

# Welcome to CS 211 – Winter 2024

“Fundamentals of Computer Programming II”



- **Professor Joe Hummel**

- ❖ *Professor of Instruction*

- ❖ *Office: Tech L365*

- **Pronouns:** he/him
- **How to address:** Professor Hummel / Professor Joe



*Lecture PPT / PDF  
available on Canvas...*

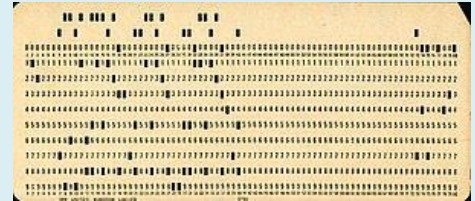
Lectures: <a href="#">dropbox</a> ➞	Homework: <a href="#">dropbox</a> ➞	Projects: <a href="#">dropbox</a> ➞
Replit: <a href="#">site</a> ➞ (join team ➞)	Piazza: <a href="#">site</a> ➞	Zybooks: <a href="#">link</a> ➞

## Things to work on...

- **HW 00** due Friday --- easy stuff (to-do items)
- **HW 01** due next Tuesday 1/9 --- chapters 1 & 2
- **Project 01** due next Friday 1/12
- Available on Canvas...

# A little bit about me...

- I'm relatively new at NU --- my 2<sup>nd</sup> year
- I've been teaching CS for over 25 years, and programming for over 45 years
  - *Yes, I wrote computer programs using punch cards*
- I'm an avid sailor
  - *I currently own "Archimedes III", a 38' sailboat*



# Why learn C and C++?

- **To understand how machines work...**
- **When you need to program at the hardware level**
  - *Embedded systems, operating systems, robotics, ...*
- **When execution speed / memory usage matter**
  - *C programs are typically 100x faster than Python programs, and use 100x less memory*

# Topics

- **Imperative programming (variables/state)**
- **C**
- **C++**
- **Memory management**
- **Abstraction**
- **Basic object-oriented programming**
- **Debugging**
- **Testing**

# Summary of class...

*Class attendance required;  
allowed 4 misses, after that  
you lose 1 point per miss*

*HW: 16%, 1 drop*

*Projects: 64%*



	Mon	Tuesday	Wed	Thursday	Friday
January				04: lecture 01	
		09: lecture 02, hw 01		11: lecture 03	12: project 01
		16: lecture 04, hw 02		18: lecture 05	19: project 02
		23: lecture 06, hw 03		25: lecture 07	26: project 03
		30: lecture 08, hw 04			
February				01: lecture 09	02: project 04
		06: lecture 10, hw 05		08: lecture 11	
		13: lecture 12, hw 06		15: lecture 13	16: project 05
		20: lecture 14, hw 07		22: lecture 15	23: project 06
		27: lecture 16, hw 08		29: lecture 17	
March					01: project 07
		05: lecture 18, hw 09		07: lecture 19	08: project 08
		12: Final Exam (noon-2pm)			15: Final Exam (noon-2pm)

