Introduction to Java

How many programmers does it take to change a light bulb?
None. It's a hardware problem.
Some people need a “sponsor”, use me:

James Parker
park0580
CSci1103 student
Why Java?

Portable

Ease of use
Java portability

Other languages
Java portability

Other languages

Converting code is called compiling

Hi

0101
Java portability
Java portability

JVM

Java
Java portability

Easy

JVM

Java

Hard
Ease of use
Ease of use

Other languages
Ease of use

Other languages
Ease of use

Other languages
Ease of use

Other languages
Ease of use

Java
Why not Java?

Speed

Control
Java vs others

Java
- Goes anywhere
- Comfy

C
- Fast
- Fine tuned

Matlab
- Low energy
- Easy to use
Object Oriented

Main focus is on **objects** and how they interact (represented by me as boxes)

Reusable groups of actions (verbs) between objects are called **functions** (squiggly boxes)

These actions can take additional information called **arguments**, (an analogy is ordering at a restaurant; the ordering format is the same, different food)
Object Oriented

Format is:
object.method(argument, argument...);

Example:
James.teaches(CSci 1103);

The dot (period) shows that “teaching” is an action done by “James”
Banana Nut Bread

Ingredients

* 3 or 4 ripe bananas, smashed
* 1/3 cup melted butter
* 1 cup sugar
* 1 egg, beaten
* 1 teaspoon vanilla
* 1 teaspoon baking soda
* Pinch of salt
* 1 1/2 cups of all-purpose flour
* 1 cup of nuts
Banana Nut Bread

Directions
1. Preheat the oven to 350°F (175°C).
2. Mix butter into the mashed bananas in a large mixing bowl.
3. Mix in the sugar, egg, and vanilla.
4. Sprinkle the baking soda and salt over the mixture and mix in.
5. Add the flour and nuts last, mix.
6. Pour mixture into a buttered 4x8 inch loaf pan.
Banana Nut Bread

Directions
1. Preheat the oven to 350°F (175°C).
2. Mix butter into the mashed bananas in a large mixing bowl.
3. Mix in the sugar, egg, and vanilla.
4. Sprinkle the baking soda and salt over the mixture and mix in.
5. Add the flour and nuts last, mix.
6. Pour mixture into a buttered 4x8 inch loaf pan.
Banana Nut Bread

Directions
1. Preheat the oven to 350°F (175°C).
2. Mix butter into the mashed bananas in a large mixing bowl.
3. Mix in the sugar, egg, and vanilla.
4. Sprinkle the baking soda and salt over the mixture and mix in.
5. Add the flour and nuts last, mix.
6. Pour mixture into a buttered 4x8 inch loaf pan.
Banana Nut Bread

Pseudo code directions
1. `oven.preheat(350);`
2. `bowl.mix(butter, bananas);`
3. `bowl.mix(sugar, egg, vanilla);`
4. `bowl.sprinkle(baking soda, salt);`
5. `bowl.mix(flour, nuts);`
6. `bowl.pour(pan);`
7. `pan.bake(60);`
8. `pan.cool();`
Banana Nut Bread

Pseudo code directions #2

1. **oven.preheat**(350);
2. **bowl.add**(butter, bananas);
3. **bowl.mix**();
4. **bowl.add**(sugar, egg, vanilla);
5. **bowl.mix**();
6. **bowl.sprinkle**(baking soda, salt);
7. **bowl.add**(flour, nuts);
8. **bowl.mix**();
9. **pan.pour**(bowl);
10. **pan.bake**(60);
11. **pan.cool**();
mashedBananas = bananas.mashed();
bowl.add(butter, mashedBananas);

same as:
bowl.add(butter, bananas.mashed());

Kitchen.bowl.add(butter, bananas.mashed());

hand.mix(butter, mashedBananas);
bowl.add(hand.mix(butter, mashedBananas));
CPU trends
CPU trends

What happened?

Why did we stop progressing (and sort of degress)?

Anyone remember what started happening in the 2000s?
CPU trends

Intel Processor Clock Speed (MHz)

- Pentium 4 Prescott
- Core 2 Extreme
- Pentium III
- Celeron
- Multicore Crisis is Here!
- Pentium
- 80486
- 80386
- 80286
- 8080
- 1968
- 1973
- 1979
- 1984
- 1990
- 1995
- 2001
- 2006
CPU trends
CPU trends

While it is true that the overall speed of computers is still doubling every 2.5 years, the ways in which it is doubling is different than the past - now we are focused more on throughput - less on “speed”

This is fine, but puts a larger burden on programmers (lucky us)
CPU trends

Say you are commuting to the UofM (and pretend parking spaces exist here)

Would you rather take a car:
1-2 people, travel time ~10 minutes

Or a bus:
20-40 people, travel time ~40 minutes
CPU trends

The bus is much more “efficient” on a people per second transported metric.

Yet if you drove yourself, you would get there half an hour faster....

The new computer trends are much more like a bus than the car, focusing on the quantity of data moved not the speed.
How the computer thinks

All code is a list (sequence) of instructions, default behavior is to do next.

You can have conditions: “If still cold, put back in microwave”

... and also jump to other instructions: “Flip over and repeat steps 3-4”
Each set of instructions the computer is trying to follow is called a thread.

This is because typically multiple threads are being run on a machine (which makes a full “string”).

Each CPU core can only handle one thread at a time (if there are more threads than CPUs, they take turns too fast for you to notice).
How the computer thinks

Each program has at least one thread for it, so if you are:

- watching youtube
- playing a game
- email open

You are using at least 3 threads (a 4th for your operating system...)
How the computer thinks

For just about the entire class, we will focus on how coding a single thread.

At the end of the class, we will discuss the basics of multi-threading (so you are not limited to pre-2000 computing speed).

A good analogy of this might be music: Most songs have a melody (main thread), but are often have accompaniments.