Assignment 5-2: Binary Math Skills

Name: _____

Objective

In this exercise, you will practice converting binary values to decimal values.

Background

192.168.001.123 IP Address
255.255.255.0 Subnet Mask

11000000.10101000.00000001.01111011 IP Address (Binary)
11111111.11111111.11111111.00000000 Subnet Mask (Binary)

Binary data consists of 1s and 0s (on and off). While binary data can be grouped in varying increments like three or four digits (110 or 1011), in TCP/IP it is usually grouped in eight-digit groups called a *byte*.

A *byte* (8 bits) can range from 00000000 to 11111111, creating 256 combinations with decimal values ranging from 0 to 255. IP addressing uses 4 bytes (32 bits) to identify both the network and specific device (node). The example at the top of this lab is an example of an IP address in both binary decimal formats.

The following table is a simple tool for easily converting binary to decimal values. The first row is created by counting right to left from 1 to 8 for the basic 8-bit positions (although it would work for any size binary value). The Value row starts with 1 and doubles (base 2) for each position to the left.

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

Steps

1. Type the binary bits (for example **10111001**) in row 3.
2. Put the decimal values in row 4 only for the third-row 1s. Technically the row 2 values are being multiplied by row 4.
3. Now just sum row 4 (across).

Position	8	7	6	5	4	3	2	1	
Value	128	64	32	16	8	4	2	1	
	1	0	1	1	1	0	0	1	
	128		32	16	8			1	= 185

Practice: Binary Math Skills

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

Convert the following binary values to decimals:

1. 1110 _____
2. 100110 _____
3. 11111111 _____
4. 11010011 _____
5. 01000001 _____
6. 11001110 _____
7. 01110101 _____
8. 10001111 _____
9. 11101001.00011011.10000000.10100100 _____._____._____._____
10. 10101010.00110100.11100110.00010111 _____._____._____._____

The answers are on the last pages.

Decimal to Binary Conversion

Objective

In this exercise, you will practice converting decimal values to binary values.

Background

The following table is a simple tool for easily converting binary to decimal values. The first row is created by counting right to left from 1 to 8 for the basic 8-bit positions (although it would work for any size binary value). The Value row starts with 1 and doubles (base 2) for each position to the left.

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

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

Steps

Say you want to convert 207 to binary.

1. Start with the leftmost value (the largest) in the table and divide the decimal by it. Since it will divide once, you put a 1 in row 3 of the conversion table and calculate the remainder (79). If the result of the division is two or more, add another column and value to the conversion table – the only digits we can use are 0 and 1.
2. Since the remainder can be divided by the next table value (64), put a 1 in row 3 of the table otherwise put a 0 row three and move to the next value.
3. Since the remainder cannot be divided by either 32 or 16, you put 0s in row 3 of the table.
4. Continue until there is no remainder Put a 0 in any remaining columns.

128	207
	128
64	79
	64
8	15
	8
4	7
	4
2	3
	2
	1

If necessary, use row 4 to check your work.

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

Practice: Decimal to Binary Conversion

Convert the following decimal values to binary:

1. 123 _____
2. 202 _____
3. 67 _____
4. 7 _____
5. 252 _____
6. 91 _____
7. 116.127.71.3 _____._____._____._____
8. 255.255.255.0 _____._____._____._____
9. 192.143.255.255 _____._____._____._____
10. 12.101.9.16 _____._____._____._____

The answers are on the last pages.

Module 4 Lab #1: Answers

Binary Math Skills

1. 1110 14
2. 100110 38
3. 11111111 255
4. 11010011 211
5. 01000001 65
6. 11001110 206
7. 01110101 117
8. 10001111 143
9. 11101001.00011011.10000000.10100100 233.27.128.164
10. 10101010.00110100.11100110.00010111 170.52.230.23

Decimal to Binary Conversion

1. 123 01111011
2. 202 11001010
3. 67 01000011
4. 7 00000111
5. 252 11111100
6. 91 01011011
7. 116.127.71.3 01110100.01111111.01000111.00000011
8. 255.255.255.0 11111111.11111111.11111111.00000000
9. 192.143.255.255 11000000.10001111.11111111.11111111
10. 12.101.9.16 00001100.01100101.00001001.00010000