*Final exam: 20%*

*You must pass final  
exam with  $\geq 40$  to  
pass class*

# In-class programming on replit.com

- If you haven't already, join replit CS211 team

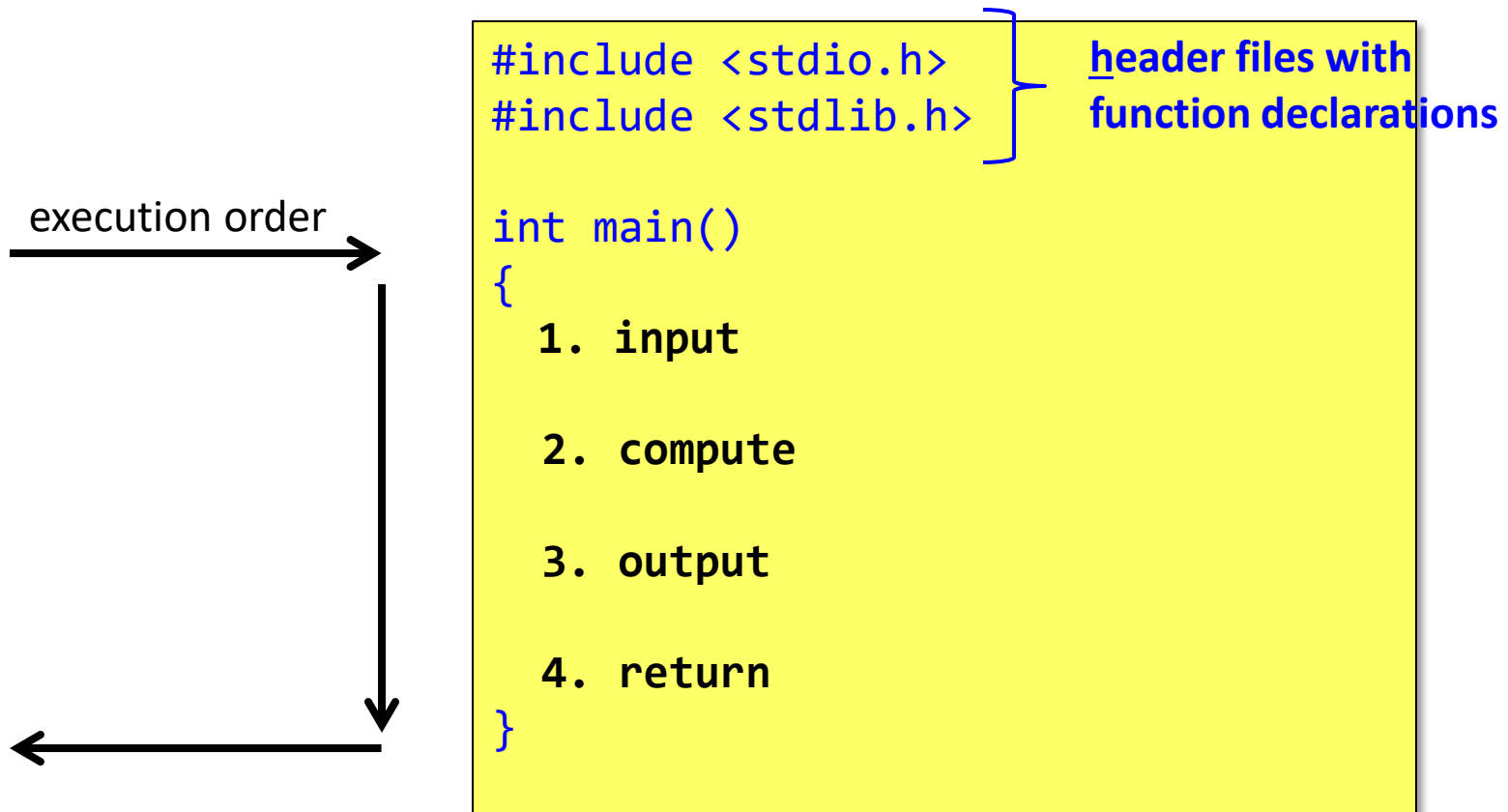
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*Join link on Canvas...*

- Then:
  - *Login to replit.com*
  - *Open team "CS 211 Winter 2024"*
  - *Start project "**Lecture 01**"*
  - *Disable AI (bottom-left corner of editor)*



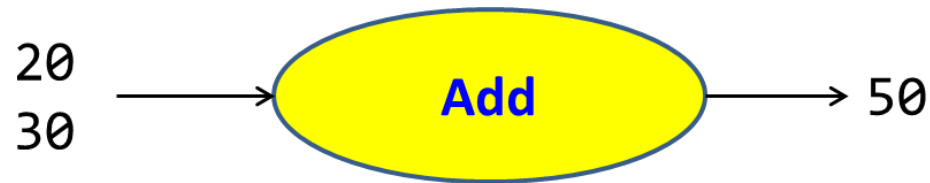
- Outline of a typical **C** program:





## Example: Add

- Simple program to add 2 numbers:



```
Run
20
30
sum=50
```

- **Add** program in **C**:

```
#include <stdio.h>
#include <stdlib.h>
```

```
int main()
{
```

```
    int x;
    int y;
    int z;
```

