1.3 Binary, hexadecimal, and octal

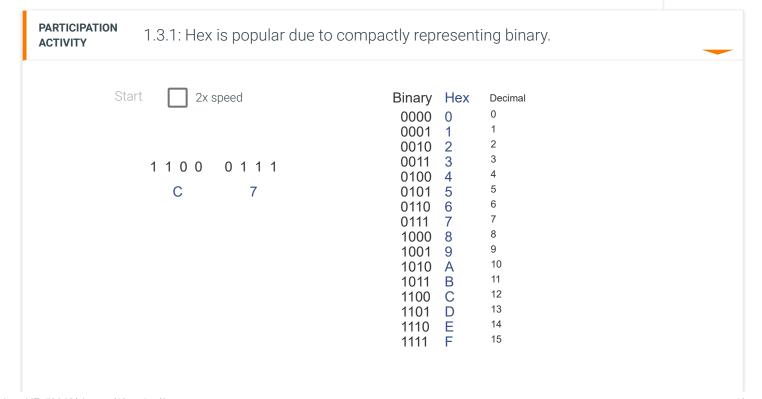
Hexadecimal

While decimal means a base 10 number, **hexadecimal** (or **hex**) means a base 16 number. Each digit is an increasing power 16^2 , etc.

16 symbols are needed for a digit. The symbols are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F.

Hexadecimal is popular due to being a compact representation of a binary number. Four binary digits can be represented a since both have 16 possibilities. Thus 0000 is 0, 0001 is 1, 0010 is 2, ..., 1110 is E, and 1111 is F.

More binary digits use more hex digits. Ex: 00101111 is 2F (0010 is 2, and 1111 is F).



PARTICIPATION ACTIVITY	1.3.2: Converting binary to hex.	
1) 0011 O B		•
O 3		
2) 1010 O A O 10		•
3) 1111 O F O Not p	possible	•
4) 11110000 O FF O F0		•
5) 10100101		•
6) 10011 O 91 O 13		•
7) 000111110	00001111	•

O 1F0	F	
O FOF	1	
PARTICIPATION ACTIVITY	1.3.3: Converting hex to binary.	
1) AA		_
Check	Show answer	
2) OF		_
Check	Show answer	
3) 00		_
Check	Show answer	
4) FF0077		_
Check	Show answer	
PARTICIPATION ACTIVITY	1.3.4: Hex example: Colors on the web.	

Colors on web pages are specified using 24 bits: 8 bits for red, 8 green, and 8 blue. Hex is a convenient way to specify those 24 bits. Thus FF0000 is bright red, 990000 is a darker red, FF00FF is a bright purple, and 000000 is black. Modify some colors below and press "Render HTML".

Reset

Type HTML below	Rendered HTML
html	T. 1
<html></html>	Line1
<body></body>	Line2
<pre></pre>	Line3
Line1	Line4
<pre></pre>	
Line2	Line5
<pre></pre>	Line6
Line3	
<pre></pre>	
Line4	
<pre></pre>	İ

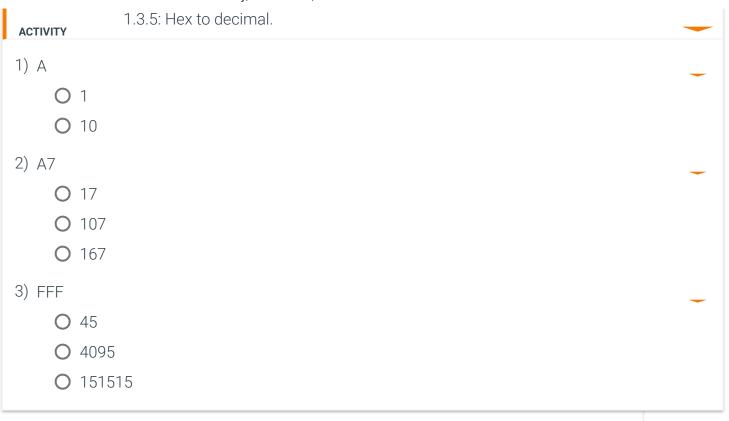
Render HTML

Line5

Hex to decimal

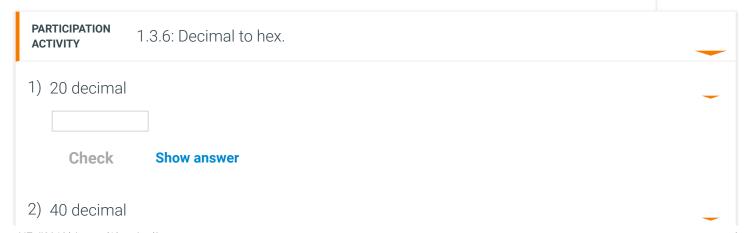
A hex number is converted to decimal simply by multiplying each digit's decimal value by that digit's weight and summing. $+7\times16^{1} + 15\times16^{0} = 2560 + 112 + 15 = 2687$.

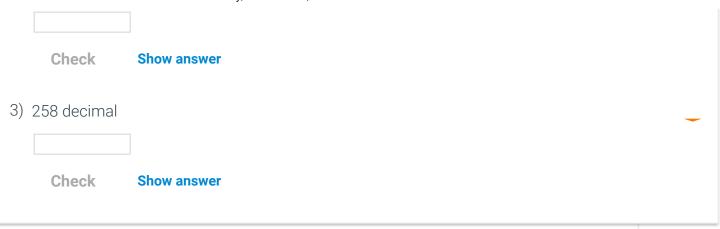
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Decimal to hex

Decimal is converted to hex by finding the highest hex digit where a 1 doesn't exceed the decimal value, incrementing as m without exceeding the decimal value, and repeating for lower digits.





Octal

Octal means a base 8 number. Octal is sometimes used as a compact binary representation because three bits can be repoctal digit, though hex is more common. The eight symbols for an octal digit are 0, 1, 2, 3, 4, 5, 6, 7.

PARTICIPATION ACTIVITY	1.3.7: Binary to octal, octal to binary.	_
1) 101010 bir	nary is octal.	•
2) 1010 binar O 22 O 12	ry is octal.	•
3) 14 octal is O 0017	100	•
4) 07 octal is	binary.	-

