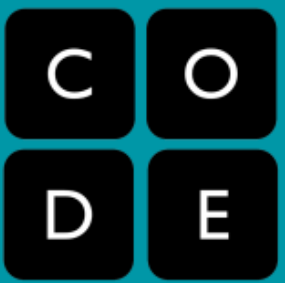
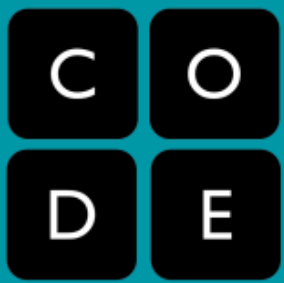


Sending Numbers

Unit 1 Lesson 6 (U1.6)



Review binary numbers:

Convert to decimal:

01001

0100

9

4

Convert to binary:

11010

110011

26

51

What is the first (lowest) value that can be represented with n bits in a positional number system, the first value we represent is 0.

With n bits, any binary number system that uses values we can represent the lowest value we can represent is composed of all 0s and is exactly 0.

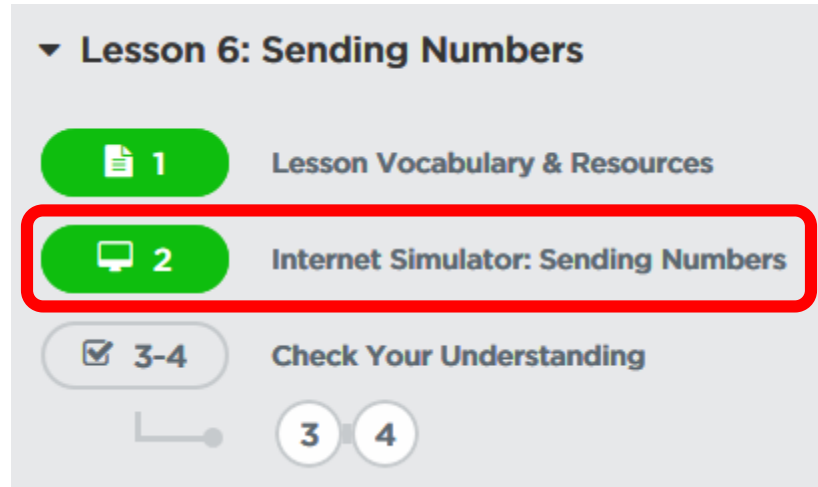
In general the answer is $2^{(\text{number of bits})} - 1$

In computer science, and when talking about transmitting information between computing devices, a protocol is a set of rules that tell us how to encode, communicate and exchange information.

Today, you and a partner will invent a communication **protocol** that allows you to send a list of numbers to represent a drawing.

DON'T WORRY - we have a new version of the Internet Simulator widget that abstracts away the coordination problems you had to deal with previously.

Navigate to the Internet Simulator: Sending Numbers



Explore the NEW Internet Simulator with your partner and see what's new and improved.
(5 mins)

Puzzle 2 of 4

Sending Numbers Activity

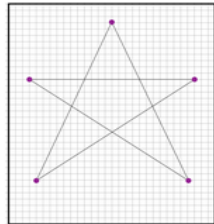
Challenge: Develop a protocol or set of rules for communicating a drawing to your partners using only bits.

Challenge Rules: The image will be a line drawing created by connecting points on a grid, like the one seen here. You can discuss and agree on a protocol ahead of time, but the image exchange must happen without communication between the two parties other than through using the Internet Simulator.

Things to Consider:

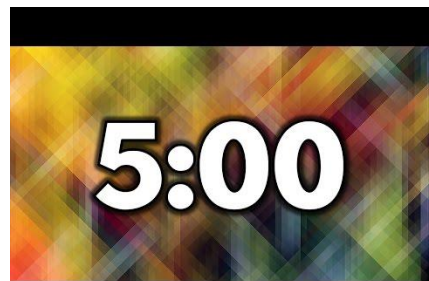
- How will your points be formatted?
- How does the recipient know when one number ends and the next begins?

Your Protocol: Write the steps of your protocol on the worksheet provided by your teacher.



OK

Don't worry about the directions, just click OK.



The major change is in how you send and receive messages:

You no longer have to coordinate setting and reading the wire with your partner.

Now the simulator is a two-way street, and everything you send will be received by your partner automatically.

You send a full sequence of symbols all at once, rather than one symbol at a time.

