Development Environment

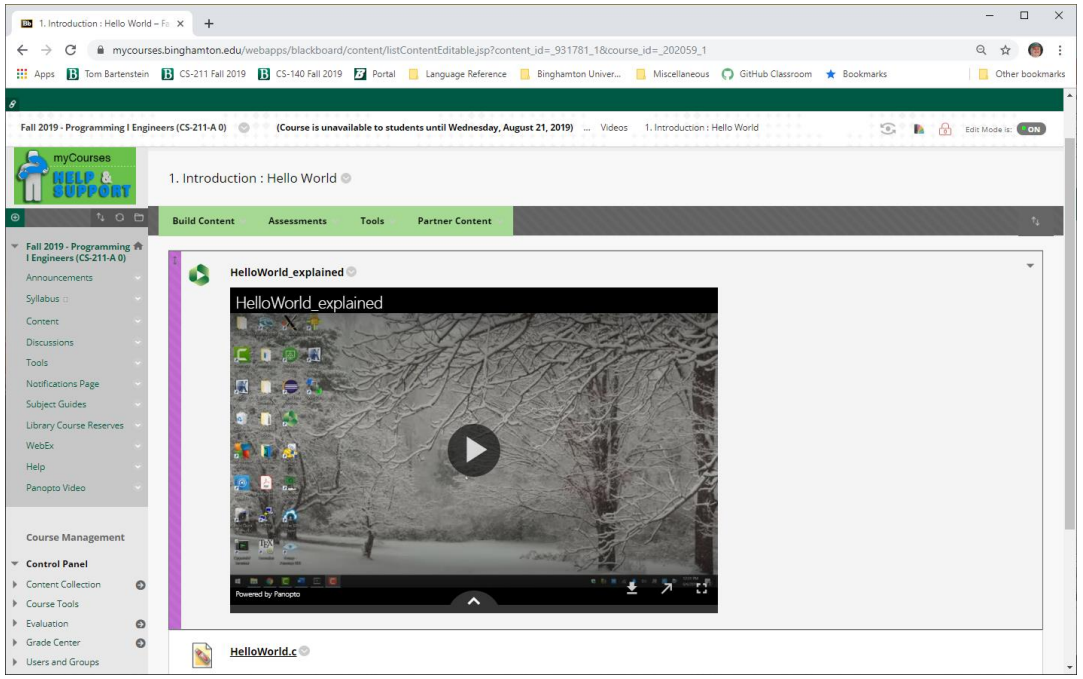
iClicker Attendance

Please click on A if you are here:

A. I am here today.

Video Review: Hello World

- Terminal Window
- Unix Directories
- #include
- The main function
- C instructions
- Running the compiler
- Running the compiled code (the command)
- Compiler errors



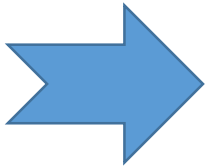
Demonstration

- Creating and Running “Hello World” using SSH/Remote
- Showing edit:
  - On remote system
  - Using MobaXterm automated Upload/Download
  - Using WinSCP automated Upload/Download
  - Using mounted U-Drive

Algorithm

- List of instructions that transform input into output
  - Finite set of steps
  - Executed in a definite order by a deterministic mechanism
  - Execution must terminate

- Analogous to a recipe
  - Finite set of steps
  - Executed in a definite order (but may not be a deterministic mechanism)
  - Execution terminates



Computer

A programmable algorithm execution machine

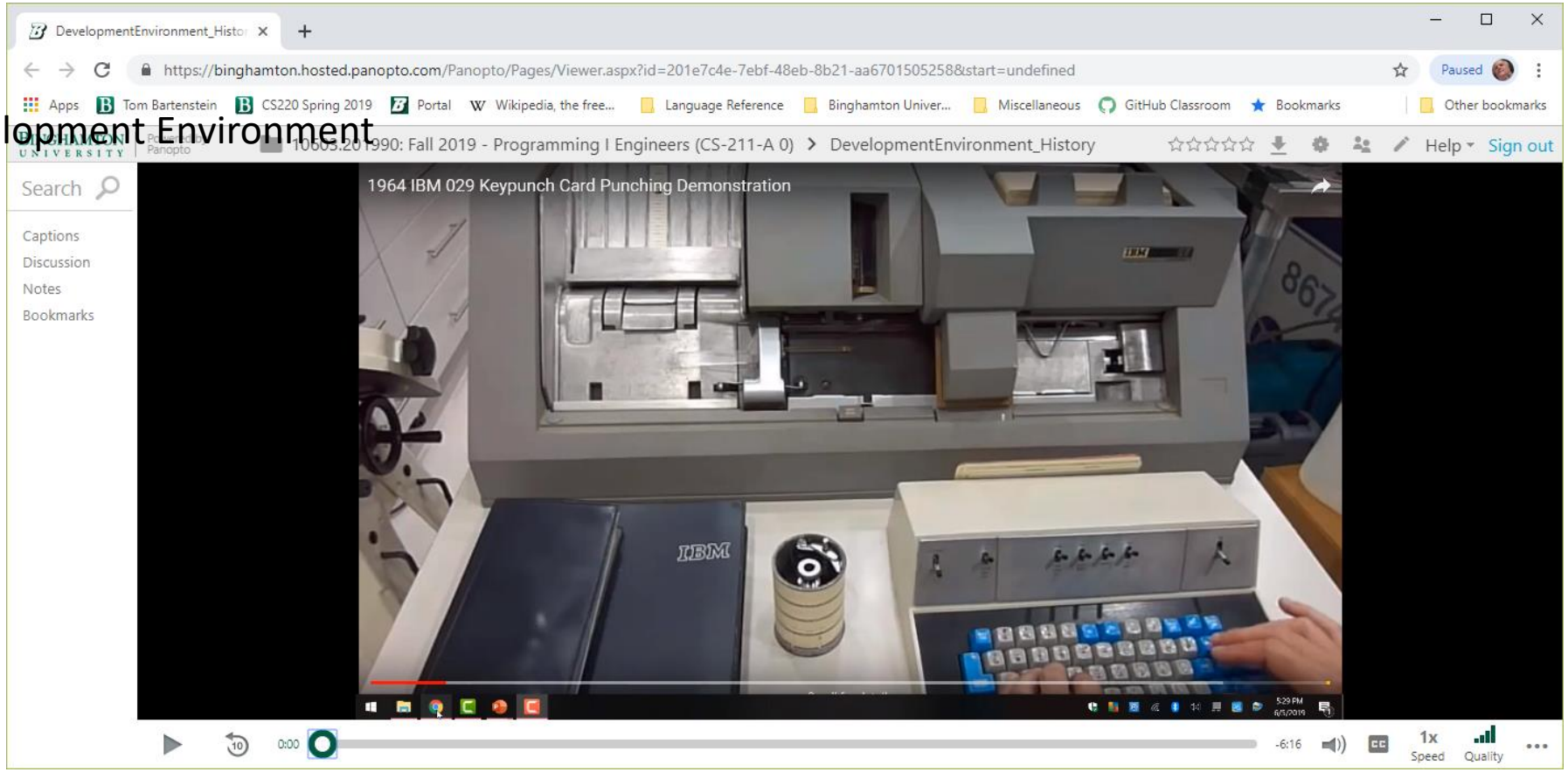
iClicker Question

Please click on the FIRST choice that is true:

