Worksheet: Denary to Binary

Converting From Denary to Binary

The textbook (pages 112-114) has a pretty good explanation of one simple method of converting from denary to binary. Here is the calculation done in a single table converting the denary value 201 to binary.

bit position	8	7	6	5	4	3	2	1	0
exponential	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
bit value (denary)	256	128	64	32	16	8	4	2	1
difference	×	201 −128 73	73 −64 9	×	×	9 −8 1	×	×	1 −1 0
binary digits (bits)		1	1	0	0	1	0	0	1

The following is a more concise and compact version of the calculations in the table above.

denary		**201**	**73**			**9**			**1**
bit value	256	128	64	32	16	8	4	2	1
difference		**73**	**9**			**1**			**0**
binary digits (bits)		**1**	**1**	**0**	**0**	**1**	**0**	**0**	**1**

1. Given the denary number 182, complete the table.

a)

denary		182		54	22		6	2	
bit value	256	128	64	32	16	8	4	2	1
difference		**54**		22	6		2	0	
binary digits (bits)		**1**	**0**	**1**	**1**	**0**	**1**	**1**	**0**

b) Write the final 8-bit binary value here: 1011_0110

2. Given the denary number 125, complete the table.

a)

denary			125	61	29	13	5		1
bit value	256	128	64	32	16	8	4	2	1
difference			**61**	29	13	**5**	1		**0**
binary digits (bits)		**0**	**1**	**1**	**1**	**1**	**1**	**0**	**1**

b) Write the final 8-bit binary value here: 0111_1101

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3. For Pearson, you will only be asked to convert numbers that result in a maximum of 8 bits; however it is not any more difficult to convert larger numbers. Given the denary number 801, complete the table.

a)

denary		801	289			33					1
bit value	1024	512	256	128	64	32	16	8	4	2	1
difference		289	33			1					0
binary digits (bits)	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**

b) Write the final 10-bit binary value here: 11_0010_0001

4. Back to numbers less than 8 bits. Given the denary number 255, complete the table.

a)

denary		255	127	63	31	15	7	3	1
bit value	256	128	64	32	16	8	4	2	1
difference		127	63	31	15	7	3	1	0
binary digits (bits)		1	1	1	1	1	1	1	1

b) Write the final 8-bit binary value here: 1111_1111

5. Back to numbers less than 8 bits. Given the denary number 127, complete the table.

a)

denary			127	63	31	15	7	3	1
bit value	256	128	64	32	16	8	4	2	1
difference			63	31	15	7	3	1	0
binary digits (bits)		0	1	1	1	1	1	1	1

b) Write the final 8-bit binary value here: 0111_1111

Notice the answers to question 4 and question 5. The value 2^8 is 256, and when we convert one fewer than this number, 255, the result is all 1's for the remaining 8 bits, so 1111_1111. The same happens with $2^7 = 128$, so 127 is 0111_1111. This is a good thing to remember to allow you to quickly convert certain numbers.

We will also study another algorithm for converting from denary to binary when we study bit shifting.