Now the binary sends 0's and 1's instead of A's and B's

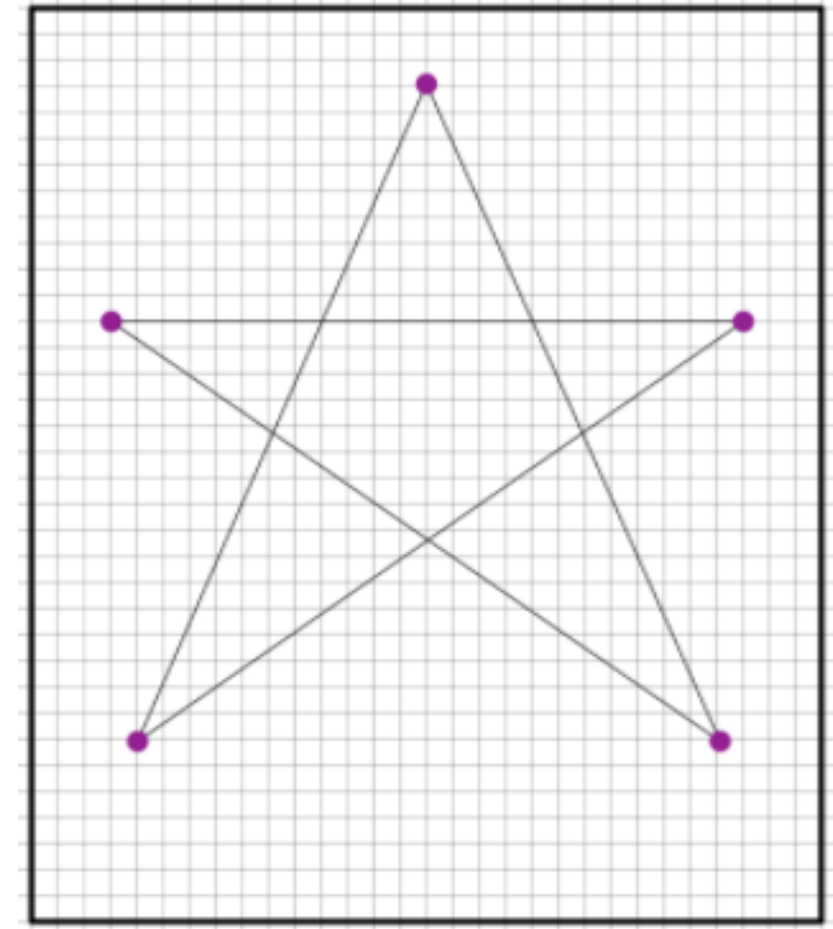
It is possible to see the decimal interpretation of the binary.

Challenge: Develop a protocol or set of rules for communicating a drawing to your partners using only numbers.

Challenge Rules:

The image will be a line drawing created by connecting points on a grid, like the one seen here.

You can discuss and agree on a protocol ahead of time, but the image exchange must happen **without communication** between the two parties other than through using the Internet Simulator.



You can only send a **single message** - a **single list of numbers** - through the Internet Simulator to describe the whole image.

Things to Consider:

How will your points be formatted?

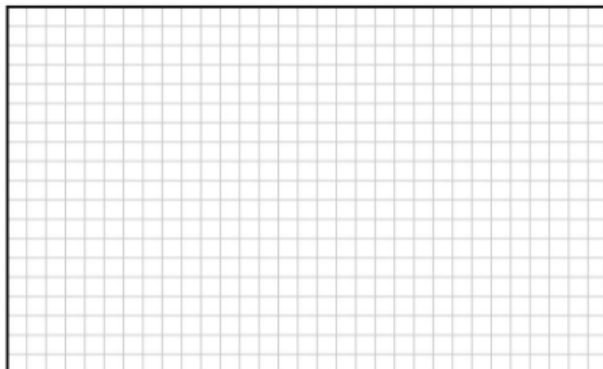
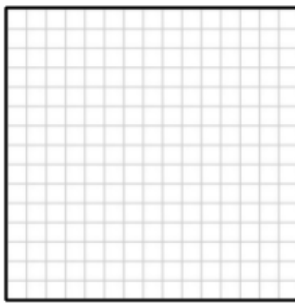
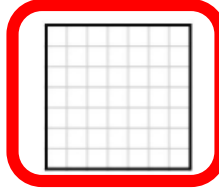
How does the recipient know when one number ends and the next begins?

Your Protocol: Write the steps of your protocol in your INB.

There are TWO sides to the worksheet. An OUTGOING side and an INCOMING side. On the OUTGOING side, create YOUR drawing, **ONLY FOR THE SMALL GRAPH**, then write your code on the right.

