CEMC at Home
## Grade 7/8 - Tuesday, March 31, 2020
Building Numbers

In this activity we will explore a way to build the counting numbers. Let's think about the following sequence of numbers:

$$1, 2, 4, 8$$

Notice that each number is twice as big as the number to its left. (You may recognize these numbers as powers of 2.) We will represent each of the numbers in the list using a card with the correct number of dots on its face. Notice that we have placed the cards in order from most to fewest dots.
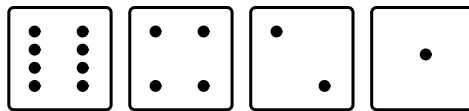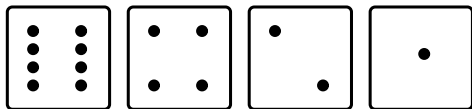
We will build different numbers by choosing which of these cards to put face up and which of these cards to put face down. The number represented by the cards will be the total number of dots that are showing.

Let's look at some examples.

If we put all of the cards face down, this would represent the number 0 because there are no dots showing.

If we put all of the cards face up, this would represent the number 15 because there are $8 + 4 + 2 + 1 = 15$ dots showing in total.


This would represent the number 5 because there are $4 + 1 = 5$ dots showing in total.

Question 1: How many different numbers can you represent using these four cards? List all of the numbers that can be represented and show how to represent each one using the cards.

See the next page for tools to help organize your solution.

Question 2: Now add a fifth card that has 16 dots on its face. Can you determine which numbers can be represented using the five cards (following the same rules)?

How might you use your work in Question 1 to help answer Question 2?
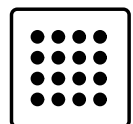
Variation: Make four cards with 1, 3, 9, and 27 dots on them. What numbers can you make with these cards? What do you notice about building numbers with these cards that is different from building numbers with the original cards 1, 2, 4, 8?
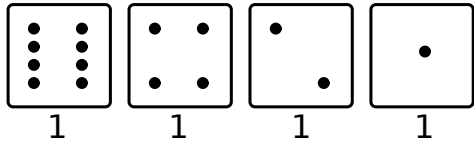
On the last page, you will find cards you can cut out and use while you explore these questions.
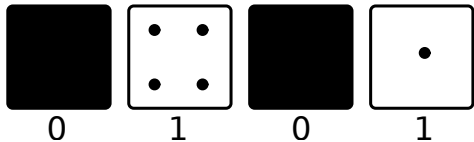
Drawing the cards for each number will take a lot of time, so let's use a simple "code" to keep track of our work. We will indicate that a card is face up by a 1, and indicate that a card is face down with a 0. This means we can communicate what our cards look like using just 0s and 1s.
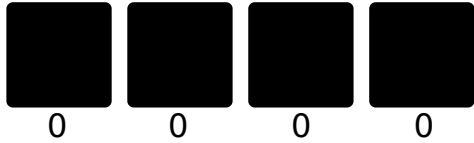
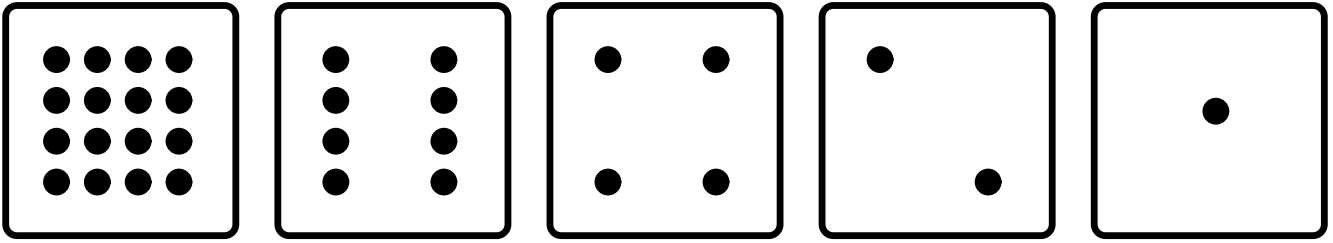|	
0 0 0 0	The code 0000 represents all cards being face down (the number 0).
1 1 1 1	The code 1111 represents all cards being face up (the number 15).
0 1 0 1	The code 0101 represents this configuration of cards (the number 5).

Record all of the numbers you can represent here.

Code	Number		Code	Number		Code	Number		Code	Number
0000	0									
										1111	15

More Info:

Check out the CEMC at Home webpage on Wednesday, April 1 for the solution to Building Numbers.

We will explore Building Numbers further on Wednesday, April 1 with Secret Messages.

Cards for the main activity

Cards for the variation