Name _____

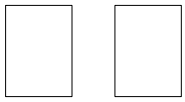
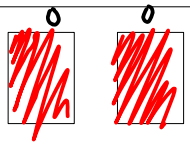
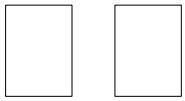
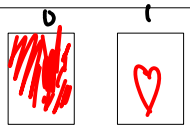
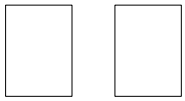
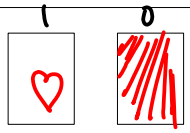
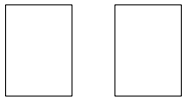
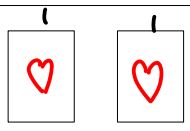
Date _____ Period _____

Geometry 1, Balboa High School

Binary Counting

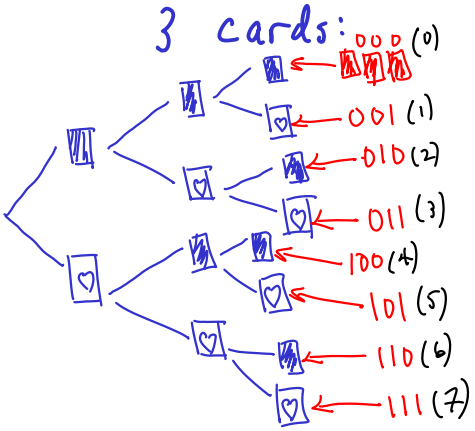
I. Counting with Two Cards

Your team has been issued 2 playing cards. Line the cards up in a row and come up with a system for representing the numbers 0 through 3. Complete column (a) below. **A face-up card is left blank and a face-down card is shaded in.**

Number	*(a) Team's agreed-upon arrangement*	*(b) Class' agreed-upon arrangement*	*(c) Using 0s and 1s*
0			0 0
1			0 1
2			1 0
3			1 1

II. Counting with 1, 2, 3, 4, and More Cards

Your team will now be given two additional cards, for a total of four. In the last exercise, we were able to represent 4 different values – 0, 1, 2, 3 – using two cards. How many values can you represent using different numbers of cards?



Number of Cards	*Number of Values*
1 card 2^1	2 ← 0, 1
2 cards 2^2	4 ← 0, 1, 2, 3
3 cards 2^3	8 ← 0, 1, …, 7
4 cards	16
5 cards	32
20 cards 2^{20}	$2^{20} = 1,048,576$
n cards	2^n

III. Binary Counting with 4 bits

Using face-up and face-down cards is a hands-on way to represent zeros and ones known as **B**INARY DIG**IT**S, or **bit**s for short. Using just zeros and ones, we can come up with a way to represent the base-10 (decimal) numbers you've always used.

Let's complete this together:

19
20
21
...
99
100

Decimal #	*Binary #*	*Decimal #*	*Binary #*
0	0 0 0 0	8	1 0 0 0
1	0 0 0 1	9	1 0 0 1
2	0 0 1 0	10	1 0 1 0
3	0 0 1 1	11	1 0 1 1
4	0 1 0 0	12	1 1 0 0
5	0 1 0 1	13	1 1 0 1
6	0 1 1 0	14	1 1 1 0
7	0 1 1 1	15	1 1 1 1

8 1 0 0 0

IV. HW: Count from 0 to 31 in Binary.

Decimal #	*Binary #*	*Decimal #*	*Binary #*
0	0 0 0 0 0		
1	_ _ _ _ _		
2			
3			
4			