `main` or another function)



Output (return value) is sent back to where function was called from

Moving onto functions...

- There are **library functions** (functions that already exist in different libraries available to you in C++)
 - Sqrt(), abs(), ceil(), floor() → include <cmath> library
- There are also **user-defined functions** (functions you create to develop your program)
- Functions help reduce duplication of code
- You can reuse them with **different parameters (inputs)** to complete a specific task → you don't have to type the same calculations over and over again! Just use a function

Thinking about functions...

Separate print statements for each ingredient vs.
One function that takes in ingredient and needed amount, and prints these out

```
How many people do you need to serve? 3
```

```
You need to make: 1 batch of cupcakes
```

```
Shopping List for "Best Ever" Vanilla Cupcakes
```

```
-----  
1 bag of flour  
1 bag of granulated sugar  
1 pound of butter  
1 container of sour cream  
1 dozen eggs  
1 bag of powdered sugar  
1 bottle of vanilla
```

```
Total expected cost of ingredients: $17.84
```

```
Have a great party!
```

Functions

Most important elements of a function:
**name, parameters/inputs, output (what's returned),
return type, task/body**

Setting up a function:

- What should the function do?
- What descriptive name should it have?
- Will it take inputs? Why? What kind?
- Should it return a value? Why? What kind?
- How will it do the necessary work?

Add Function

```
int main() {  
    cout << add(2, 3);  
    return 0;  
}
```

main() calls add
function and passes it
two ints, 2 and 3

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

This works, because function
expects two ints!

parameters

add() uses **parameters** to calculate
sum (local int variable to add()) by
adding x and y

add() **returns** sum to where add()
was called from and exits

↑
output

***What's add()'s
return type?***

Add Function

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int main() {  
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output

***What's add()'s
return type?***

int!

Function Practice

Finish the following user-defined function, which says hello to whoever (the name) we pass into it as input

```
_____ say_hello (string _____) {  
    cout << _____ << _____ << endl;  
}
```

Function Practice

Finish the following user-defined function, which says hello to whoever (the name) we pass into it as input

```
void say_hello (string _____) {  
    cout << _____ << _____ << endl;  
}
```

Function Practice

Finish the following user-defined function, which says hello to whoever (the name) we pass into it as input

```
void say_hello (string name_in) {  
    cout << _____ << _____ << endl;  
}
```

Function Practice

Finish the following user-defined function, which says hello to whoever (the name) we pass into it as input

```
void say_hello (string name_in) {  
    cout << "Hello " << _____ << endl;  
}
```


Function Practice

Finish the following user-defined function, which says hello to whoever (the name) we pass into it as input

```
void say_hello (string name_in) {  
    cout << "Hello " << name_in << endl;  
}
```

Function Practice

Finish the following user-defined function, which says hello to whoever (the name) we pass into it as input

```
void say_hello (string name_in) {  
    cout << "Hello " << name_in << endl;  
    return; //ends the function  
}
```

Function Practice

- Now let's call this function from main()
- We need to:
- Declare and initialize the variable we will pass in
- Call our function

```
void say_hello (string name_in) ; //function declaration
```

```
int main(){  
    _____ name = "Jimmy";  
    say_hello(_____);  
}
```

Function Practice

- Now let's call this function from main()
- We need to:
- Declare and initialize the variable we will pass in
- Call our function

```
void say_hello (string name_in) ; //function declaration
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```
int main(){  
    string name = "Jimmy";  
    say_hello(name);  
}
```

Function Practice

- Now let's call this function from main()
- We need to:
- Declare and initialize the variable we will pass in
- Call our function

```
void say_hello (string name_in) ; //function declaration
```


```
int main(){
```

```
    name = "Jimmy";
```

```
    say_hello("Jimmy");
```

```
}
```

Could we call say_hello()
this way too?



Function Practice

- Now let's call this function from main()
- We need to:
- Declare and initialize the variable we will pass in
- Call our function

```
void say_hello (string name_in) ; //function declaration
```

```
int main(){  
    _____name = "Jimmy";  
    say_hello("Jimmy");  
}
```

Could we call say_hello()
this way too?

Yes!

Full Program

```
void say_hello (string name_in); // function declaration
```

```
int main(){  
    string name = "Jimmy";  
    say_hello(name);  
}
```

```
void say_hello (string name_in) {  
    cout << "Hello " << name_in << endl; // implementation  
}
```

Scope

- A variable can either have **local scope** or **global scope**
- Local scope
 - Exists only within **current function**
- Global scope
 - Exists for **all functions** in the program

Full Program && Scope

```
void say_hello (string name_in); // function declaration
```

```
int main(){  
    string name = "Jimmy";  
    say_hello(name);  
}
```

What is the scope of the variable `name`?

```
void say_hello (string name_in) {  
    cout << "Hello " << name_in << endl; // implementation  
}
```

What is the scope of the variable `name_in`?