A. I have written and run a program in C.
B. I have written and run a program in Python.
C. I have written and run a program in some other language (e.g. Java)
D. I have never written a computer program before

Historical Background: Terminal Window

- Watch the video, available on myCourses
  - Content
    - Videos
      - 2. Development Environment



Using Terminal Windows

- Watch the video, available on myCourses
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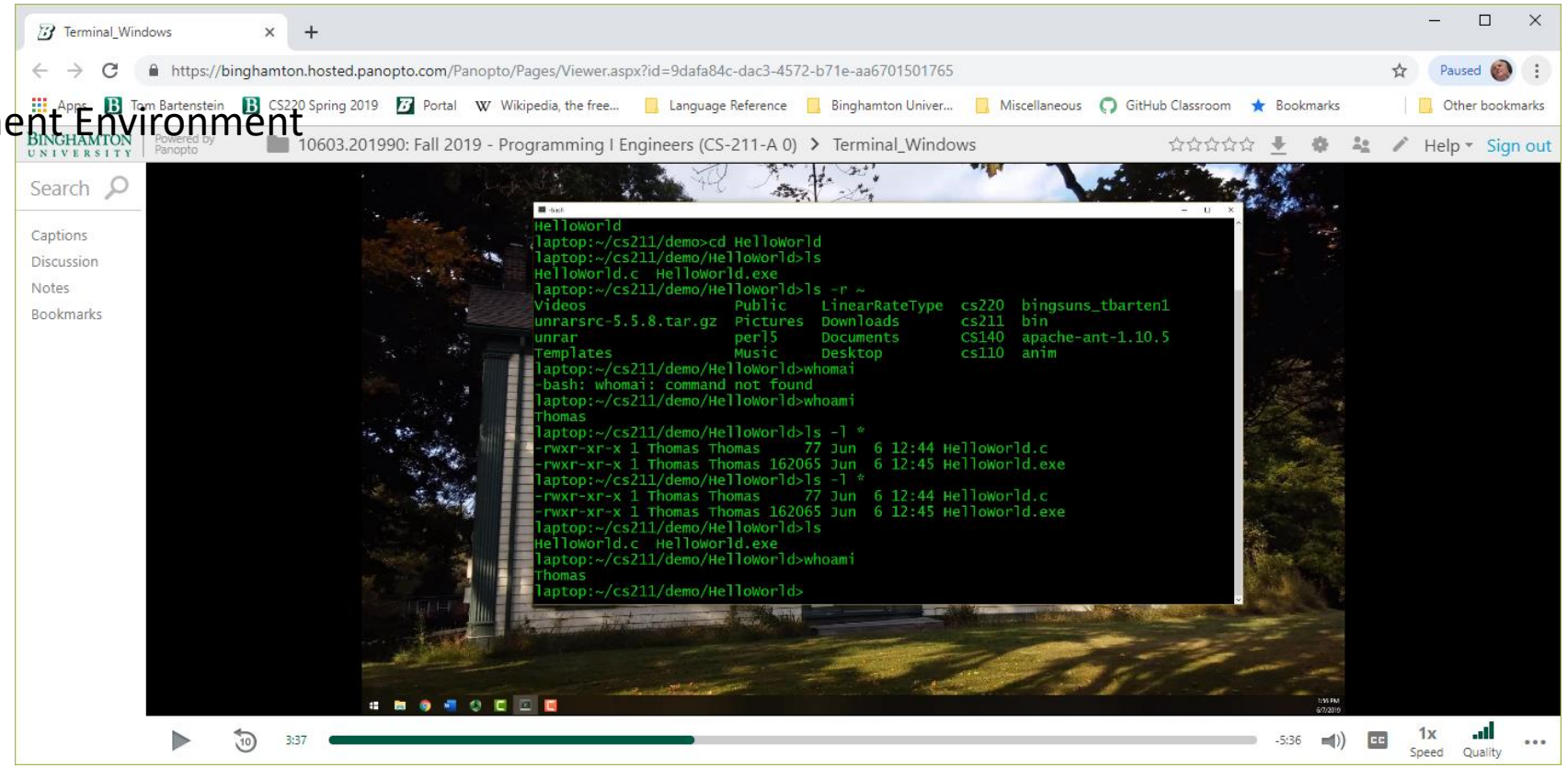

