Student Activity Guide: Converting Decimal to Binary Name: _____

Unit 1 Lesson 7

Directions: Answer these questions after the opening activity.

1. If you were in a classroom with two light switches, how many different ways or combinations can you set those switches? _____ ways

2. How many different combinations can you set switches if you were in a larger room with more switches such as in a library? Fill in the chart.

number of light switches	3	4	5	6	N
number of different ways to set the lights					

3. Let's go back to the situation where you would have 3 switches. List the different combinations of switches that you could set to turn on lights.

 [1]

First Switch On or Off	Second Switch On or Off	Third Switch On or Off

[1] <http://www.tlc-direct.co.uk/Images/Products/size_3/VLXC3W.JPG>

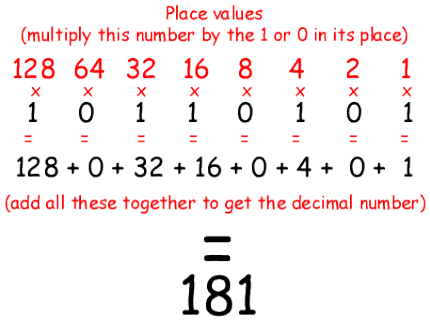
4. Using the idea of the light switches, people created a number system called base two, or binary. In this system, numbers are represented with combinations of the digits 0 and 1. Complete the chart:

zero	one	two	three	four	five	six	seven
0000	0001	0010	0011				

eight	nine	ten	eleven	twelve	thirteen	fourteen	fifteen
1000							

5. Using the table above as a guide, can you guess how to represent the number **twenty** in binary? Write your answer here and explain how you know it is correct.

6. Binary numbers can be much larger than just 4 digits. Here is a number with 8 binary digits. Explain in the box on the right how the number is converted from binary to decimal.



The number in binary is written as:

It represents the decimal number :

7. Using the above example as a guide, try to convert this number from binary into decimal.

place value	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
binary digit	1	0	0	1	0	1	0	0
value								

[2] <http://spaceplace.nasa.gov/review/binary-code2/binary_table.en.gif>

The binary number 1 0 0 1 0 1 0 0 is equivalent to the decimal number _____.

7. In the previous examples we started with a binary number and converted to decimal. We can go in the other direction, as well.

To change the decimal number 35 into binary,
a. Moving from left to right, circle the numbers in the table that add up to 35.

place value	128	64	32	16	8	4	2	1
binary digit								

b. Put a 1 in the "binary digit" row for each number you circled. Put a 0 in the other cells.

c. Write your eight binary digits here: __ __ __ __ __ __ __ __

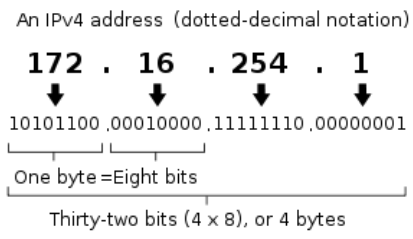
d. You don't have to write the leading zeros; rewrite your answer here: _____

Extended Learning

8. Practice converting these numbers from binary to decimal.
(The space between the first 4 and the second 4 digits is there to help you read more clearly.)

Binary	0001 1000	1000 0010	0010 0101	
Decimal		70		97

9. IPv4 Addresses are usually written as a series of 4 numbers.



[3]

Convert the IPv4 address 96. 130. 255. 1
into 32-bit notation.

[3] <http://upload.wikimedia.org/wikipedia/commons/thumb/7/74/Ipv4_address.svg/300px-Ipv4_address.svg.png>