

# Lecture 1 - Number Systems

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## CONVERTING DECIMAL TO HEXADECIMAL

### Steps:

1. Divide the decimal number by 16. Treat the division as an integer division.
2. Write down the remainder (in hexadecimal).
3. Divide the result again by 16. Treat the division as an integer division.
4. Repeat step 2 and 3 until result is 0.
5. The hex value is the digit sequence of the remainders from the last to first.

Note: a *remainder* in this topic refers to the left over value after performing an integer division.

HEXADECIMAL	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
DECIMAL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

### Example 1

Convert the number **1128** DECIMAL to HEXADECIMAL

NOTES	DIVISION	RESULT	REMAINDER (in HEXADECIMAL)
<p>Start by dividing the number by 16, that is</p> <p>(1128/16).</p> <p>1128 divided by 16 is 70.5. So the integer division result is 70 (throw out anything after the decimal point). Record it on the RESULT column.</p> <p>The remainder is (70.5 - 70) multiplied with 16; or (0.5 times 16), which is 8. Record it on the REMAINDER column.</p>	1128 / 16	70	8
Then. divide the result again			

<p>by 16, that is</p> <p>(70/16).</p> <p>(the number 70 on the DIVISION column comes from the previous RESULT).</p> <p>In this case, <math>70/16=4.375</math>. So the integer division result is 4 (throw out anything after the decimal point)</p> <p>The remainder is (0.375 multiplied with 16, which is 6.</p>	70 / 16	4	6
<p>Repeat. Note here that <math>4/16=0.25</math>. So the integer division result is 0.</p> <p>The remainder is (0.25-0) multiplied with 16, which is 4.</p>	4 / 16	0	4
<p>Stop because the result is already 0 (0 divided by 16 will always be 0)</p>			
<p>Well, here is the answer.</p> <p>These numbers come from the REMAINDER column values (read from bottom to top)</p>			468

Side note: You can get the remainder of a division using the **Modulus** (or % operator in programming code). I.e:  $1128\%16=8$ .

## Example 2

Convert the number **256** DECIMAL to HEXADECIMAL

DIVISION	RESULT	REMAINDER (in HEX)
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DIVISION	RESULT	REMAINDER (in HEX)
256 / 16	16	0
16 / 16	1	0
1 / 16	0	1
ANSWER		100

### Example 3

Convert the number **921** DECIMAL to HEXADECIMAL

DIVISION	RESULT	REMAINDER (in HEX)
921 / 16	57	9
57 / 16	3	9
3 / 16	0	3
ANSWER		399

### Example 4

Convert the number **188** DECIMAL to HEXADECIMAL

DIVISION	RESULT	REMAINDER (in HEX)
188 / 16	11	C (12 decimal)
11 / 16	0	B (11 decimal)
ANSWER		BC

Note that here, the answer would not be 1112, but BC. Remember to write down the remainder in hex, not decimal.

### Example 5

Convert the number **100** DECIMAL to HEXADECIMAL

		REMAINDER
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DIVISION	RESULT	(HEX)
100 / 16	6	4
6 / 16	0	6
ANSWER		64

### Example 6

Convert the number **590** DECIMAL to HEXADECIMAL

DIVISION	RESULT	REMAINDER (HEX)
590 / 16	36	E (14 decimal)
36 / 16	2	4 (4 decimal)
2 / 16	0	2 (2 decimal)
ANSWER		24E