Worksheet - Sending Numbers for Graphing C O
D E

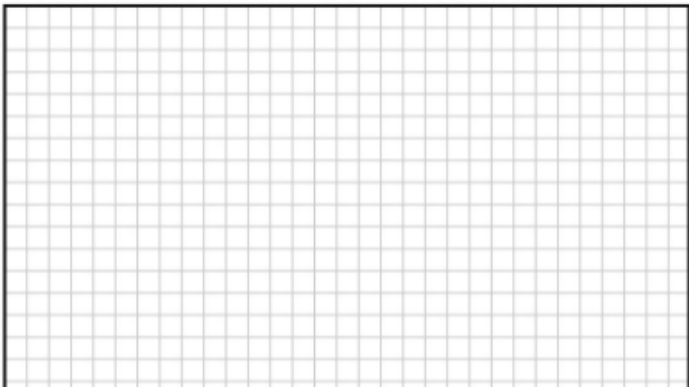
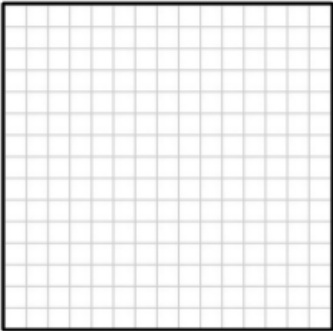
Outgoing Graph: Create your drawing on the left, translate the coordinates to binary, and log the bits on the right. (This is the code you will send to your partner.)



This code is what you will send in the Internet Simulator. Complete this BEFORE sending.

Incoming Graph: Log your partner's binary message below, translate it into coordinates, and plot on the graph to the right.

The code you receive goes here.



Once you have received the code, recreate the drawing your partner sent you.

Worksheet - Sending Numbers for Graphing

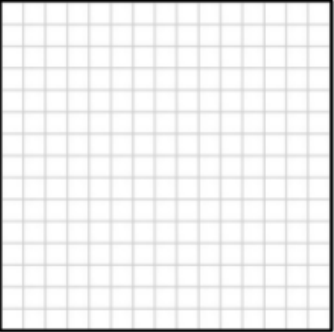


Outgoing Graph: Create your drawing on the left, translate the coordinates to binary, and log the bits on the right. (This is the message you will send to your partner.)

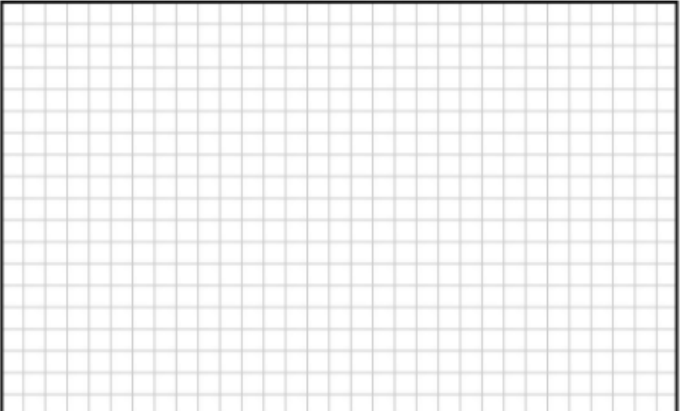
First Round: 3 – 5 points



Second Round: 7 – 10 points



Third Round: 10+ points



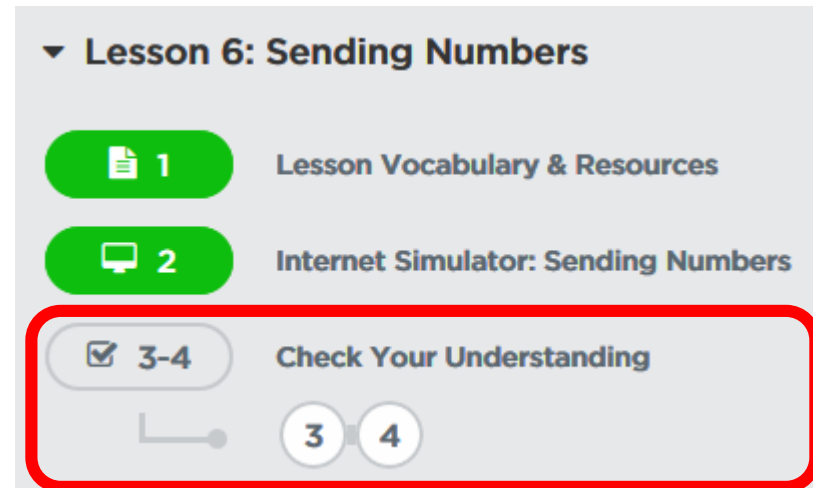
After the first round, debrief with your partner and make changes to your protocol, as needed.

Wrap Up

Were you successful in sending your drawings to your partner?

What difficulties did you encounter? How did you overcome them?

Check Your Understanding



Vocabulary:

Protocol - A set of rules governing the exchange or transmission of data between devices.

Assessment

Develop a protocol that allows the user to send a calendar date (mm/dd). What is the minimum number of bits necessary?

The minimum number is 9 bits.

Develop a protocol that allows the user to send a time (use 24hr military time hh:mm:ss). What is the minimum number of bits necessary?

The minimum number is 17 bits.