Binary to Decimal Converter

In order to use this new **binary to decimal converter** tool, type any binary value like 1010 into the left field below, and then hit the Convert button. You can see the result in the right field below. It is possible to convert up to 63 binary characters to decimal.

Binary Value

Decimal Value

63

Convert

swap conversion: Decimal To Binary Converter

Binary to decimal conversion result in base numbers

Binary System

The **binary numeral system** uses the number 2 as its base (radix). As a base-2 numeral system, it consists of only two numbers: 0 and 1.

While it has been applied in ancient Egypt, China and India for different purposes, the binary system has become the language of electronics and computers in the modern world. This is the most efficient system to detect an electric signal's off (0) and on (1) state. It is also the basis for binary code that is used to compose data in computer-based machines. Even the digital text that you are reading right now consists of binary numbers.

Reading a binary number is easier than it looks: This is a positional system; therefore, every digit in a binary number is raised to the powers of 2, starting from the rightmost with 2^0. In the binary system, each binary digit refers to 1 bit.

Decimal System

The decimal numeral system is the most commonly used and the standard system in daily life. It uses the number 10 as its base (radix). Therefore, it has 10 symbols: The numbers from 0 to 9; namely 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.

As one of the oldest known numeral systems, the **decimal numeral system** has been used by many ancient civilizations. The difficulty of representing very large numbers in the decimal system was overcome by the Hindu–Arabic numeral system. The Hindu-Arabic numeral system gives positions to the digits in a number and this method works by using powers of the base 10; digits are raised to the n^{th} power, in accordance with their position.

For instance, take the number 2345.67 in the decimal system:

- The digit 5 is in the position of ones (10^0, which equals 1),
- 4 is in the position of tens (10^1)
- 3 is in the position of hundreds (10^2)
- 2 is in the position of thousands (10^3)
- Meanwhile, the digit 6 after the decimal point is in the tenths (1/10, which is 10^{-1}) and 7 is in the hundredths (1/100, which is 10^{-2}) position
- Thus, the number 2345.67 can also be represented as follows: $(2 * 10^3) + (3 * 10^2) + (4 * 10^1) + (5 * 10^0) + (6 * 10^{-1}) + (7 * 10^{-2})$

How to Read a Binary Number

In order to convert binary to decimal, basic knowledge on how to read a binary number might help. As mentioned above, in the positional system of binary, each bit (binary digit) is a power of 2. This means that every binary number could be represented as powers of 2, with the rightmost one being in the position of 2^0.

Example: The binary number $(1010)_2$ can also be written as follows: $(1 * 2^3) + (0 * 2^2) + (1 * 2^1) + (0 * 2^0)$

How to Convert Binary to Decimal

There are two methods to apply a binary to decimal conversion. The first one uses positional representation of the binary, which is described above. The second method is called double dabble and is used for converting longer binary strings faster. It doesn't use the positions.

Method 1: Using Positions

Step 1: Write down the binary number.

Step 2: Starting with the least significant digit (LSB - the rightmost one), multiply the digit by the value of the position. Continue doing this until you reach the most significant digit (MSB - the leftmost one).

Step 3: Add the results and you will get the decimal equivalent of the given binary number.

Now, let's apply these steps to, for example, the binary number above, which is $(1010)_2$

- **Step 1**: Write down $(1010)_2$ and determine the positions, namely the powers of 2 that the digit belongs to.
- **Step 2**: Represent the number in terms of its positions. $(1 * 2^3) + (0 * 2^2) + (1 * 2^1) + (0 * 2^0)$
- **Step 3**: $(1 * 8) + (0 * 4) + (1 * 2) + (0 * 1) = 8 + 0 + 2 + 0 = 10$
- Therefore, $(1010)_2 = (10)_{10}$

(Note that the digits 0 in the binary produced zero values in the decimal as well.)

Method 2: Double Dabble

Also called doubling, this method is actually an algorithm that can be applied to convert from any given base to decimal. Double dabble helps converting longer binary strings in your head and the only thing to remember is 'double the total and add the next digit'.

- Step 1: Write down the binary number. Starting from the left, you will be doubling the previous total and adding the current digit. In the first step the previous total is always 0 because you are just starting. Therefore, double the total (0 * 2 = 0) and add the leftmost digit.
- Step 2: Double the total and add the next leftmost digit.
- Step 3: Double the total and add the next leftmost digit. Repeat this until you run out of digits.

- Step 4: The result you get after adding the last digit to the previous doubled total is the decimal equivalent.

