Making Real Fake Stuff

Simulating Real World Data

Charlie Chiccarine

PaTTAN Computer Science Praxis Prep

Applications of Computing

There is a wide variety of reasons to write code

- Create software
- Automate tasks
- Simulate and model situations and experiments

We'll focus on this simulation and modeling. This is something that's incredibly easy to bring into the classroom for a wide variety of subjects.

Simulation and Modeling

Why would we do this?

- To predict future conditions
- Test things unable to be tested in our backyard
- Practice experiments before performing them

Requirements

What do we need to simulate a situation?

- A starting point
- A formula to use in the situation
- Prior data to prove accuracy
- Specific situations may require other data

An Example

- Currently, I am 20 year old man who weighs 150 lbs
- If I were to gain 5 lbs every week, how would this affect me?
- How much would I weigh when I'm 50 years old?

An Example

Starting Point

- 20 years old
- 150 lbs

Formula

- $150 + 5n$
- Where n is the number of weeks

The Code

- Since the situation is incredibly simple, so is the code
- I have commented the code at each of the main parts
- This code is in the 'Java Code Examples' folder
- Let's test and see if this is accurate

```java
import java.util.*;

public class weight
{
    public static void main(String[] args)
    {
        Scanner input = new Scanner(System.in);

        //Starting information
        int startAge = 20,
            startWeight = 150;

        //How many years will pass?
        System.out.print("How many years will pass: ");
        int yearsPass = input.nextInt();

        //Convert that to weeks since that's what our formula uses
        int weeksPass = yearsPass * 52;

        //Get the final results
        int finalAge = startAge + yearsPass;
        int finalWeight = startWeight + (5 * weeksPass);
        System.out.println("At age " + finalAge +
                " you will be " + finalWeight + " lbs");
    }
}
```

Results and Accuracy

```
How many years will pass: 30
At age 50 you will be 7950 lbs
```

Is this factually correct?

Yes. The formula produced the correct answer.

Is this realistic?

No. I would be long dead before I reached age 50 at nearly 8000 lbs

Results and Accuracy

How can we make this more accurate?

- Include more variables
  - A death condition
  - What food I am eating
  - Exercise
  - Other health aspects
- The more data we take into account, the more accurate our simulation would be
- We cannot make an accurate statement about my health at age 50 from the data given to us from this simulation

Other Examples

I mentioned earlier that a wide variety of simulations can be created for a wide variety of subjects

The following slides go though different subjects and simulations you can do

Biology - Population Growth

- A common simulation in biology is population growth rate
- Lots of different factors to take into account
  - Environment and Climate
  - Food
  - Predator/prey relations
  - Growth rates
- In the 'Java Code Examples' folder, try out the population code

Physics - Ball Throwing

- The act of throwing a ball and it's position on an x and y axis
- Typically the military considers this "missile trajectory"
- Many different factors to take into account
  - Gravity
  - Velocity
  - Angle
  - Air resistance
- In the 'Java Code Examples' folder, try out the ballthrowing code

Recap

- We use code to simulate situations
- We need a certain amount of data to perform simulations
- We can also get a lot of data from performing accurate simulations