Files and Folders

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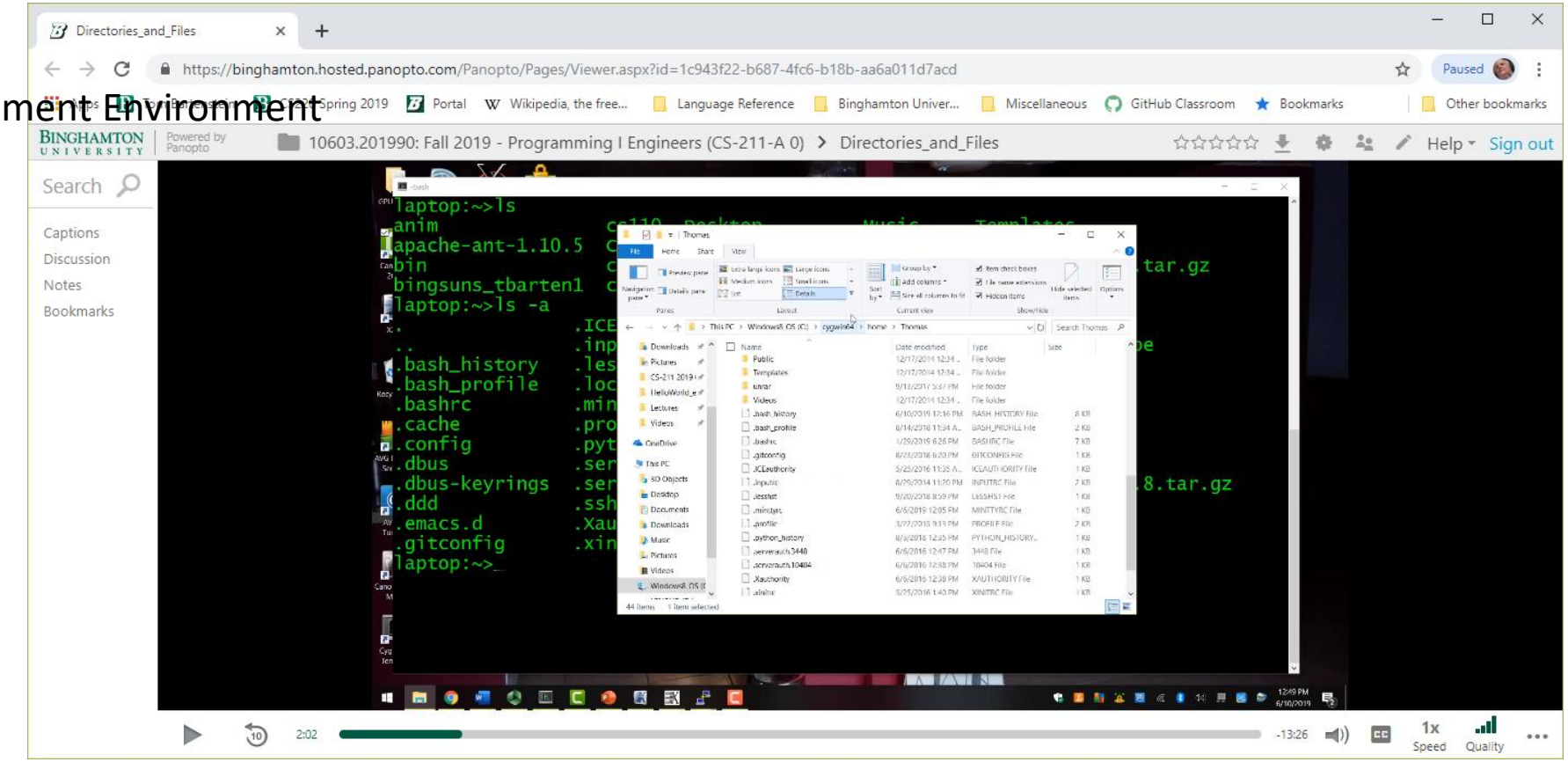

Compiling C Code

- Watch the video, available on myCourses
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    - Videos
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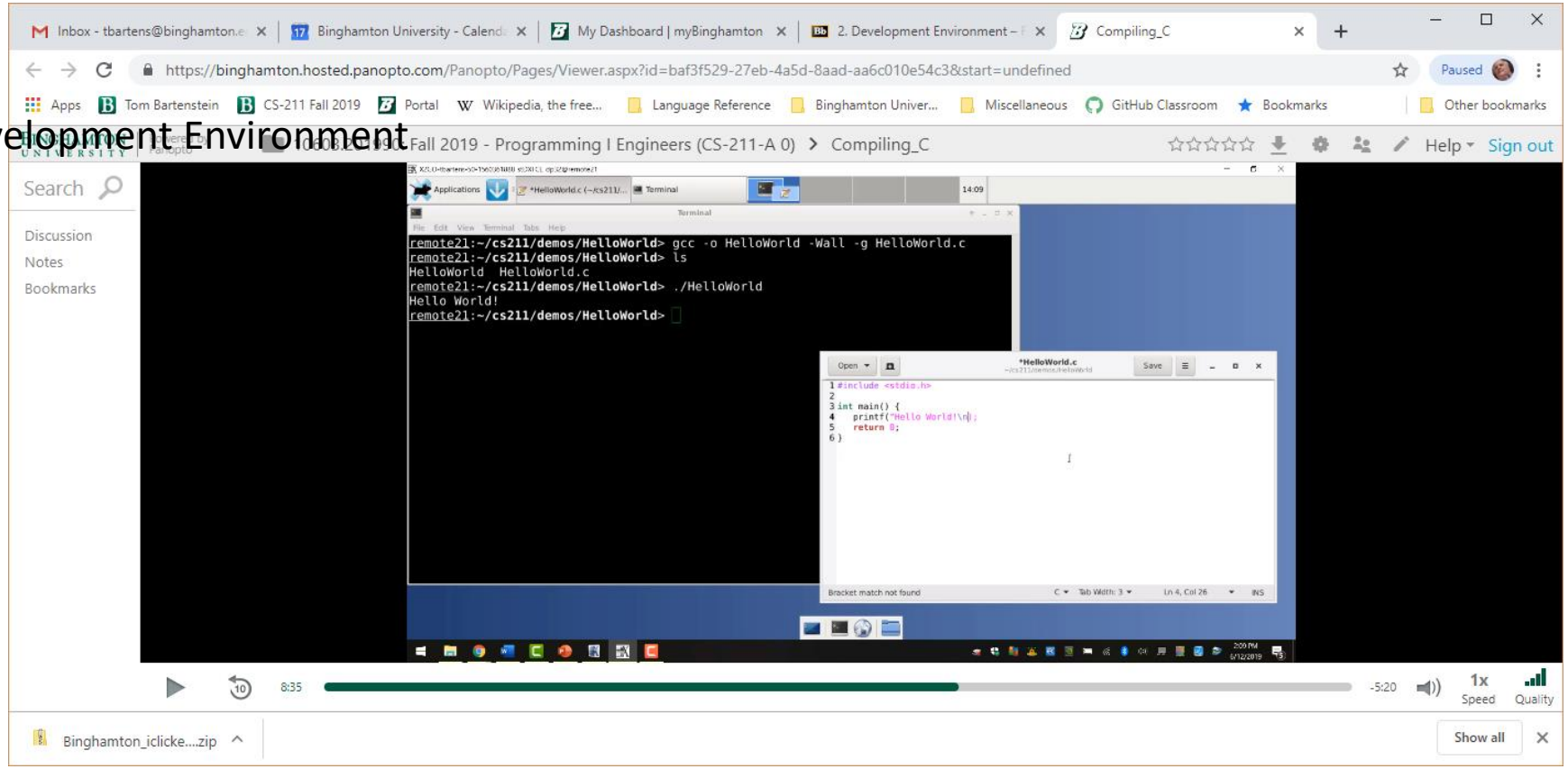
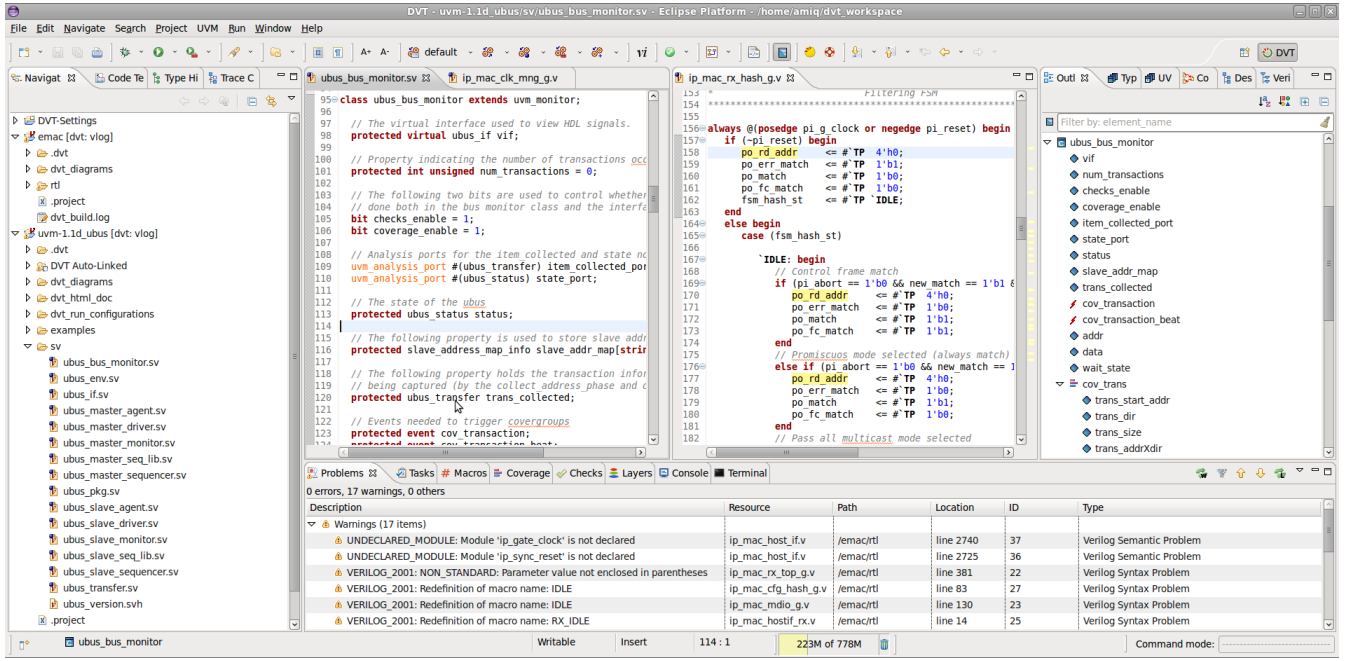