**declare variables to hold integer numbers**

(variables are locations whose contents can change)

```
    scanf("%d", &x);
    scanf("%d", &y);
```

**scan input stream for decimal integers**

```
    z = x + y;
```

**add together, assign result to variable z**

```
    printf("sum=%d\n", z);
```

**print z as decimal integer with EOL**

```
    return 0;
```

**0 ==> successful program execution**

```
}
```



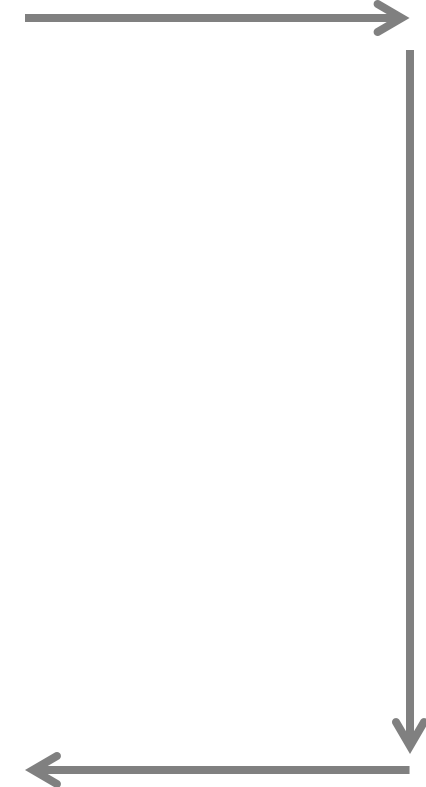
Run

20

30

sum=50

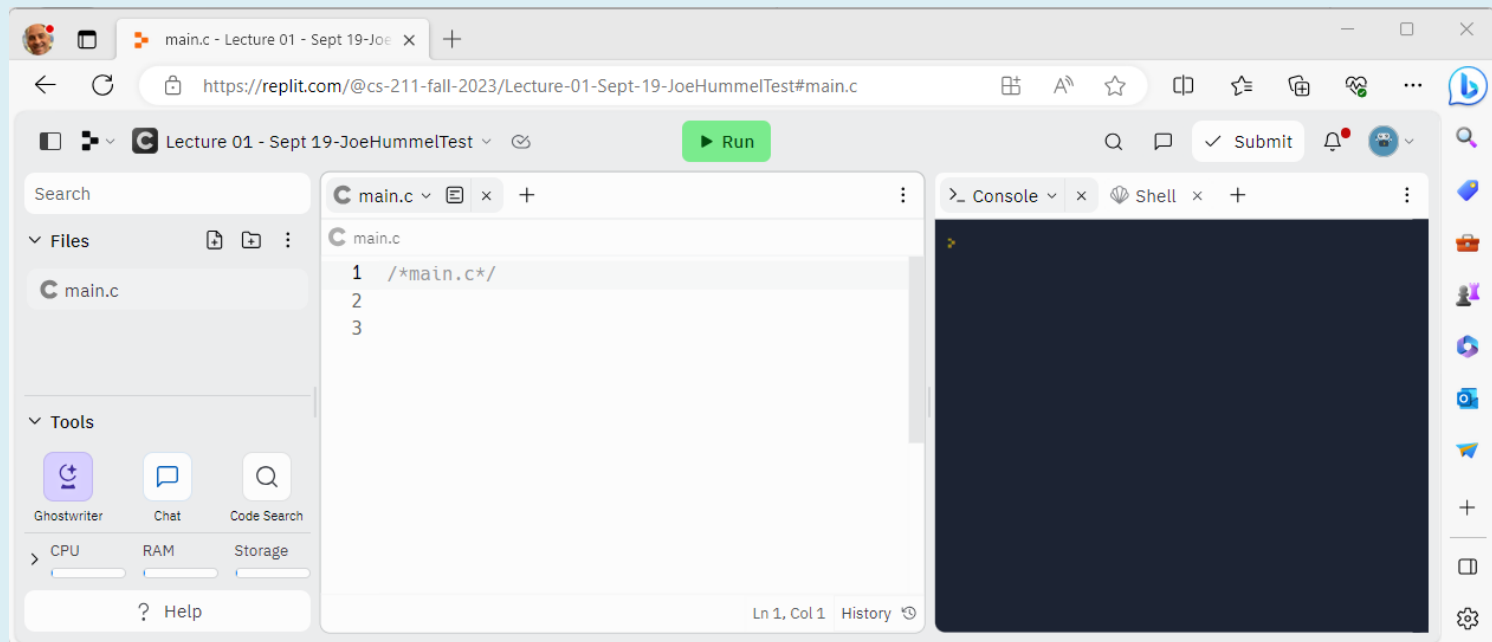
execution order



# Code it...

```
▼ Run
20
30
sum=50
```

- [replit.com](https://replit.com) is great for small programs / experiments
- Supports over 50 programming languages