Full Program && Scope

```
void say_hello (string name_in); // function declaration
```

```
int main(){  
    string name = "Jimmy";  
    say_hello(name);  
}
```

What is the scope of the variable `name`?
LOCAL to main()

```
void say_hello (string name_in) {  
    cout << "Hello " << name_in << endl; // implementation  
}
```

What is the scope of the variable `name_in`?
LOCAL to say_hello()

Global Variables

- A global variable is declared outside of any and all functions → *above everything so any function (main included) can use it!*
- Must be named in ALL CAPS
- Must be declared **const**

**** Remember: **const** means the variables cannot be changed anywhere in the program**

RME's

// REQUIRES:

// MODIFIES:

// EFFECTS:

- Put an RME above any user-defined function you create
- These are special types of comments specific to functions
- Functions given to you will have RME's
- RME's are meant to aid the user

Fix this Function!

```
int code_master(string n){  
  
    cout >> "Hello" >> n >> endl  
    "You are the code master!";  
    n = Code Master;  
    return n;  
}
```

Fix this Function!

```
int code_master(string n){  
  
    cout >> "Hello_" >> n >> endl_  
    _____ "You are the code master!";  
    n = Code Master;  
    return n;  
}
```

Corrected Version:

```
string code_master(string name_in){  
  
    cout << "Hello_" << name_in << endl;  
    cout << "You are the code master!";  
    name_in = "Code Master";  
    return name_in;  
}
```

Why use a function?

- Helps reduce duplicated code
- Call more than once with new parameters to do the same work, but with new values
- **One approach:** If you know all the details about a function (RME) you can implement it...
 - assuming everything else, including main, already works (even if it doesn't yet)

Why use a function?

- **Another approach:** plan out the logic of your `main()` first
 - you can assume all the functions already do what they are supposed to do...
 - even though you haven't implemented them yet!
-
- Helps organize your project and your code
 - This is good for you, and also for anyone that reads or uses your code

Function Signature

- what is the function signature of our add function?

```
int add (int a, int b){  
    return a + b;  
}
```

Function Signature

what is the function signature of our add function?

```
int add (int a, int b){  
    return a + b;  
}
```

int add(int, int) or int add(int a, int b)

The first of these is ONLY a valid function **signature, declaration or prototype**, not a valid function **definition** (which is when you actually implement it)

Function Signature

The signature of a function is the combination of the unique/defining elements of the function

- Return type
- Name
- Parameter *types*

Scope practice

- What is an example of Local scope?
- What is the difference between a global variable, and a const global variable?
- Which do we NEVER use?

Scope Practice

- What is the difference between a global variable, and a const global variable?
- Which do we NEVER use?
- We NEVER use **global** variables
- We do use **const global** variables
- If you are going to use a variable with a global scope, it MUST be declared const, it must be in ALL CAPS and never be changed throughout the program

Testing – very important for functions!

- The purpose of testing is to write a few lines of code that clearly **show you whether your function works** as it should, or your code does what you expect it to do
- The tests should display your program or function's output (using `cout`)
- The *correct* or *expected* output should be displayed in a comment
- If the output and the expected differ, your test code caught a bug in your code

Testing Example

// write a few lines of code that add three numbers together and store them in a variable called sum

```
int x = 3;
```

```
double y = 4.3;
```

```
int sum = x + y;
```

//expected output: 7 (why?)

```
cout << sum << endl;
```


Testing Example

// write a few lines of code that add three numbers together and store them in a variable called sum

```
int x = 3;
```

```
double y = 4.3;
```

```
int sum = x + y;
```

//expected output: 7 (why?)

```
cout << sum << endl;
```

since sum is an integer, y is truncated (as occurred with double vs integer division) and then the two are added together

Challenge Problem!

- Let's say we want a program that will print the **exact integer square root** of a number, if there is one.
 - ie $\sqrt{64} = 8$ //good, this is an integer
 - But $\sqrt{12} = 3.4641$ // no good
- Otherwise, it will tell the user that there is no exact square root, and round to the nearest integer

Challenge: Notes for Implementation

Remember:

- `#include <_____>`
- We need `iostream`, `string`, and `cmath`
- `using namespace std;`
- Function declarations
- `int main()`
- `return 0;` at the end of `main`
- Function implementations
- **ceil and floor functions**
- We will need write two of our own functions
- One will call the other!

**Follow this order
for your program!**