Integrated Development Environments

- Single interactive graphical user interface (GUI)
- Includes:
  - File/Project Management
  - Editor
  - Compiler
  - Builder
  - Debugger
  - Execution Environment

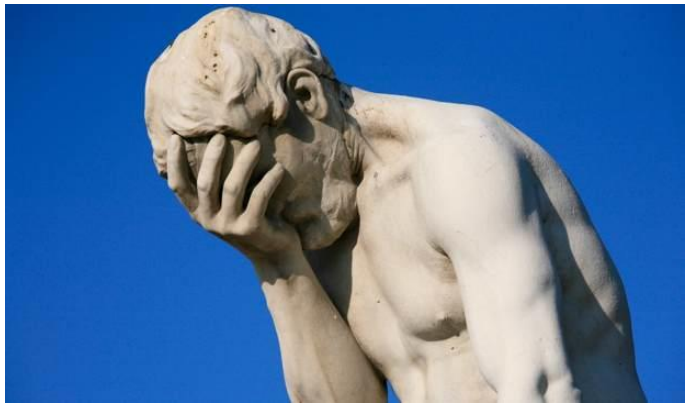


iClicker Question

Please click on the FIRST choice that is true:

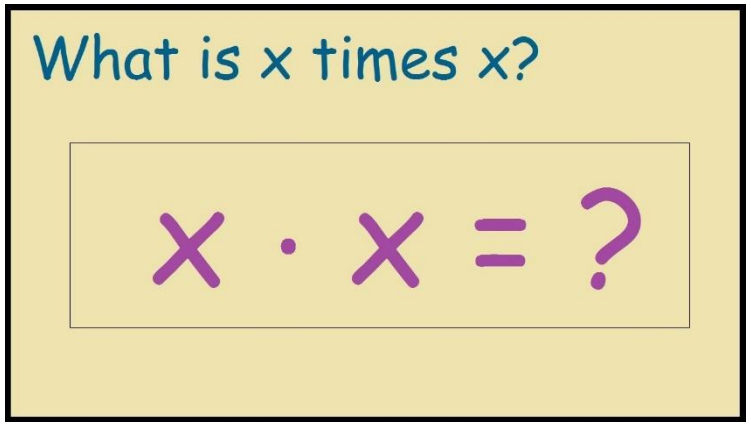
A. I have written code without using an IDE.
B. I have written code using an IDE.
C. I have seen a friend writing code using an IDE
D. I have never written a computer program before

Why not use an IDE for CS-211?



- There is no generally acceptable IDE for C
- IDE hides the basics of programming
  - Things you don't have to know the rest of your life, but
  - You should understand how they work at least once.
  - Know what an IDE is doing for you!
- Learn the alternatives to an IDE
  - Sometimes, the old ways are faster / more efficient
  - Sometimes you are in an environment where the IDE doesn't exist

Exercise



- Write a computer program that reads a number, and computes the square of that number.

Infrastructure

- Use the same basic structure of a program that we used for “HelloWorld.c”

```
#include <stdio.h>

int main() {
    printf(“Hello World!\n”);
    return 0;
}
```

- (But use a different sub-directory and a different file name, e.g. “square.c”)

What kind of a number is *x*?

