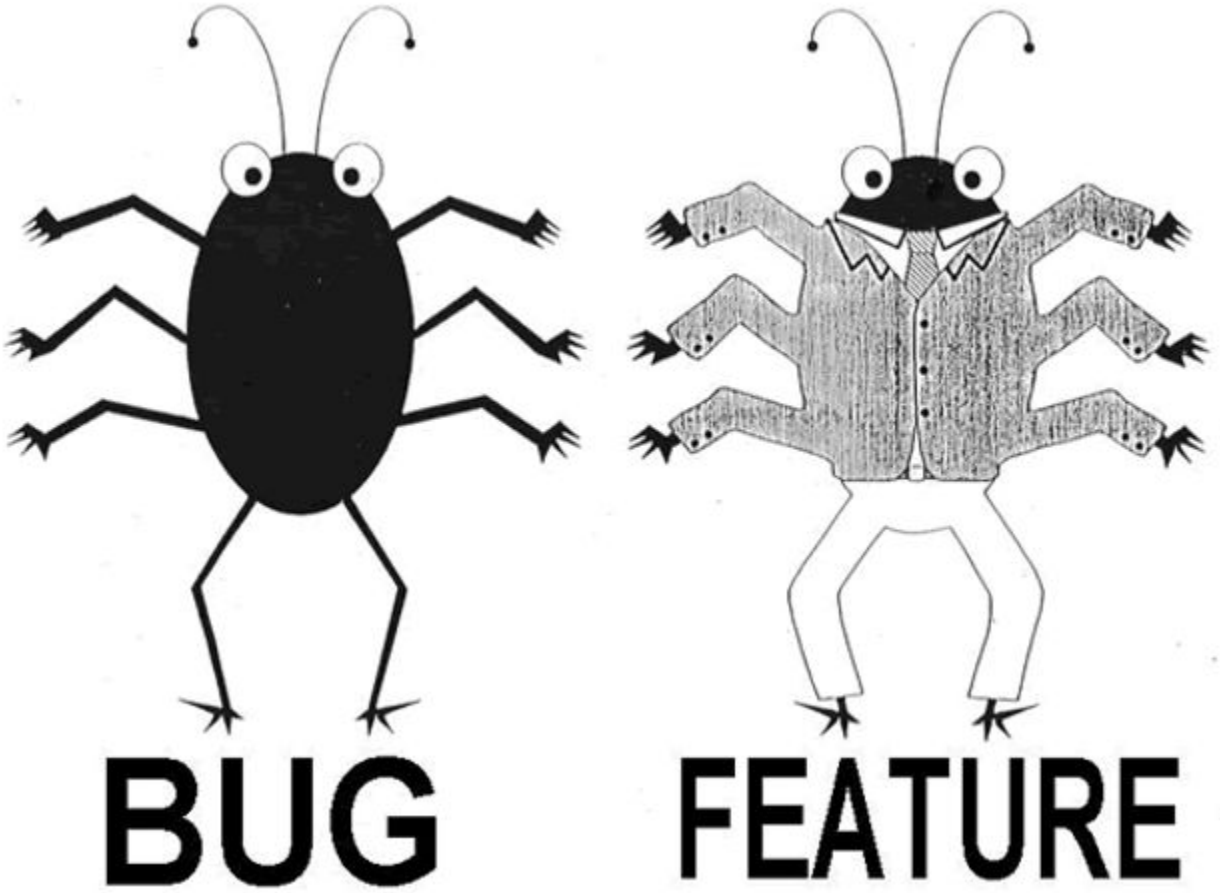
Lab 5: Getting Started with C++



Some remarks

- C++ Files folder on Canvas contains C++ setup instructions in PDF
- Lab 5 folder contains PDF for useful terminal commands

Agenda

- **Practice Questions**
- Comments on Debugging
- Lab 5 assignment
- Weekly Reminders
- Q&A

Practice Problem #1

Say we want the output

```
Welcome to C++!
<space>
<space>
Hope you enjoy.
```

Option 1:

```
cout << "Welcome to C++!" << endl;
cout << endl << endl;
cout << "Hope you enjoy.";
```

Option 2:

```
cout << "Welcome to C++!" << endl;
cout << endl;
cout << "Hope you enjoy.";
```

Option 3:

```
cout << "Welcome to C++!" << endl << endl << endl;
cout << "Hope you enjoy.";
```

Which code snippet below will give us the right output? Note: <space> isn't printed. It's there to denote that there are two lines of spaces between the two phrases.

A. Options 1 and 3
B. Option 2
C. Option 3
D. Options 2 and 3

Practice Problem #1: Solution

Say we want the output

```
Welcome to C++!
<space>
<space>
Hope you enjoy.
```

Option 1:

```
cout << "Welcome to C++!" << endl;
cout << endl << endl;
cout << "Hope you enjoy.";
```

Option 2:

```
cout << "Welcome to C++!" << endl;
cout << endl;
cout << "Hope you enjoy.";
```

Option 3:

```
cout << "Welcome to C++!" << endl << endl << endl;
cout << "Hope you enjoy.";
```

Which code snippet below will give us the right output? Note: <space> isn't printed. It's there to denote that there are two lines of spaces between the two phrases.

