

Binary to decimal and back

Each place in a binary number is worth twice the place to its right. Write the place values over the bits, then add the values that sit over a 1.

Example. 01001101 has 1s under 64, 8, 4 and 1, so it equals $64 + 8 + 4 + 1 = 77$.

128	64	32	16	8	4	2	1
0	1	0	0	1	1	0	1

A Convert binary to decimal

- 1010 = _____
- 1111 = _____
- 10000 = _____
- 11001 = _____
- 100110 = _____
- 110010 = _____
- 1000000 = _____
- 1100100 = _____
- 10101010 = _____
- 11111111 = _____

B Convert decimal to binary

Subtract the biggest place value that fits, write a 1 there, and repeat with what is left.

- 6 = _____
- 13 = _____
- 21 = _____
- 30 = _____
- 45 = _____
- 64 = _____
- 100 = _____
- 127 = _____
- 200 = _____
- 255 = _____

C Write each number as a full byte (8 bits)

- 5 = _____
- 72 = _____
- 130 = _____

D Count from 8 to 15 in 4 bits

8	9	10	11	12	13	14	15

E Think about it

- What is the largest number one byte (8 bits) can hold? Why?

- What happens to a binary number when you add a 0 on the right end?

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Answer key

Example. 01001101 has 1s under 64, 8, 4 and 1, so it equals $64 + 8 + 4 + 1 = 77$.

128	64	32	16	8	4	2	1
0	1	0	0	1	1	0	1

A Convert binary to decimal

1. $1010 = 10$
2. $1111 = 15$
3. $10000 = 16$
4. $11001 = 25$
5. $100110 = 38$
6. $110010 = 50$
7. $1000000 = 64$
8. $1100100 = 100$
9. $10101010 = 170$
10. $11111111 = 255$

B Convert decimal to binary

1. $6 = 110$
2. $13 = 1101$
3. $21 = 10101$
4. $30 = 11110$
5. $45 = 101101$
6. $64 = 1000000$
7. $100 = 1100100$
8. $127 = 1111111$
9. $200 = 11001000$
10. $255 = 11111111$

C Write each number as a full byte (8 bits)

1. $5 = 00000101$
2. $72 = 01001000$
3. $130 = 10000010$

D Count from 8 to 15 in 4 bits

8	9	10	11	12	13	14	15
1000	1001	1010	1011	1100	1101	1110	1111

E Think about it

1. 255, because all eight bits are 1: $128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 = 255$.
2. It doubles. Adding a 0 on the right moves every bit one place left, so each one is worth twice as much: 101 is 5 and 1010 is 10.