- Symbols: ‘2’ ‘5’ is that 2,5 or 25 or 2.5???
- Integer? 3x3=9, 5x5=25, …
- Real Number: 3.1 x 3.1 = 9.61, 5.5 x 5.5 = 30.25, …
  - How big or small?
  - How much precision?
- In a C program, we create a variable and assign a type to tell C what kind of number we are using:

```
float x;
```

read as “x is a floating point number” (floating point is “real”)

How do we get a value for “x”?

- Ask our “user” (person running the program) for a value.
- First, tell the user we are looking for a value to square:

```
printf(“Enter a number to square :>”);
```

- Then, invoke a C library function to get input from the user

```
scanf(“%d ”,&x);
```

How do we calculate and print the result?

- Calculate x^2 by using the C expression: `x*x`
  - Multiply the current value of x by itself

- Print the result using the C library function, printf:

```
printf("The square of %f is %f\n", x, x*x);
```

How do we compile the result?

- Use the same concepts as “HelloWorld”

```
> gcc –g –Wall –o square square.c
```

How do we run the result?

- Use the same concepts as in HelloWorld
  - But now we have to enter a number at the prompt and hit “enter”!

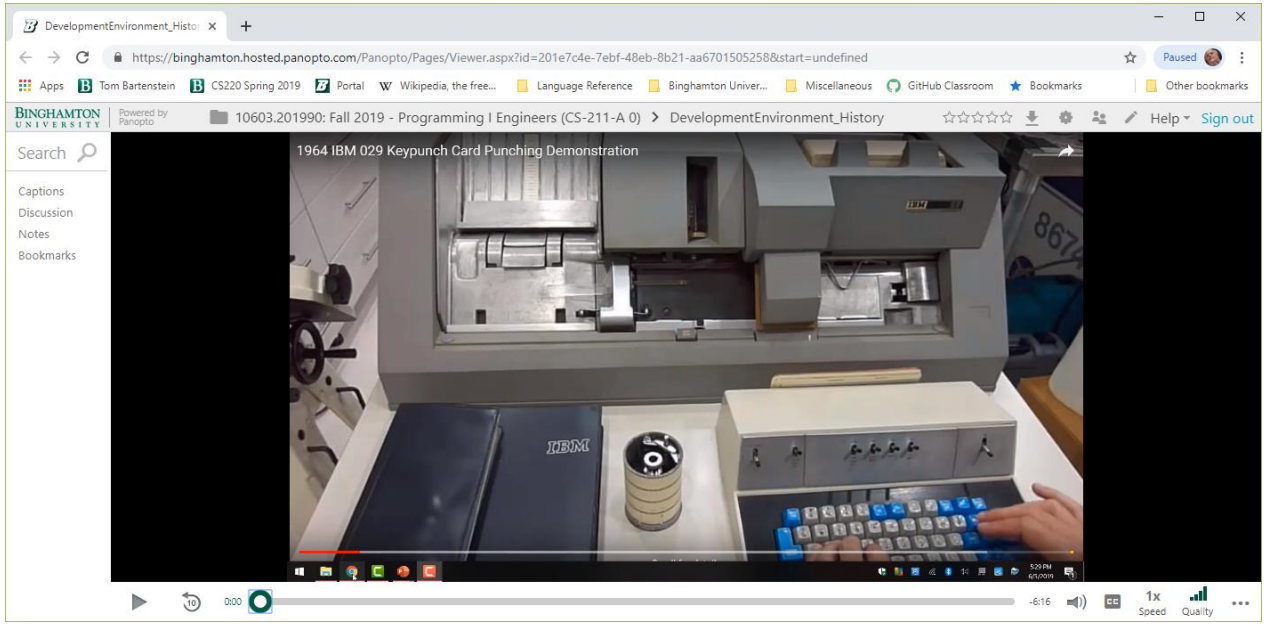
```
>./square
Enter a number to square :> 3.1
The square of 3.100000 is 9.610000
>
```

How do we test our code?

- Think about what might break the program
  - Simple tests first: 3,5
  - More complicated: 3.1, 5.5
  - Negative numbers? : -7, -9.3
  - How big can I get?: 100, 999999999
  - How little can I get?: 0.0001, 0.00000000000001
  - What if user doesn’t enter a number? : hello

Resources

- Programming in C Chapters 1&2
- UNIX tutorial http://www.ee.surrey.ac.uk/Teaching/Unix/
- Wikipedia: List of Unix Commands https://en.wikipedia.org/wiki/List_of_Unix_commands
- gedit wiki https://wiki.gnome.org/action/show/Apps/Gedit?action=show&redirect=Gedit
- gedit on-line manual https://help.gnome.org/users/gedit/stable/
- gcc on-line manual https://gcc.gnu.org/onlinedocs/gcc-4.7.4/gcc/
- Wikipedia: IDE https://en.wikipedia.org/wiki/Integrated_development_environment

