Write your name below and indicate your role,

Project Manager (PM), Recorder (R)

Name _____ Role _____

Name _____ Role _____

Binary Numbers

☐ Brainstorm: How many three place patterns can you make with a circle and square

In the previous lesson you created 27 different 3-place patterns out of circles, triangles and squares, and tried to define a system of rules to generate all of the patterns.

What if you only had a circle and square? With only a circle and square, how many 3-place patterns are there? A few are started below. How many are there total?
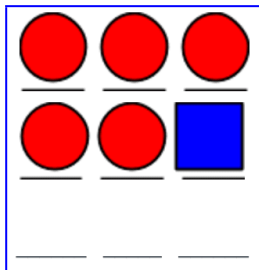
☐ Watch the Circle-Triangle-Square to Binary Video

To help with the transition from circle-triangle-square to binary check out the following video, https://www.youtube.com/watch?v=91HLBUjCHbs

☐ Make a Flippy-Do

Using the template provided by Ms. Pluska construct your Flippy-Do. Use the image below as a guide.

Flippy Do

Fold along the bold line. Cut on the dotted lines

Name:_____

1. Write in the powers of 2

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

2. Write in the whole number equivalents

128	64	32	16	8	4	2	1

3. Write a row of 0s

0	0	0	0	0	0	1	1

4. Write a "1" on the back of each flap.
(Careful about upside-down)

Flip it up!

5. Cut on dotted lines

☐ **Have Ms. Pluska check off your Flippy-Do**

STOP

Before you continue have Ms. Pluska check off your Flippy-Do

Do not continue until you have Ms. Pluska's (or her designated TA's) signature _____

☐ **Use your Flippy-Do to determine all the 4 place binary numbers**

If you have a binary numbers system (0 and 1's only) how many 4 place combinations are there?

Use your Flippy-Do to determine the binary value of each base 10 equivalent.

☐ Determine the base 10 value of all the 8-bit binary numbers with exactly one 1

The table below contains *every* 8-bit number that has exactly one *1* in it. Write down the decimal equivalent next to each one. Do you notice a pattern?

Binary: 8-bit number (with exactly one *1*)	Decimal
0000 0001	1
0000 0010	2
0000 0100	
0000 1000	

Binary: 8-bit number (with exactly one *1*)	Decimal
0001 0000	
0010 0000	
0100 0000	
1000 0000	

☐ Have Ms. Pluska check off the previous tasks before you continue

Before you continue have Ms. Pluska check off the previous tasks before you contineu

Do not continue until you have Ms. Pluska's (or her designated TA's) signature _____

☐ Practice with conversions

Using your own binary skills (aided by the flippy do) fill in the decimal and binary equivalents below.

What's the Decimal Number?

Binary	Decimal
100	
101	
1101	
0001 1111	
0010 0000	
1010 1010	
1111 1111	

What's the Binary Number?

Binary	Decimal
	5
	17
	63
	64
	127
	256*
	513*

NOTE: a short binary number like **101** is assumed to have leading 0s for all the other bits, like: **00000101.** Typically large binary numbers are grouped in 4-bit chunks to improve readability, for example: **0110 0101 1010**

*NOTE: 256 and 513 exceed the capacity of the flippy-do but you can work it logically following what you know about patterns with binary numbers.

☐ Complete the reflection questions

There is a simple pattern for determining if a binary number is odd. What is it and why does this pattern occur?

How many bits would you need if you wanted to have the ability to count up to 1000?

How high could you count in binary if you used all 10 of your fingers as bits? (finger up means 1, finger down means 0)

☐ Receive Credit for the group portion of this lab

- Indicate the names of all group members.
- Have Ms. Pluska check your Number Systems lab.
- Submit your lab to the needs to be graded folder to receive credit for the group portion of this lab.

Do not submit your lab until you have Ms. Pluska's (or her designated TA's) signature _____