C++ DATA TYPES
BASIC CONTROL FLOW

Problem Solving with Computers-I

Chapter 1 and Chapter 2

Review: Program compilation

What does it mean to “compile” a C++ program?

A. Write the implementation of the program in a .cpp file
B. Convert the program into a form understandable by the processor
C. Execute the program to get an output
D. None of the above

Kinds of errors

Which of the following types of errors is produced if our program divides a number by 0?

A. Compile-time error
B. Run-time error
C. Both A and B
D. Neither A nor B

Let's play Fizzbuzz

We'll play fizzbuzz and then code it up!

In the process we will learn about different ways of getting input into C++ programs:

Standard input cin

- Arguments to main
- Reading from files (a later lecture)

We will also learn about diffferent ways of showing output to C++ programs:

Let's code Fizzbuzz -1.0

$ Enter a number: 1
1
$ Enter a number: 2
2
$ Enter a number: 3
fizz
$ Enter a number: 4
4

$Enter a number: 5
5
$Enter a number: 6
fizz
$Enter a number: 7
7
$Enter a number: 15
fizz

Review: C++ Variables and Datatypes

- **Variables** are containers to store data
- **C++** variables must be “declared” before they are used by specifying a datatype
  - `int`: Integers
  - `double`: floating point numbers
  - `char`: characters

C++ Uninitialized Variables

- Value of uninitialized variables is “undefined”
- Undefined means “anything goes”
- Can be a source of tricky bugs

- What is the output of the code below?

```
int main() {
    int a, b;
    cout<<"The sum of "<< a << " and " << b<< " is:"<< a+b<<endl;
}
```

Variable Assignment

- The values of variables can be initialized...

```
int myVariable = 0;
```

-or-

```
int myVariable;
myVariable = 0;
```

- ...or changed on the fly...

```
int myVariable = 0;
myVariable = 5 + 2;
```

Variable Assignment

- ...or even be used to update the same variable!

```
int myVariable = 0;
myVariable = 5 + 2;
myVariable = 10 - myVariable;
myVariable = myVariable==0;
```

Control flow: if statement

- The `condition` is a **Boolean expression**
- These can use relational operators

```
if ( Boolean expression) {
   // statement 1;
   // statement 2;
}
```

- In C++ 0 evaluates to false
- Everything else evaluates to true

Examples of if statements

- The `condition` is a **Boolean expression**
- These can use relational operators

```
if ( 1 < 2 ) {
   cout<< "foo" ;
}

if ( 2 == 3) {
   cout<<"foo" ;
}
```

Use the curly braces even if you have a single statement in your if

Fill in the ‘if’ condition to detect numbers divisible by 3

A. `x/3 == 0`

B. `!(x%3)`

C. `x%3 == 0`

D. Either B or C

E. None of the above

```
if ( _________ )
   cout<< x << “is divisible by 3 \n” ;
}
```

Control Flow: if-else

```
if (x > 0){
    pet = dog;
    count++;
}   else {
    pet = cat;
    count++;
}
```

- Can you write this code in a more compact way?

Control Flow: Multiway if-else

```
if (x > 100){
    pet = dog;
    count++;
}   else if (x > 90){
    pet = cat;
    count++;
}   else {
    pet = owl;
}
```

- Can you write this code in a more compact way?

Let's code Fizzbuzz -2.0 (taking arguments from main)

$ ./fizzbuzz 1
1

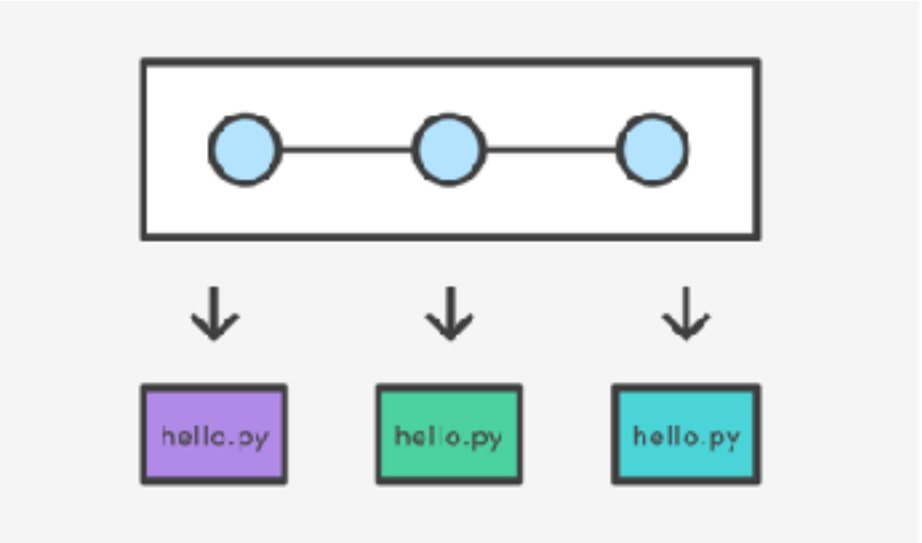
$ ./fizzbuzz 9
Fizz

$ ./fizzbuzz 15
Fizzbuzz

What is git?