- Understanding **memory** is a HUGE part of understanding C...

```
#include <stdio.h>
#include <stdlib.h>

int main()
{
    int x;
    int y;
    int z;

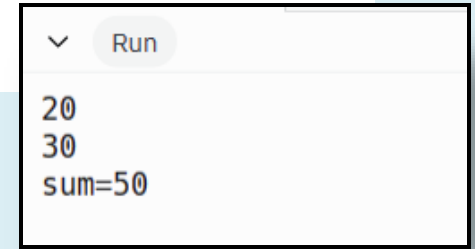
    scanf("%d", &x);
    scanf("%d", &y);

    z = x + y;

    printf("sum=%d\n", z);

    return 0;
}
```

# Discussion



```
Run
20
30
sum=50
```

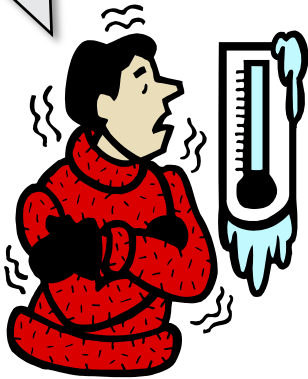
- What happens if user enters 3.14?
- What happens if user enters 2147483647 and 1?

# Implication?

- **Computers are not very smart...**
- **...they are just really really fast**
  
- **\*WE\* make them smart...**

## Another example

*The thermometer says  
it's 32° F, but it sure feels  
a lot colder with this  
wind...*



- Write a C program to compute windchill...

