LESSON 3

SENDING BINARY MESSAGES WITH THE INTERNET SIMULATOR

YESTERDAY/A FEW MINUTES AGO

- We made our own binary message devices
- We learned we could compose any number of messages by sending a sequence of states
- In order to interpret the message we needed to know:
  - Which signal meant A and which meant B
  - Some kind of mapping between sequences of signals and a possible message
- We were beginning to develop a communication protocol

TODAY…

- We are going to develop a protocol to solve a problem.

WHAT IS PROTOCOL?

- The word "protocol" has a variety of meanings outside of computing. It typically refers to a **formal procedure or set of rules**. In computing a protocol usually implies a "communication protocol" that governs how devices should transmit and interpret data. There are many similarities between protocols and algorithms that can be made later in the course.
- Definition: a set of rules governing the exchange or transmission of data between devices.

BINARY SIGNAL TEST

- Imagine that you and your friend have made a binary signaling protocol using a flashlight. The light on is state A, off is state B.
- https://docs.google.com/presentation/d/1juvbxu1begVxgiVcGMHsGv4QuunxdHFJwT-TVR8wZuc/edit#slide=id.g12976fcfcc_0_71

DISCUSSION

- Did this new message make you think about your answer to the first question? Do you want to change your answer to the first question?
- What assumptions did you make in interpreting these messages?
- Is this protocol specific enough to allow useful communication of a binary message? If not, what information would need to be added to it?

TWO MAIN POINTS:

- A flashlight turning on and off truly has only two states. Many of the devices we made yesterday probably had a third "do nothing" state that was used to signal a break between As and Bs.
- When there are truly only two states, time and synchronization become huge factors and must be accounted for in a protocol

QUICK VOCAB:

- Protocol: a set of rules governing the exchange or transmission of data between devices.
- Bit: we will call each element of a binary message a bit. "Bit" is short for binary digit.
  - Example: if you have a binary message A B B A, we would say that is a 4-bit message
- Today, you and your partner will be developing a protocol for exchanging 2-bit messages using an Internet Simulator.

INTRO TO THE INTERNET SIMULATOR

- Today we will be using the Internet Simulator to explore some of the challenges of sending bits on the Internet.
- This tool simulates a single wire connecting two people who cannot otherwise see or speak to each other.
- The Internet Simulator helps to enforce "the binary rule" for sending messages – it will present challenges that we will need to problem solve around.

5-MINUTE DISCOVERY

- Your job is to explore this tool with a partner – click all the buttons, type in the text areas what you can."
- You cannot break it, so don't worry
- There is a bit of a mystery in what the tool does… and doesn't do. Can you figure it out?
- You and your partner have 5 minutes to poke around and see what you can find
- See Internet Simulator – Part 1 – Video in code studio

THE CHALLENGE:

- The major challenge is that the wire is SHARED between the two people.
- At any time either person can set the wire to State A or State B
- At any time either person can read the wire to see which state it's in
- This means you and your partner need to coordinate your actions carefully because you can easily squash your communications.

SENDING BITS WITH THE INTERNET SIMULATOR

- Experiment: Coordination and Single-Bit Protocols
- You will need a copy of the **Coordination and Binary Messages**
- You will work with your shoulder partner

ALL-CLASS SHOWDOWN

- Who can transmit messages the quickest?
- I will reveal which sequence will be sent. Partner A of each group may enter this sequence of bits into the Internet Simulator but may not begin sending them.
- I will say "GO" and partners will exchange messages.
- During the challenge you may not communicate with one another.
- You will say "STOP" once you have completed your exchange
- I will check to see if the correct messages were sent and received.

THE INTERNET: WIRES, CABLES & WIFI

- https://www.youtube.com/watch?v=ZhEf7e4kopM

MAIN IDEAS:

- Bandwidth: transmission capacity, measured by bitrate
- Bit rate: the number of bits that are conveyed or processed per unit of time
  - Example: 8 bits/sec
- Latency: time it takes for a bit to travel from sender to receiver

	PRO	CON
 ELECTRIC	CHEAP	SIGNAL LOSS
 LIGHT	FAST NO SIGNAL LOSS	EXPENSIVE HARD TO WORK WITH
 RADIO	WIRELESS	SIGNAL LOSS

DISCUSSION:

- How has today's activity added to or altered your definition of a bit?
- A major focus of today's activity was timing and coordination. What things did you need to coordinate or agree about ahead of time in order for your protocol to work?
- What is the best bit rate you were able to achieve? What would it take to go faster?
- How fast do you think computers transmit bits?

FUN FACT:

- It's difficult for us to get a bitrate faster than 1 bit/sec
- Even in the early 90s, modems had bitrates higher than about 10,000

HOMEWORK:

- Finish the worksheet
- Four questions on studio.code.org