Git is a version control system (VCS).

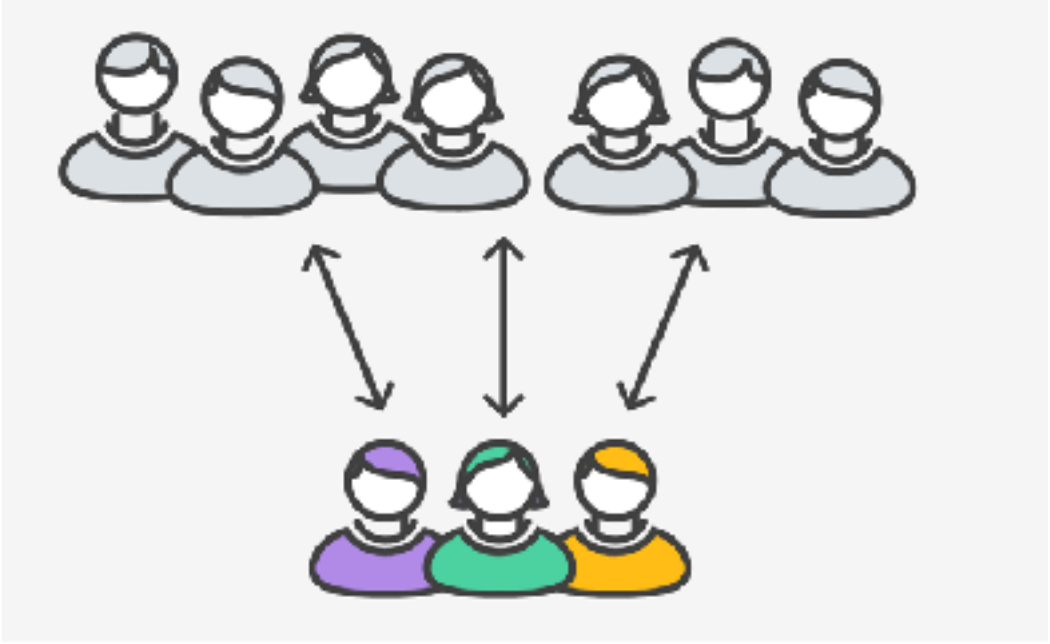
A VCS allows you to keep track of changes in a file (or groups of files) over time



Git allows you to store code on different computers and keep all these different copies in sync

Why are we learning git in this class?

- Collaborate
- Share code ownership
- Work on larger projects
- Provide feedback on work in progress
- Learn professional software development tools

