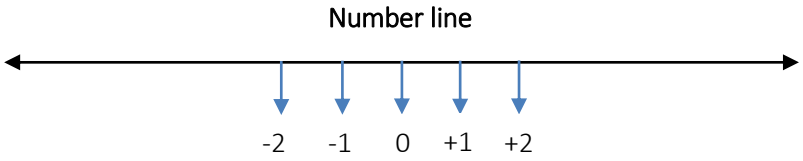
TA Lecture Notes
September 4, 2014

Counting in Computers

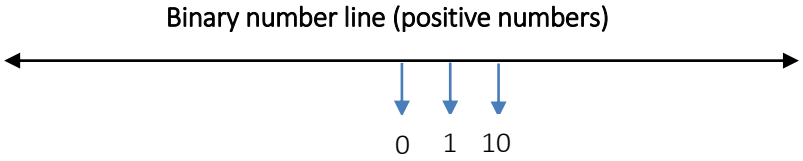
Base-10 counting: -2, -1, 0, 1, 2, … , 10, 11, 12, … , 20, 21, … , 99, 100, 101, …



- Think about how the digits carry. In base-10, "10" is the symbol that represents the number after 9.
- *Natural numbers*: 0, 1, 2, …

Numbers in binary

- Computers consist of transistors, which can be thought of as lightbulbs: either off or on.
- Computers can only think in on and off states.
  - "Off" is represented by 0 or false
  - "On" is represented by 1 or true
- Binary is the number system in which we count in zeroes and ones, and is in base 2.
  - A *binary decision* is a true or false decision.
  - The convention is to start counting from 0.
  - 000, 001, 010, 011, 100, 101, …
  - "10" is pronounced "one zero" not "ten"
  - example: 1001 in binary is equivalent to 8 + 1 = 9 in base ten



Flow Diagrams and Variables

Flow diagrams can be used as a form of pseudocode to organize program logic.

- Represent the flow of logic used in the program
- Consist of blocks that describe something a computer should do (e.g., "say Hello")
- Rectangles represent statements
- Diamonds represent Boolean expressions or conditional statements, which are statements that evaluate to either "true" or "false"
  - == indicates comparison/equality and is used to check if something is equal to something else
  - = indicates assignment and is used to set a variable to a specific value

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Variables are named items that allow you to store information.

- Names cannot start with a number or have spaces or weird characters
- Found in the "Data" tab in Scratch → make a variable → give it a name
- Example: `clicks`

You can use flow diagrams and variables to make a program of your own.

- Example: make a cat say hello when you click the cat in Scratch
  - Step 1: Create a variable called `clicks`
  - Step 2: Write a forever loop to sense the cat being clicked and condition it to say hello only if the variable `clicks` == 1
  - Step 3: Update the variable `clicks` when the cat is clicked