

## Lab 1.2.5 Decimal to Binary Conversion – Instructor Version

### Objective

- Learn to convert decimal values to binary values.
- Practice converting decimal values to binary values.

### Background

Knowing how to convert decimal values to binary values is valuable when converting human readable IP addresses in dotted decimal format to machine-readable binary format. This is normally done for calculation of subnet masks and other tasks. The following is an example of an IP address in 32-bit binary form and dotted decimal form.

**Binary IP Address:** 11000000.10101000.00101101.01111001

**Decimal IP Address:** 192.168.45.121

A tool that makes the conversion of decimal values to binary values simple is the following table. The first row is created by counting right to left from one to eight, for the basic eight bit positions. The table will work for any size binary value. The value row starts with one and doubles, Base 2, for each position to the left.

Position Value	8	7	6	5	4	3	2	1
	128	64	32	16	8	4	2	1

$$\begin{array}{r}
 128 \overline{)207} \\
 128 \\
 \hline
 64 \overline{)79} \\
 64 \\
 \hline
 8 \overline{)15} \\
 8 \\
 \hline
 4 \overline{)7} \\
 4 \\
 \hline
 2 \overline{)3} \\
 2 \\
 \hline
 1
 \end{array}$$

The same conversion table and simple division can be used to convert binary values to decimal values.

### Steps

#### To convert 207 to binary:

1. Start with the digit farthest to the left. Determine if the decimal value can be divided by it. Since it will go one time, put a 1 in row three of the conversion table under the 128 value and calculate the remainder, 79.
2. Since the remainder can be divided by the next value, 64, put a 1 in row three under the 64 value of the table.
3. Since the remainder cannot be divided by either 32 or 16, put 0s in row three of our table under the 32 and 16 values.

4. Continue until there is no remainder.
5. If necessary, use row four to check the work.

Position Value	8	7	6	5	4	3	2	1	
	128	64	32	16	8	4	2	1	
	1	1	0	0	1	1	1	1	
	128	64			8	4	2	1	
									= 207

6. Convert the following decimal values to binary values:

- a. 123      01111011
- b. 202      11001010
- c. 67      01000011
- d. 7      00000111
- e. 252      11111100
- f. 91      01011011
- g. 116.127.71.3      01110100.01111111.01000111.00000011
- h. 255.255.255.0      11111111.11111111.11111111.00000000
- i. 192.143.255.255      11000000.10001111.11111111.11111111
- j. 12.101.9.16      00001100.01100101.00001001.00010000

This concludes the lab.