

ABOUT BASE CONVERSION

Common Bases :

- Decimal == base-10. Range: 0,..., 9
- Hexadecimal == base-16. Range : 0 ... A, B, C, D, E, F
- Octal == base-8, Range: 0, ..., 7
- Binary == base-2 . Range: 0, 1

Convert base-10 to base-2 base-10 to base-8 base-10 to base-16

<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <table style="width: 100%; border-collapse: collapse;"> <tr><td style="border-right: 1px solid black; padding: 2px;">2</td><td style="padding: 2px;">75</td><td style="padding: 2px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 2px;">2</td><td style="padding: 2px;">37 ...</td><td style="padding: 2px;">1</td></tr> <tr><td style="border-right: 1px solid black; padding: 2px;">2</td><td style="padding: 2px;">18 ...</td><td style="padding: 2px;">1</td></tr> <tr><td style="border-right: 1px solid black; padding: 2px;">2</td><td style="padding: 2px;">9 ...</td><td style="padding: 2px;">0</td></tr> <tr><td style="border-right: 1px solid black; padding: 2px;">2</td><td style="padding: 2px;">4 ...</td><td style="padding: 2px;">1</td></tr> <tr><td style="border-right: 1px solid black; padding: 2px;">2</td><td style="padding: 2px;">2 ...</td><td style="padding: 2px;">0</td></tr> <tr><td style="border-right: 1px solid black; padding: 2px;">2</td><td style="padding: 2px;">1 ...</td><td style="padding: 2px;">0</td></tr> <tr><td style="border-right: 1px solid black; padding: 2px;"></td><td style="padding: 2px;">0 ...</td><td style="padding: 2px;">1</td></tr> </table> </div> <p style="margin-top: 10px;">So $75_{10} == 100\ 1011_2$</p>	2	75		2	37 ...	1	2	18 ...	1	2	9 ...	0	2	4 ...	1	2	2 ...	0	2	1 ...	0		0 ...	1	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <table style="width: 100%; border-collapse: collapse;"> <tr><td style="border-right: 1px solid black; padding: 2px;">8</td><td style="padding: 2px;">75</td><td style="padding: 2px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 2px;">8</td><td style="padding: 2px;">9 ...</td><td style="padding: 2px;">3</td></tr> <tr><td style="border-right: 1px solid black; padding: 2px;">8</td><td style="padding: 2px;">1 ...</td><td style="padding: 2px;">1</td></tr> <tr><td style="border-right: 1px solid black; padding: 2px;"></td><td style="padding: 2px;">0 ...</td><td style="padding: 2px;">1</td></tr> </table> </div> <p style="margin-top: 10px;">$113_8 ==$</p>	8	75		8	9 ...	3	8	1 ...	1		0 ...	1	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <table style="width: 100%; border-collapse: collapse;"> <tr><td style="border-right: 1px solid black; padding: 2px;">16</td><td style="padding: 2px;">75</td><td style="padding: 2px;"></td></tr> <tr><td style="border-right: 1px solid black; padding: 2px;">16</td><td style="padding: 2px;">4 ...</td><td style="padding: 2px;">11</td></tr> <tr><td style="border-right: 1px solid black; padding: 2px;"></td><td style="padding: 2px;">0 ...</td><td style="padding: 2px;">4</td></tr> </table> </div> <p style="margin-top: 10px;">$4B_{16}$</p>	16	75		16	4 ...	11		0 ...	4
2	75																																														
2	37 ...	1																																													
2	18 ...	1																																													
2	9 ...	0																																													
2	4 ...	1																																													
2	2 ...	0																																													
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Convert other bases back to base-10

<p>Binary to Decimal</p> <table style="margin: auto;"> <tr><td>1</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>2^3</td><td>2^2</td><td>2^1</td><td>2^0</td></tr> </table> <p>= 15_{10}</p>	1	1	1	1	2^3	2^2	2^1	2^0	<p>Octal to Decimal</p> <table style="margin: auto;"> <tr><td>1</td><td>1</td><td>2</td><td>1</td></tr> <tr><td>8^3</td><td>8^2</td><td>8^1</td><td>8^0</td></tr> </table> <p>= 593_{10}</p>	1	1	2	1	8^3	8^2	8^1	8^0	<p>Hex to Decimal</p> <table style="margin: auto;"> <tr><td>1</td><td>2</td><td>1</td><td>1</td></tr> <tr><td>16^3</td><td>16^2</td><td>16^1</td><td>16^0</td></tr> </table> <p>= 4625_{10}</p>	1	2	1	1	16^3	16^2	16^1	16^0
1	1	1	1																							
2^3	2^2	2^1	2^0																							
1	1	2	1																							
8^3	8^2	8^1	8^0																							
1	2	1	1																							
16^3	16^2	16^1	16^0																							

Tips:

- A single hex digits == 4 bits
- When converting binary to hex, first break the bits into 4 bits chunk.

e.g. Take 10111001010_2 , break it into $10\ 1100\ 1010_2$.

↓	↓	↓			
2	12	10			
Hex value =	2	C	A	16	

$10111001010_2 == 2CA_{16}$

Practice exercises

Decimal (base-10) to Hexadecimal (base-16) and Binary (base-2)

Decimal (base-10)	Hexadecimal (base-16)	Binary (base-2)
12		
14		
13		
15		
16		
127		
255		
256		
1023		
1024		
2047		
2048		
65535		
65536		

Binary (base-2) to Hexadecimal (base-16) and Decimal (base-10)

Binary (base-2)	Hexadecimal (base-16)	Decimal (base-10)
00001		
00011		
00111		
01001		
110011		
1001110		
00001001		
10001001		
01001001		
10101000		