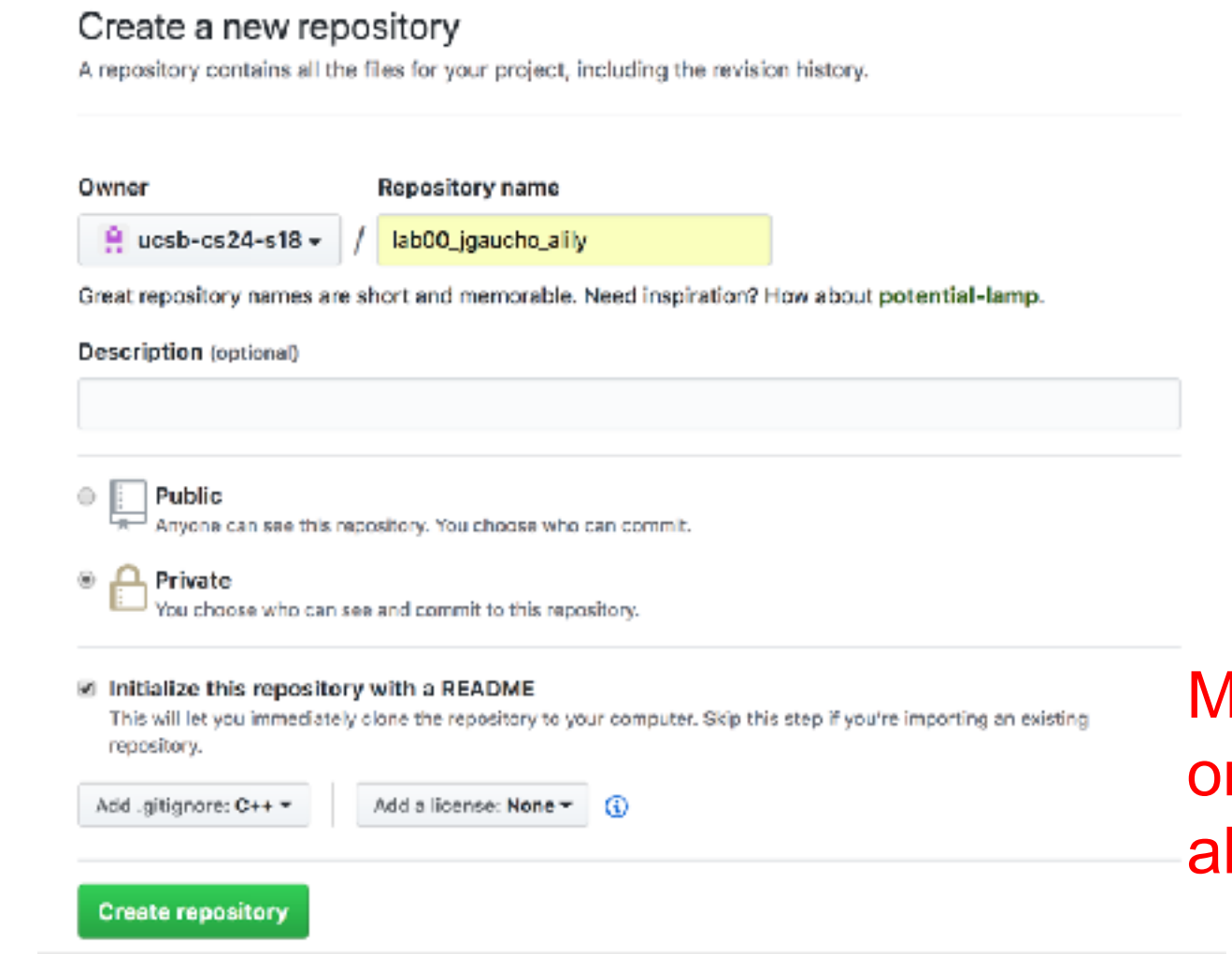


Git Concepts

repo (short for repository): a place where all your code and its history is stored

Creating a repo on the cloud (www.github.com)

Navigate to www.github.com and create a repo on the internet



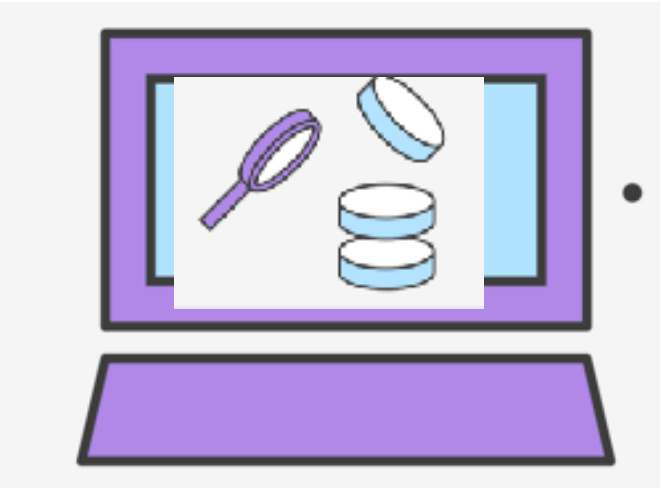
Remote repo

Make sure the repo is inside our class organization! (Otherwise you won't be able to make a private one)

Cloning a repo

```
git clone <repo>
```

Different “states” of a file in a local repo



Remote repo

To inspect the state of a file use:
git status

Workspace

Staging area

Saved in local repo

- Any file that is modified (in an editor) is saved in the **workspace**

Saving a file (in the local repo)

Remote repo

git add <filename>
git add .

git commit -m “message”

Workspace

Staging area

Saved in local repo

Syncing repos: pushing local updates to remote

git push

Local repo

Remote repo

Syncing repos: pulling the latest changes from remote

git pull

Local repo

Remote repo

Numbers

DISPLAY 2.2 Some Number Types

Type Name	Memory Used	Size Range	Precision
short (also called *short int*)	2 bytes	-32,768 to 32,767	(not applicable)
int	4 bytes	-2,147,483,648 to 2,147,483,647	(not applicable)
long (also called *long int*)	4 bytes	-2,147,483,648 to 2,147,483,647	(not applicable)
float	4 bytes	approximately 10^{-38} to 10^{38}	7 digits
double	8 bytes	approximately 10^{-308} to 10^{308}	15 digits
long double	10 bytes	approximately 10^{-4932} to 10^{4932}	19 digits

These are only sample values to give you a general idea of how the types differ. The values for any of these entries may be different on your system. `Precision` *refers to the number of meaningful digits, including digits in front of the decimal point. The ranges for the types* `float`, `double`, *and* `long double` *are the ranges for positive numbers. Negative numbers have a similar range, but with a negative sign in front of each number.*

Comparison Operators

DISPLAY 2.10 Comparison Operators

Math Symbol	English	C++ Notation	C++ Sample	Math Equivalent
=	equal to	==	x + 7 == 2 * y	x + 7 = 2y
≠	not equal to	!=	ans != 'n'	ans ≠ 'n'
<	less than	<	count < m + 3	count < m + 3
≤	less than or equal to	<=	time <= limit	time ≤ limit
>	greater than	>	time > limit	time > limit
≥	greater than or equal to	>=	age >= 21	age ≥ 21