Now, let's apply the double dabble method to same the binary number, $(1010)_2$

- Your previous total 0. Your leftmost digit is 1. Double the total and add the leftmost digit

  (0 * 2) + 1 = 1
- Step 2: Double the previous total and add the next leftmost digit.

  (1 * 2) + 0 = 2
- Step 3: Double the previous total and add the next leftmost digit.

  (2 * 2) + 1 = 5
- Step 4: Double the previous total and add the next leftmost digit.

  (5 * 2) + 0 = 10

This is where you run out of digits in this example. Therefore, $(1010)_2 = (10)_{10}$

Binary to decimal conversion examples

Example 1: $(1110010)_2 = (114)_{10}$

Method 1:

$(0 * 2^0) + (1 * 2^1) + (0 * 2^2) + (0 * 2^3) + (1 * 2^4) + (1 * 2^5) + (1 * 2^6)$

$= (0 * 1) + (1 * 2) + (0 * 4) + (0 * 8) + (1 * 16) + (1 * 32) + (1 * 64)$

$= 0 + 2 + 0 + 0 + 16 + 32 + 64 = 114$

Method 2:

0 (previous sum at starting point)

(0 + 1) * 2 = 2

2 + 1 = 3

3 * 2 =6

6 + 1 =7

7 * 2 = 14

14 + 0 =14

14 * 2 = 28

28 + 0 =28

```
28 * 2 = 56
56 + 1 = 57
57 * 2 = 114
```

Example 2: $(11011)_2 = (27)_{10}$

```
Method 1:
(0 * 2^0) + (1 * 2^1) + (0 * 2^2) + (1 * 2^3) + (1 * 2^4)
= (1 * 1) + (1 * 2) + (0 * 4) + (1 * 8) + (1 * 16)
= 1 + 2 + 0 + 8 + 16 = 27

Method 2:
(0 * 2) + 1 = 1
(1 * 2) + 1 = 3
(3 * 2) + 0 = 6
(6 * 2) + 1 = 13
(13 * 2) + 1 = 27
```

Related converters:

Decimal To Binary Converter

Binary Decimal Conversion Chart Table

Binary	Decimal	Binary	Decimal	Binary	Decimal	Binary	Decimal
00000001	1	01000001	65	10000001	129	11000001	193
00000010	2	01000010	66	10000010	130	11000010	194
00000011	3	01000011	67	10000011	131	11000011	195
00000100	4	01000100	68	10000100	132	11000100	196
00000101	5	01000101	69	10000101	133	11000101	197
00000110	6	01000110	70	10000110	134	11000110	198
00000111	7	01000111	71	10000111	135	11000111	199
00001000	8	01001000	72	10001000	136	11001000	200

00001001	9	01001001	73	10001001	137	11001001	201
00001010	10	01001010	74	10001010	138	11001010	202
00001011	11	01001011	75	10001011	139	11001011	203
00001100	12	01001100	76	10001100	140	11001100	204
00001101	13	01001101	77	10001101	141	11001101	205
00001110	14	01001110	78	10001110	142	11001110	206
00001111	15	01001111	79	10001111	143	11001111	207
00010000	16	01010000	80	10010000	144	11010000	208
00010001	17	01010001	81	10010001	145	11010001	209
00010010	18	01010010	82	10010010	146	11010010	210
00010011	19	01010011	83	10010011	147	11010011	211
00010100	20	01010100	84	10010100	148	11010100	212
00010101	21	01010101	85	10010101	149	11010101	213
00010110	22	01010110	86	10010110	150	11010110	214
00010111	23	01010111	87	10010111	151	11010111	215
00011000	24	01011000	88	10011000	152	11011000	216
00011001	25	01011001	89	10011001	153	11011001	217
00011010	26	01011010	90	10011010	154	11011010	218
00011011	27	01011011	91	10011011	155	11011011	219
00011100	28	01011100	92	10011100	156	11011100	220
00011101	29	01011101	93	10011101	157	11011101	221
00011110	30	01011110	94	10011110	158	11011110	222
00011111	31	01011111	95	10011111	159	11011111	223
00100000	32	01100000	96	10100000	160	11100000	224
00100001	33	01100001	97	10100001	161	11100001	225
00100010	34	01100010	98	10100010	162	11100010	226
00100011	35	01100011	99	10100011	163	11100011	227
00100100	36	01100100	100	10100100	164	11100100	228

00100101	37
00100110	38
00100111	39
00101000	40
00101001	41
00101010	42
00101011	43
00101100	44
00101101	45
00101110	46
00101111	47
00110000	48
00110001	49
00110010	50
00110011	51
00110100	52
00110101	53
00110110	54
00110111	55
00111000	56
00111001	57
00111010	58
00111011	59
00111100	60
00111101	61
00111110	62
00111111	63
01000000	64

