Hexadecimal and Octal Systems

* Hexadecimal is a base 16 system which combines 4 bits to use in each position in the base-16 system, aka for each power of 16.
* The table of decimal to binary to hexadecimal values is as follows:

A screenshot of a computer

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* For hexadecimal representation it starts with “0x” followed by the numbers and/or letter representing the powers of 16.

Each position (power of 16) is made up of 4 bits.

* For example, converting 300 into hexadecimal:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Power of 16 | 164 | 163 | 162 | 161 | 160 |
| Decimal | 65536 | 4096 | 256 | 16 | 1 |

-Can 300 have an even number of 65536 values divided into it?

300 – 65536 < 0. Therefore, no, and so value = 0

-Can 300 have an even number of 4096 values divided into it?

300 – 4096 < 0. Therefore, no, and so value = 0

-Can 300 have an even number of 256 values divided into it?

300 – 256 = 44. Therefore, yes, and so value = 1

-Can 44 have an even number of 16 values divided into it?

44 – 16 – 16 = 12. Therefore, yes, and so value = 2

-Can 12 have an even number of 1 values divided into it? Yes of course, value = 12 = C

Therefore, the hex value for 300 is: 0x0012C (or just 0x12C)

* Octal is a base 8 system which combines 3 bits for each to use in each position in the base-8 system, aka for each power of 8.
* The table of decimal to binary to octal values is:

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|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Power of 8 | 84 | 83 | 82 | 81 | 80 |
| Decimal | 4096 | 512 | 64 | 8 | 1 |

* For example, converting 250 into Octal:

-Can 250 have an even number of 4096 values divided into it?  
250 – 4096 < 0. Therefore, no, and so the value = 0

-Can 250 have an even number of 512 values divided into it?

250 – 512 < 0. Therefore, no, and so the value = 0

-Can 250 have an even number of 64 values divided into it?

250 – 64 – 64 – 64 = 58. Therefore, yes, and the value = 3

-Can 58 have an even number of 8 values divided into it?

58 – (8\*7) = 2. Therefore, yes, and so the value = 7

-can 2 have an even number of 1 values divided into it? Yes, of course, value = 2

Therefore, the value of 250 in Octal is: 00372 (or just 372)

* Octal is also used in Linux/Unix systems is for file permissions which uses **12 bits** total.

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First 9 bits

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Last 3 bits