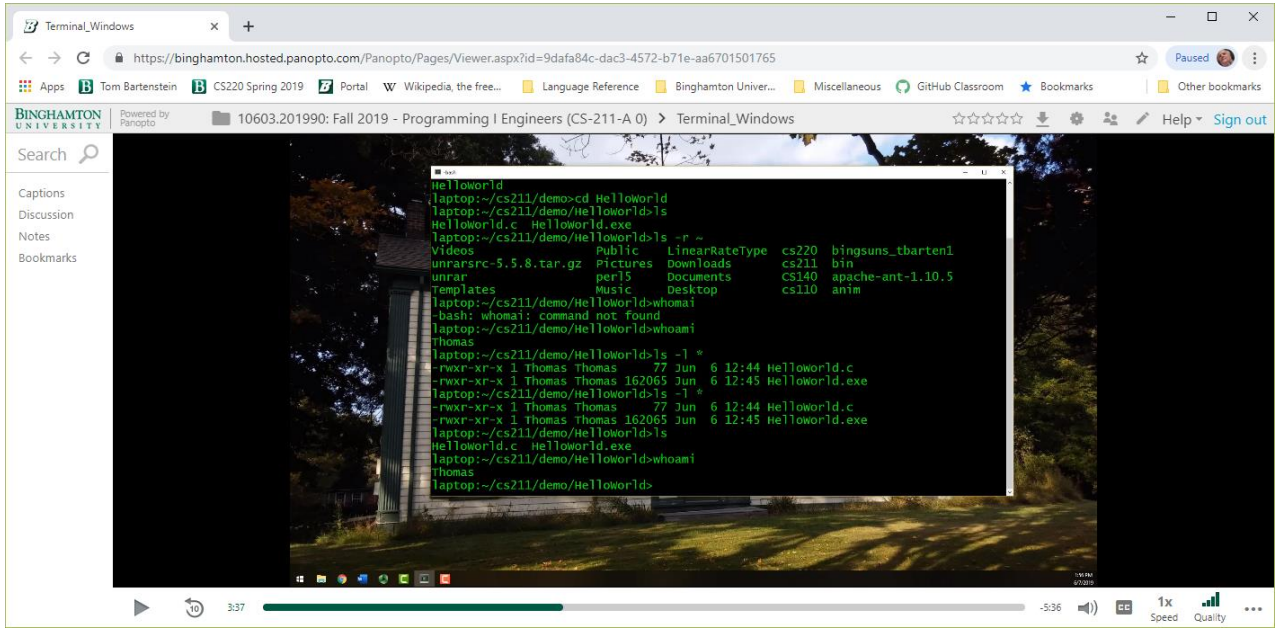


Historical Background

Summary Notes

Historical Background

- IBM Punch Card: https://www.youtube.com/watch?v=YnnGbcM-H8c
- Reading punch cards: https://www.youtube.com/watch?v=w62NC1R6WLshttps://www.youtube.com/watch?v=w62NC1R6WLs
- Printing Results: https://www.youtube.com/watch?v=FiEGoVzmyvs
- Playing Music on a printer: https://www.youtube.com/watch?v=jufHGUp3xQw
- Linux Teletype: https://www.youtube.com/watch?v=-Ul-f3hPJQM#t=67.618982

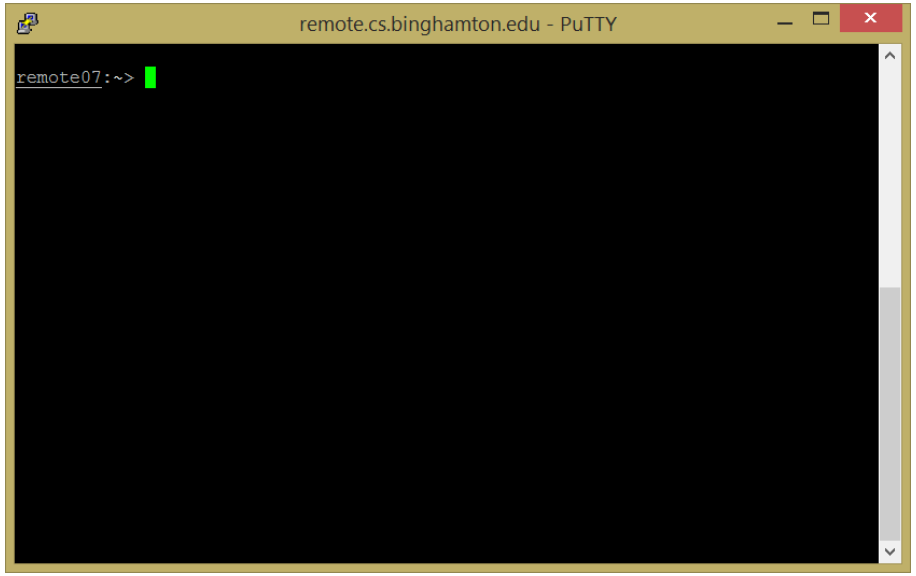


Terminal Windows

Summary Notes

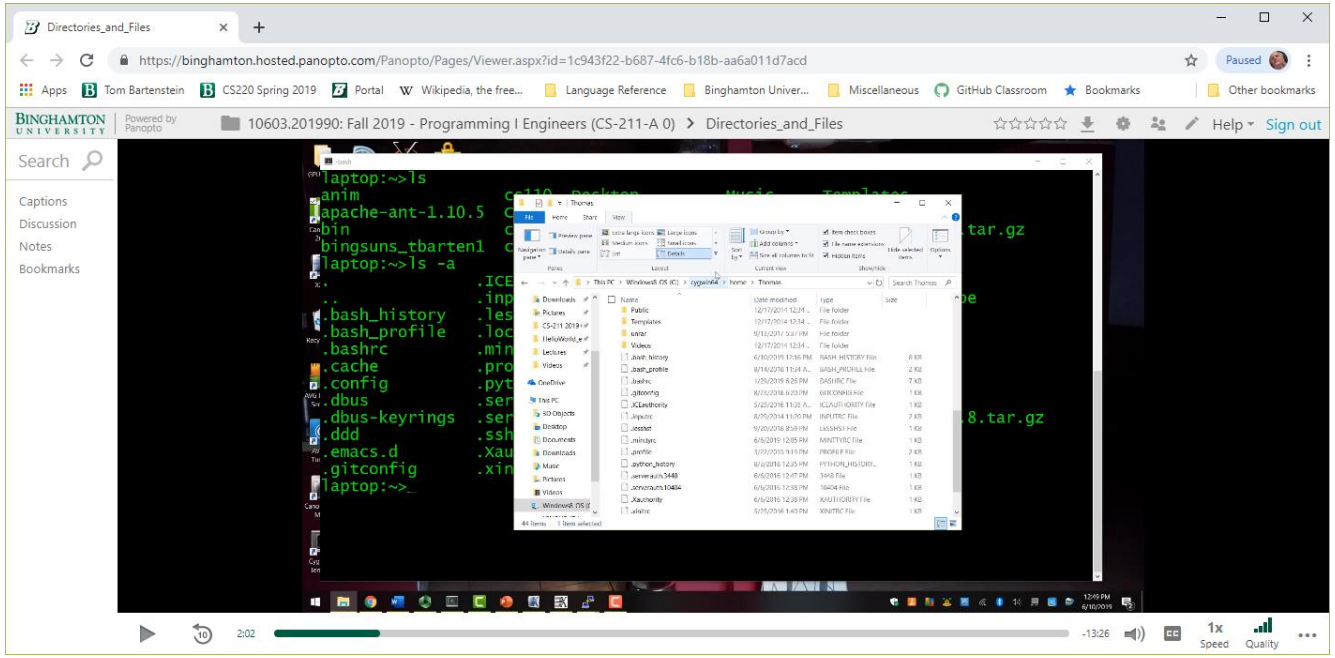
UNIX “terminal”