01100101	101
01100110	102
01100111	103
01101000	104
01101001	105
01101010	106
01101011	107
01101100	108
01101101	109
01101110	110
01101111	111
01110000	112
01110001	113
01110010	114
01110011	115
01110100	116
01110101	117
01110110	118
01110111	119
01111000	120
01111001	121
01111010	122
01111011	123
01111100	124
01111101	125
01111110	126
01111111	127
10000000	128

10100101	165
10100110	166
10100111	167
10101000	168
10101001	169
10101010	170
10101011	171
10101100	172
10101101	173
10101110	174
10101111	175
10110000	176
10110001	177
10110010	178
10110011	179
10110100	180
10110101	181
10110110	182
10110111	183
10111000	184
10111001	185
10111010	186
10111011	187
10111100	188
10111101	189
10111110	190
10111111	191
11000000	192

11100101	229
11100110	230
11100111	231
11101000	232
11101001	233
11101010	234
11101011	235
11101100	236
11101101	237
11101110	238
11101111	239
11110000	240
11110001	241
11110010	242
11110011	243
11110100	244
11110101	245
11110110	246
11110111	247
11111000	248
11111001	249
11111010	250
11111011	251
11111100	252
11111101	253
11111110	254
11111111	255

Recent Comments

Taani 2022-09-09 06:02:14

How to turn 01000000 into decimal using Double Dabble(method 2)?

sasha 2022-07-06 05:47:16

really good. helps you save time

Bharath CR 2022-06-15 14:40:15

It was use full for me I got more thing to know from this i enjoyed a lot

Rama Rao 2022-03-03 03:41:56

It is so helpful for researchers on Bitcoin

Guest 2022-02-05 09:18:24

@dilantaher 111.0101 = 7.3125

Malshan 2021-11-10 10:13:46

Your previous total 0. Your leftmost digit is 1. Double the total and add the leftmost digit
(0 * 2) + 1 = 1
Step 2: Double the previous total and add the next leftmost digit.
(1 * 2) + 0 = 2
Step 3: Double the previous total and add the next leftmost digit.
(2 * 2) + 1 = 5
Step 4: Double the previous total and add the next leftmost digit.
(5 * 2) + 0 = 10

Fatima 2021-11-08 01:12:08

17. “Schoolhouse Rock’ had a song called ‘Little Twelvetoes’ which had an alien character with 6 fingers on each hand who could count by 12 as easily as we count by 10. If he counted to 100 in his base 12 (duodecimal), what would that be in decimal?
plz help me
Answer?

Fatima 2021-11-08 01:10:06

Assign a binary code in some orderly manner to the 52 playing cards. Use the minimum number of bits. (4)
plz help me
plz send me solution of this question

Guest 2021-10-21 13:58:30

(73)2=(?)10Ans?

Josip 2021-10-10 13:14:30

Excellent tool. Kudos.

Souvik 2021-10-02 01:44:07

This is a great website and useful

guy 2021-09-29 23:14:09

helps a lot!

Adrita Bandyopadhyay 2021-09-01 15:04:16

Wonderful website for tables and conversion. Thank you for this great help.

Spiff 2021-08-10 06:46:30

Lathu,
After the point the powers keep going down into the negatives.
e.g 1101.101
1st 1 is in 4th position 2^4=16
2nd 1 is in 3rd position 2^3=8 8+16=24
3rd digit is a 0, skip
4th 1 is woth 2^1=2 24+2=26

1st place after point is worth 2^{-1}=½ 26+½ = 26.5
2nd place after point is worth 2^{-2}=¼ 26.5+¼ = 26.75
4th place after point is worth 2^{-4}=1/16 26.75+1/16 = 26.8125

Tanisha 2021-05-28 14:55:30

(011011)2=(?)10 please anyone give me these answer please

Laxmi 2021-04-30 14:05:56

Convert binary into decimal numbers (10100011)2

Guest 2021-04-07 16:50:45

so is 00000000 : 0 ? because for 8 bit we need 256 outcomes

Jahdiel 2021-03-15 13:41:54

I find the decimal on this then I work it out in my book. I am a 11 year old I am in grade 7 standard 5

Richard 2021-03-05 09:16:50

How long does it take to convert a 4 million bit binary number to decimal

Ipshita Saini 2021-03-04 11:03:23

Thanks for what all you had developed it is helping to prepare fro my computer exam very ell tomorrow

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Comment

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