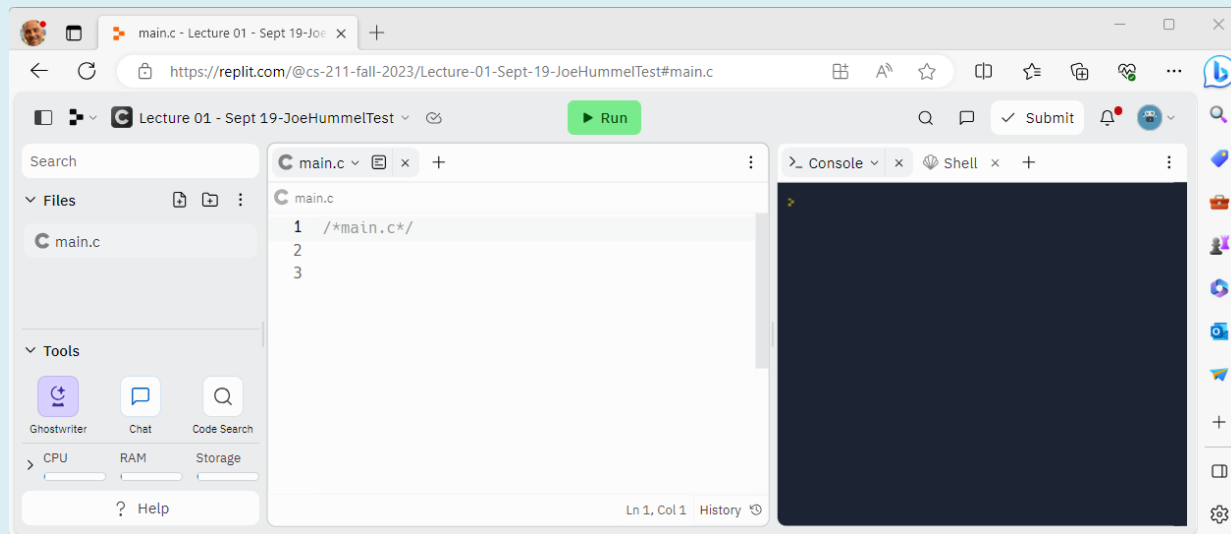
temperature  
in degrees F

wind speed  
in MPH

$$\text{windchill} = 35.7 + 0.6T - 35.7W^{0.16} + 0.43TW^{0.16}$$

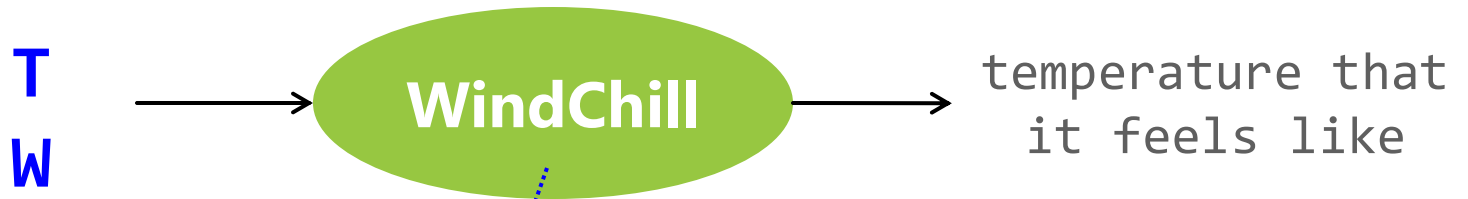
# Before you start...

- Duplicate "main.c" using the "... " menu to its right
- Rename to say "main-add-two.c"
- Now rewrite "main.c" to compute **windchill**





- There are **2** inputs:



$$\text{windchill} = 35.7 + 0.6T - 35.7W^{0.16} + 0.43TW^{0.16}$$

## Code it...

$$\text{windchill} = 35.7 + 0.6T - 35.7W^{0.16} + 0.43TW^{0.16}$$

- Use `pow(W, 0.16)` function to raise W to 0.16
- `#include <math.h>` in order to use `pow( )`

```
▼ Run
10
20
feels like -9 degrees

▼ Run
32
0
feels like 54 degrees
```

# Windchill program:



Programming

```
#include <stdio.h>
#include <stdlib.h>
#include <math.h> // pow()

int main()
{
    int T;
    int W;
    int windchill;

    scanf("%d", &T);
    scanf("%d", &W);

    windchill = 35.7 + 0.6*T - 35.7*pow(W,0.16) + 0.43*T*pow(W,0.16);

    printf("feels like %d degrees\n", windchill);

    return 0;
}
```

# Observation #1

```
▼ Run
32
0
feels like 32 degrees
```

- Online windchill calculators ignore  $W < 3$ ...
  - [https://www.weather.gov/epz/wxcalc\\_windchill](https://www.weather.gov/epz/wxcalc_windchill)
  - We can do this using *if* statement...

```
if (W < 3)
{
    windchill = T; // no change in temperature
}
else
{
    windchill = 35.7 + 0.6*T - 35.7*pow(W,0.16) + 0.43*T*pow(W,0.16);
}

printf("feels like %d degrees\n", windchill);
return 0;
}
```

## Observation #2

Run

```
28  
12  
feels like 17.29 degrees
```

- Use **double** instead of int to gain more accuracy...

```
double windchill;  
.  
.  
.  
  
if (W < 3)  
{  
    windchill = T;  
}  
else  
{  
    windchill = 35.7 + 0.6*T - 35.7*pow(W,0.16) + 0.43*T*pow(W,0.16);  
}  
  
printf("feels like %.21f degrees\n", windchill);
```

# To-do

1. *Login to Canvas, read through syllabus ...*
2. *Complete **HW 00** this week*
3. *Complete **HW 01** by next Tuesday 1/9 @ 11:59pm*
4. *Complete **Project 01** by next Friday 1/12 @ 11:59pm*