- Command line window
- “Prompt”
  - Machine name
  - Current Directory
  - “lab01:~/cs211>”
- Type commands at prompt
  - Nothing happens until you hit “<enter>”
- When you hit enter…
  - Command is executed
  - Response appears
  - Another prompt appears



UNIX terminal hints

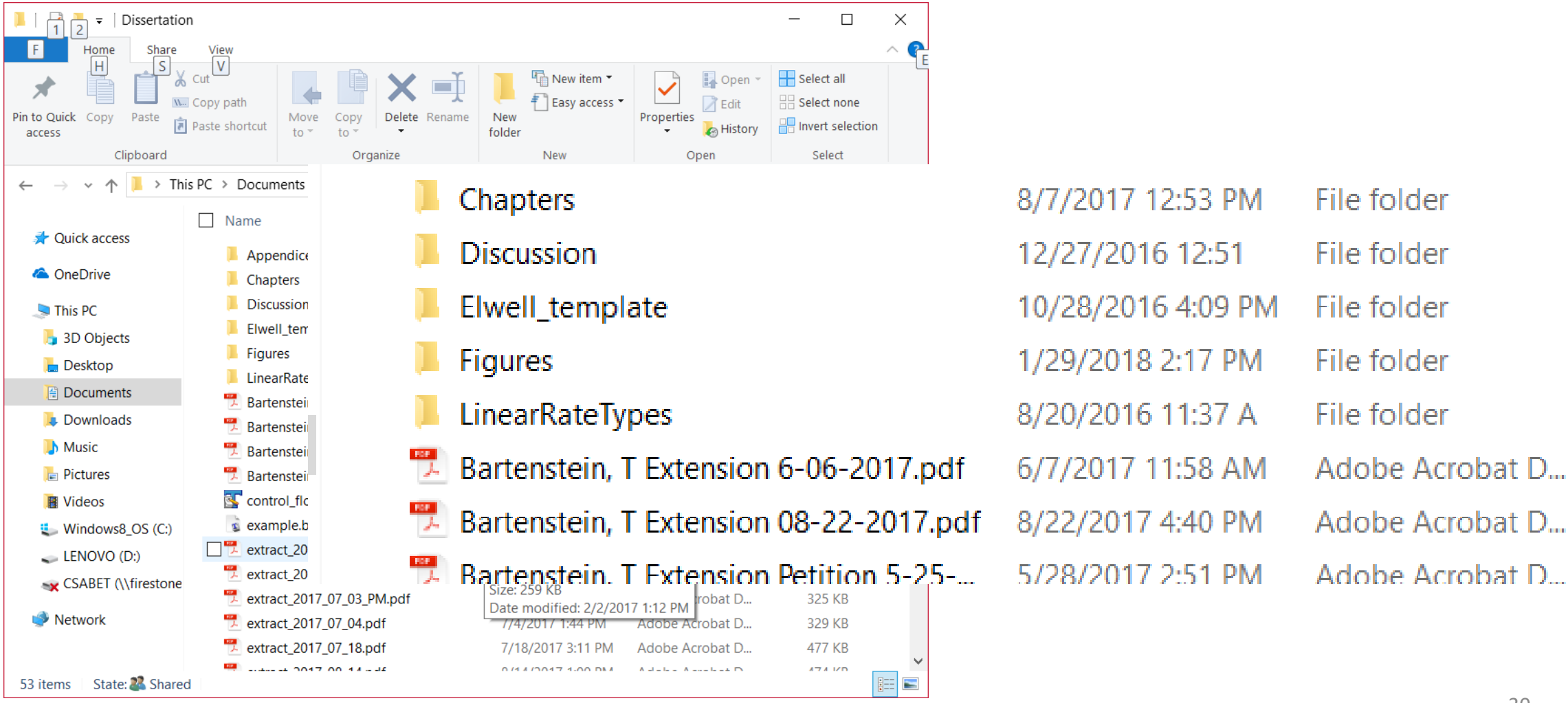
- Output is scrollable… scroll up to see what happened before
  - Scroll amount is finite… you have lost what happened too many lines ago
- Command Editing
  - You can use the left and right arrows to move in a command before you hit enter
  - Typing new characters inserts, also delete or backspace
- Command History
  - There is a command history
  - Use up and down arrows to retrieve earlier commands



Files and Folders

Summary Notes

Files and Folders



"Home Directory"

- When you log in to UNIX, you are in your "Home" directory
  - .e.g /home/tbarten1
- Shorthand: "~"
- You own your home directory
  - You can create or remove files
  - You can create or remove sub-directories
  - You control attributes of files in your home directory
- You may be able to read outside your home directory
- You probably cannot write outside your home directory

Current Directory

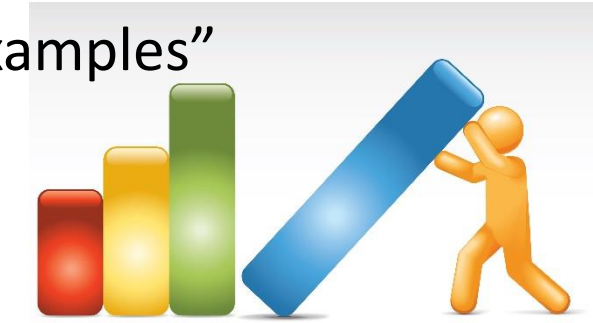
- “Current Directory” is the directory you are working in
  - Starts at your home directory
- Abbreviated as “.”
- Change the current directory with the command “cd <argument>”
  - “cd /<fully-qualified directory>” move to the fully qualified directory
  - “cd <label> moves to the <label> sub-directory of the current directory
  - “cd ..” moves to the parent of the current directory
  - “cd” with no argument returns to your home directory

Listing what's in a directory

- "ls <arguments>"
  - "ls" with no arguments lists what's in the current directory
  - "ls <label>" lists what's in the label sub-directory of the current directory
  - …
- "ls –l <arguments>" lists file names and attributes

Unix Directory Commands

- Make a new directory using “mkdir <label>”
  - makes a sub-directory of your current directory
  - e.g. “mkdir examples” will create directory “/home/tbarten1/examples”
    - <label> becomes a sub-directory of the current directory
    - The “examples” directory will be empty
- Remove an empty directory using “rmdir <label>
  - e.g. “rmdir examples” removes the “examples” subdirectory of the current directory



Using Directories

- In the Linux Lab, your home directory is space provided by BU
- Your home directory is shared between Linux and Windows on PODS
- Recommend, make a subdirectory for each class