A. Options 1 and 3
B. Option 2
C. Option 3
D. Options 2 and 3

Practice Problem #2

Given

```
#include <iostream>


using namespace std;


int main() {
   int wage = 0;
   wage = 20;
   cout << "Salary is ";
   cout << wage * 40 * 50;
   cout << endl;
   return 0; }
```

What's the value of `wage` after main executes?

A. 20
B. 0
C. 40000

Practice Problem #2: Solution

Given

```
#include <iostream>


using namespace std;


int main() {
   int wage = 0;
   wage = 20;
   cout << "Salary is ";
   cout << wage * 40 * 50;
   cout << endl;
   return 0; }
```

What's the value of `wage` after main executes?

A. 20
B. 0
C. 40000

Practice Problem #3

Given

```
#include <iostream>


using namespace std;


int main() {
   int wage = 0;
   wage = 20;
   cout << "Salary is ";
   cout << (wage = wage * 40 * 50);
   cout << endl;
   return 0;
```

What's the value of `wage` after main executes?

A. 20
B. 0
C. 40000

Practice Problem #3: Solution

Given

```
#include <iostream>


using namespace std;


int main() {
   int wage = 0;
   wage = 20;
   cout << "Salary is ";
   cout << (wage = wage * 40 * 50);
   cout << endl;
   return 0;
```

What's the value of `wage` after main executes?

A. 20
B. 0
C. 40000

Practice Problem #4

Given

```
#include <iostream>

using namespace std;

int main() {
   double a = 1.0;
   double b = 2.0;
   int c;
   double d;

   c = a/b;
   d = a/b;

   cout << c << endl;
   cout << d << endl;
   return 0;
}
```

What's the output?

A. 0
   0

B. 0.5
   0.5

C. 0
   0.5

Practice Problem #4: Solution

Given

```
#include <iostream>

using namespace std;

int main() {
   double a = 1.0;
   double b = 2.0;
   int c;
   double d;

   c = a/b;
   d = a/b;

   cout << c << endl;
   cout << d << endl;
   return 0;
}
```

What's the output?

A. 0
   0

B. 0.5
   0.5

C. 0
   0.5

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Basic Structure of a C++ program

```
#include <library_name>
using namespace std;

int main() {
    /* your code goes here */
    return 0;
}
```

libraries define the functions you can use

sets the scope of the types/functions you will use

Main is a special function; Execution of the program always begins at main

Basic C++ program

```
#include <iostream>
using namespace std;

int main() {
    int section = 101;
    cout << "hello section " << section << "!" << endl;
    return 0;
}
```

include your libraries

set std namespace

in C++, declare the type of a variable before using it

in C++, end lines with a semicolon

use quotes to print the exact text

no quotes indicate a variable and will print the value of that variable

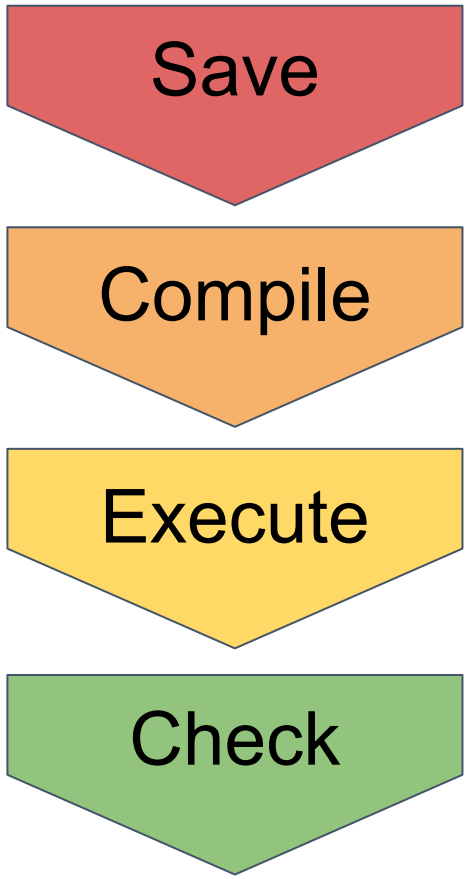
Remember to always have return 0 in main!

Program Output:

```
bash-4.1$ ./example.out
hello section 101!
bash-4.2$
```

Workflow

Every time you make a change...



