Hexadecimal

Hexadecimal

- Most Western cultures use the decimal system, aka *base-10*, to represent numeric data.

```
0  1  2  3  4  5  6  7  8  9
```

- As we know, computers use the binary system, aka *base-2,* to represent numeric (and indeed all data).

```
0  1
```

Hexadecimal

- As computer scientists, it’s useful to be able to express data the same way the computer does.

- The problem, of course, is that trying to parse a huge chain of 0s and 1s can be quite difficult.

Hexadecimal

- The **hexadecimal system,** aka *base-16*, is a much more concise way to express the data on a computer's system.

```
0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
```

- Hexadecimal makes this mapping easy because a group of four binary digits (bits) is able has 16 different combinations, and each of those combinations maps to a single hexadecimal digit.

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Hexadecimal

Decimal	Binary	Hexadecimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7

Decimal	Binary	Hexadecimal
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

Hexadecimal

Decimal	Binary	Hexadecimal
0	0000	0x0
1	0001	0x1
2	0010	0x2
3	0011	0x3
4	0100	0x4
5	0101	0x5
6	0110	0x6
7	0111	0x7

Decimal	Binary	Hexadecimal
8	1000	0x8
9	1001	0x9
10	1010	0xA
11	1011	0xB
12	1100	0xC
13	1101	0xD
14	1110	0xE
15	1111	0xF

Hexadecimal

- Just like binary has place values (1, 2, 4, 8…) and decimal does too (1, 10, 100, 1000…), so does hexadecimal.

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3 9 7

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0x 3 9 7

Hexadecimal

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	256	16	1
0x	3	9	7

Hexadecimal

- Just like binary has place values (1, 2, 4, 8…) and decimal does too (1, 10, 100, 1000…), so does hexadecimal.

	16^2	16^1	16^0
0x	3	9	7

Hexadecimal

- Just like binary has place values (1, 2, 4, 8…) and decimal does too (1, 10, 100, 1000…), so does hexadecimal.

	16^2	16^1	16^0
0x	A	D	C

Hexadecimal

- To convert a binary number to hexadecimal, group four binary digits (bits) together from right to left.
  - Pad the leftmost group with extra 0 bits at the front if necessary.

- Then use the chart a few slides back or your memory to convert those bits to something a bit more concise.

Hexadecimal

```
01000110101000101011100100111101
```

Hexadecimal

01000110101000101011100100111101

0100 0110 1010 0010 1011 1001 0011 1101

Hexadecimal

01000110101000101011100100111101

0100 0110 1010 0010 1011 1001 0011 **1101**

Hexadecimal

01000110101000101011100100111101

0100 0110 1010 0010 1011 1001 **0011** 1101

13

Hexadecimal

01000110101000101011100100111101

0100 0110 1010 0010 1011 1001 **0011** 1101

D

Hexadecimal

01000110101000101011100100111101

0100 0110 1010 0010 1011 **1001** 0011 1101

3 D

Hexadecimal

01000110101000101011100100111101

0100 0110 1010 0010 **1011** 1001 0011 1101

9 3 D

Hexadecimal

01000110101000101011100100111101

0100 0110 1010 **0010** 1011 1001 0011 1101

B 9 3 D

Hexadecimal

01000110101000101011100100111101

0100 0110 **1010** 0010 1011 1001 0011 1101

2 B 9 3 D

Hexadecimal

01000110101000101011100100111101

0100 **0110** 1010 0010 1011 1001 0011 1101

A 2 B 9 3 D

Hexadecimal

01000110101000101011100100111101

0100 0110 1010 0010 1011 1001 0011 1101

6 A 2 B 9 3 D

Hexadecimal

01000110101000101011100100111101

0100 0110 1010 0010 1011 1001 0011 1101

4 6 A 2 B 9 3 D

Hexadecimal

01000110101000101011100100111101

0100 0110 1010 0010 1011 1001 0011 1101

4 6 A 2 B 9 3 D

0x46A2B93D