  ~> mkdir cs211

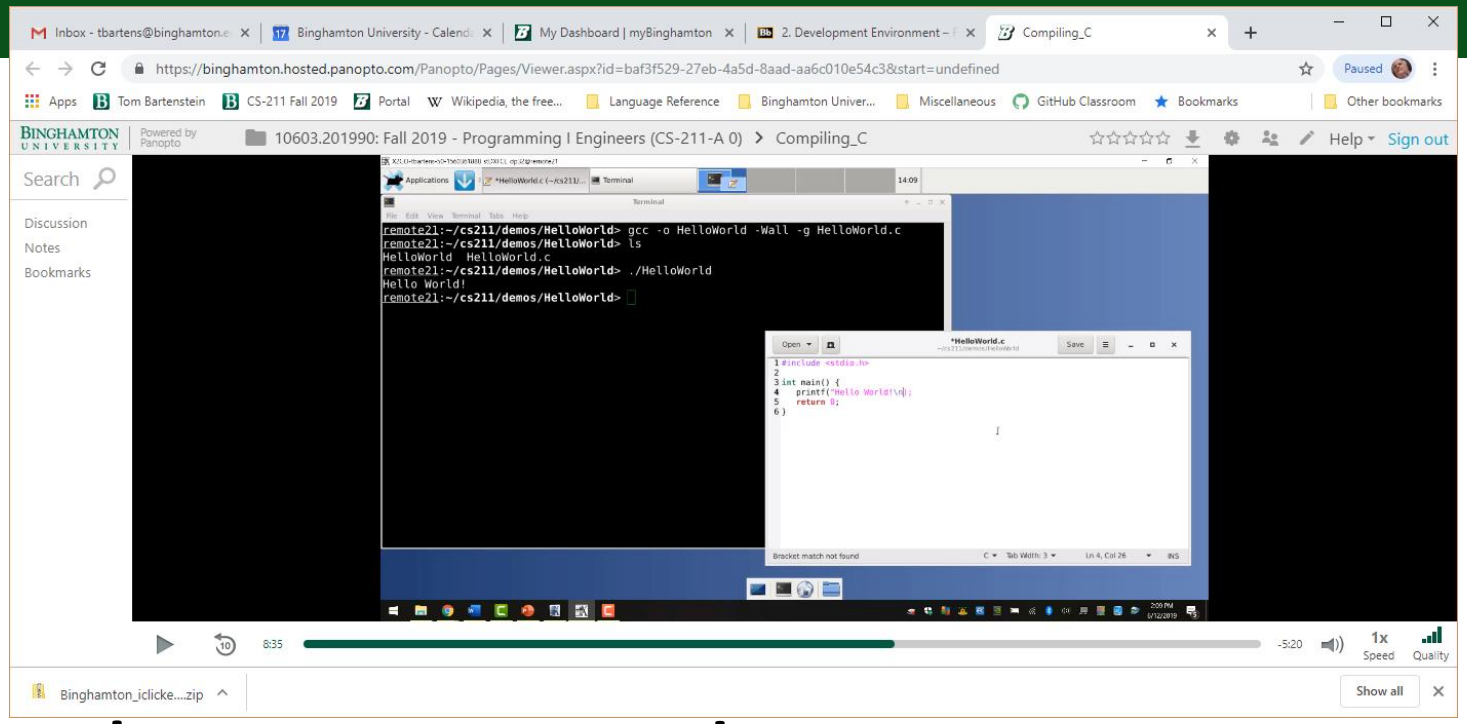
  ~> cd cs211

- Typically, make a subdirectory for each activity in the class

  ~/cs211> mkdir lab01

  ~/cs211> cd lab01

  ~/cs211/lab01>

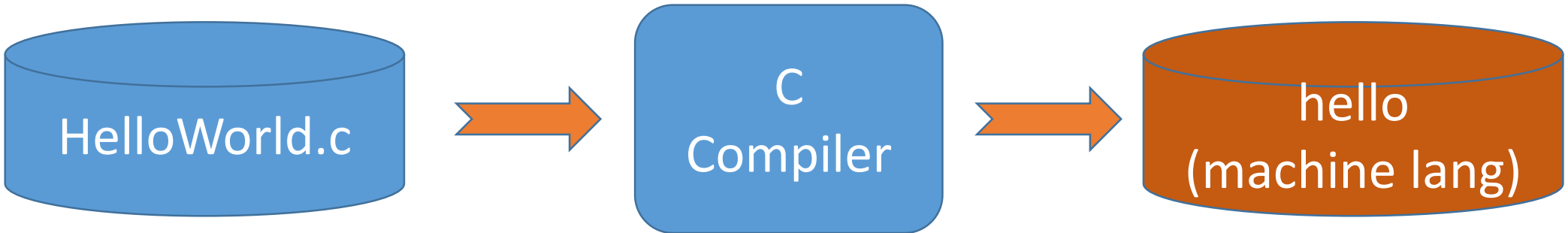


Compiling C Code

Summary Notes

Computer Instructions

- Computers "understand" a very low level binary set of instructions called ***machine language***
- Machine language is not easily read or understood by humans
- A ***programming language*** is a well defined "language" with a precise syntax and meaning (semantics)
  - Designed to be understood by humans
  - Easily translated into machine language by a compiler
  - An algorithm expressed in a computer language is a computer program



Compiling C Code

- Compile command: gcc (Followed by parameters)
  - "-o <filename>" to create executable file named <filename>
  - "-g" to enable debugging
  - "-Wall" to turn on all warning messages

gcc –o HelloWorld -g -Wall HelloWorld.c

- Compiles HelloWorld.c from the current directory
- If there are no errors, writes executable file "HelloWorld"

Compiler Messages

- When the compiler gets confused it generates a message
  - Warning: Something seems wrong, but compiler can live with it
  - Error: Something is wrong that stops the compile – No output generated!
- Messages contain the <line>.<column> that the compiler was working on when it got confused.
- Message contains the compiler's description of the problem

```
floatx.c:32:2: warning: statement with no effect [-Wunused-value]
  result << 1;
  ^
floatx.c:71:9: error: invalid operands to binary << (have ‘double’ and ‘int’)
  result << 1;
         ^
```

Running C Code

- You need to tell the operating system what executable file to run
- Shorthand is to use "." to represent the current directory
- e.g. "./mycmd" runs the executable file "mycmd" in the current directory