Save the new changes in your code (.cpp file)

Create new executable (.out file) to reflect those changes

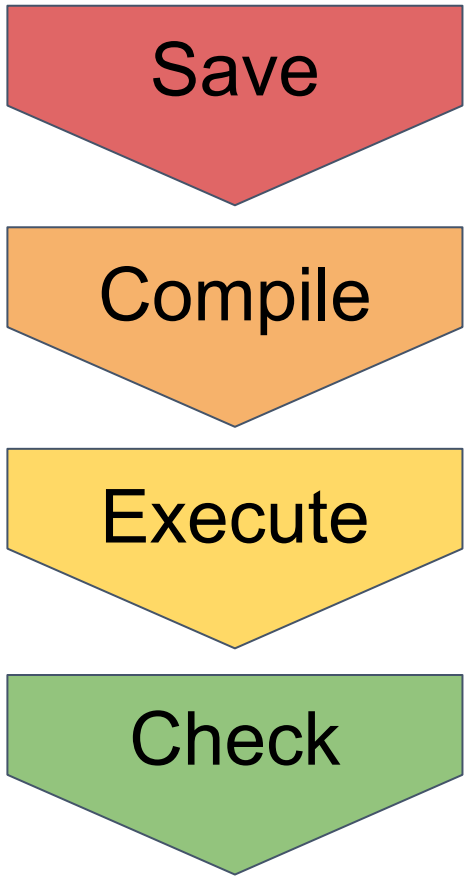
Re-run the new executable

See the effects of the changes you made

Workflow

Every time you make a change...

use the up arrow key to retrieve previous commands!



save

g++ -Wall -Werror filename.cpp -o filename.out

./filename.out

check results with `cout` statements or `diff` output file against pre-computed solution

Debugging Tips

MATLAB

- Check your Workspace and compare!
- `disp`, statements not terminated with ‘`;`’

C++

- `cout` to print out variables, statements, etc.
- `diff` (you’ll practice this in Lab 5 Exercise 1)

Debugging examples

- Print variables by either using disp(var_name), or by removing the semicolon at the end of the line. These are especially useful when you are writing functions, since the variables are not saved to the workspace.

❖ disp doesn't show the variable name

```
% Get School Averages
average_fb_ratios = sum(fb_ratios) / num_years;
average_bb_ratios = sum(bb_ratios) / num_years;
disp(average_fb_ratios)
disp(average_bb_ratios)
```

Output:

```
0.6511    0.8269    0.5918    0.6292    0.5415    0.6343

0.5186    0.6314    0.6920    0.5797    0.3333    0.2933
```

❖ Removing the semicolon shows the name of the variable being printed to the console.

```
% Get School Averages
average_fb_ratios = sum(fb_ratios) / num_years
average_bb_ratios = sum(bb_ratios) / num_years
```

Output:

```
average_fb_ratios =

    0.6511    0.8269    0.5918    0.6292    0.5415    0.6343

average_bb_ratios =

    0.5186    0.6314    0.6920    0.5797    0.3333    0.2933
```

Debugging examples

- For large arrays, use the size of the matrix as a sanity check. You can double click on the variable in the workspace to see the array as a spreadsheet

```
% Read in Football wins data from input file
fb_wins = readmatrix('stats.xlsx', 'Sheet', 1, 'Range', 'B2:G20');
disp(size(fb_wins));
```

Output:

```
    19     6
```

fb_wins

19x6 double

	1	2	3	4	5
1	9	8	5	9	8
2	8	7	7	5	4
3	10	14	4	10	3
4	10	11	8	5	6
5	9	8	5	6	6
6	7	10	5	9	7
7	11	12	4	10	4
8	9	11	7	3	6
9	3	10	9	7	9
10	5	11	6	6	8

General Ideas

- Comment your code! Organize it into sections!
- Debug line by line.
- Write down or think about what you expect as the output for each line, before printing.
- Understand what you've written and what you've tried to debug!
- Patience → it usually takes multiple debug attempts to resolve issues. Solving one error may expose another!

OH and Piazza

- Follow the debugging guidelines to isolate a few lines of code with the error.
- When you reach out, formulate your question as a conceptual question:
  - eg: “I am not sure how to concatenate two strings. This is what I’ve written, is this right?”
  - “This line of code does this: ___. I want it to do this: ___. How can I perform this operation?”
- Paste/show the relevant line(s) of code if you think it is important.
- This will help you get answers faster!
- You may end up solving your issue in the process of formulating these questions!

Common Errors in C++

- You didn’t save your cpp file with .cpp extension
- Not in the same directory
- Typos in command line
- Unterminated statements (missing ‘;’)

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Today’s lab - C++ Introduction

- Exercise 1: Compiling a program and debugging practice
- (Optional) Exercise 2: Writing a simple program

Goal: This lab is to get you set up for C++

Warning: Expect a learning curve when getting used to any programming environment. It may be frustrating at first, but once your foundation is built, your programming experience will be smoother

Note: You will no longer submit your programs to Canvas, instead you will submit your programs to autograder.io

Useful basics for lab assignment

Topic	**Example**	**Notes**
Writing a comment	// your comment here	Comments are just for people, the computer ignores that text
Printing output	cout << “output message”	cout << endl prints a new line
Getting user input	cin >> variable_name	What the user enters is stored in the variable
Declaring type of variable	*type variable_name* ex. int number_of_pets; double volume;	in C++ you must declare a variable’s type before using it

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- **Q&A**

Weekly Reminders

- Project 2:
  - MATLAB
  - Released October 2nd
  - Due October 18th
  - Start soon, come to office hours!
- Lab 5 due 6 days from today

Questions?