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**THE HEXADECIMAL NUMBER SYSTEM**

The hexadecimal number system is base 16 and is abbreviated hex. This system has 16 digits, numbers 0-9 and the letters A-F.

| Hexadecimal Digit | Decimal Value | Binary Equivalent |
| --- | --- | --- |
| 0 | 0 | 0000 |
| 1 | 1 | 0001 |
| 2 | 2 | 0010 |
| 3 | 3 | 0011 |
| 4 | 4 | 0100 |
| 5 | 5 | 0101 |
| 6 | 6 | 0110 |
| 7 | 7 | 0111 |
| 8 | 8 | 1000 |
| 9 | 9 | 1001 |
| A | 10 | 1010 |
| B | 11 | 1011 |
| C | 12 | 1100 |
| D | 13 | 1101 |
| E | 14 | 1110 |
| F | 15 | 1111 |

| 160 | 1 |
| --- | --- |
| 161 | 16 |
| 162 | 256 |
| 163 | 4096 |

# **Hexadecimal to Binary Conversion**

Each hexadecimal digit can be converted to a four bit binary number. Just convert the hex digit to its binary equivalent. For example,

E80316 is converted to binary in the following way:

E = 1110

8 = 1000

0 = 0000

3 = 0011

So the number E80316 = 1110 1000 0000 00112.

# **Binary to Hexadecimal Conversion**

Each nibble (four bits) of a binary number can be converted to a hexadecimal digit. Just convert the nibble to its hexadecimal digit. For example,

1101 0000 1001 01012

1101 = 13 = D

0000 = 0

1001 = 9

0101 = 5

Therefore, 1101 0000 1001 01012 = D09516

**Hexadecimal to Decimal Conversion**

To convert a hex number to decimal, express the number in expanded notation, changing the letters to their decimal equivalents.

**Example:**

73D516 = 7\*163 + 3\*162 + 13\*161 + 5\*160

= 28,672 + 768 + 208 + 5

= 29, 653

**Decimal to Hexadecimal Conversion**

To convert a decimal number to hexadecimal, divide the number and each successive quotient by 16 noting the remainder.

| Division | Quotient | Remainder |
| --- | --- | --- |
| 9719/16 | 607 | 7 |
| 607/16 | 37 | 15 |
| 37/16 | 2 | 5 |
| 2/16 | 0 | 2 |

Replace the decimal digit 15 by F, and sequence the remainders in reverse order. Therefore, 971910 = 25F716.

**Problems**

1. Convert 1A7416 to decimal.

So first we need to convert each digit of the hexadecimal number into its equivalent decimal value based on its position going right to left just like when we find decimals in binary. So step by step  
  
1. 4 \* 16^0 = 4 (rightmost digit)

2. 7 \* 16^1 = 112 (next digit to the left)

3. A \* 16^2 = 2560 (left of 7)

4. 1 \* 16^3 = 4096

5. 4 + 112 + 2560 + 4096 = 6772

Now we add these values up together and you get 677210 in decimal form

2. Convert 15,32110 to hexadecimal.

So first we must divide 15,321 and each successive quotient by 16 and noting each remainder.  
  
I've taken 15,321 and divided by 16 and got 957.56 with a remainder of 9

then I got 957.56 divided by 16 and got 59.84 with a remainder of 13 (D)

then I took 59.84 and divided by 16 and got 3.74 with a remainder of 11 (B)

and we have 3 which is less than 16 so it’s our last number 3.

3BD916

3. Convert 3D5916 to binary.

To break this down we have to go through each individual number and find its hexadecimal digit. Starting with 3, 2^0 and 2^1 fit into 3 so we get 0011.  
With D (13) 2^3, 2^2 and 2^0 fit into D so we get 1101

5 has 2^0 and 2^2 fit into 5 so we get 0101

lastly 9 has 2^3 and 2^0 fit into 9 so we get 1001

All in all we get

0011 1101 0101 10012

4. Convert 00101101001011102 to hexadecimal.

0010 1101 0010 1110

So to make it easier to see we break up the nibbles. We start with 0010 and calculate its hexadecimal digit. We get 2.

Next, we take 1101 and calculate it to be C (13)

Next, we take 0010 and calculate it to be 2 like the first one

lastly, we take 1110 and calculate it to be E (14)  
The answer is 2D2E16

Answers (don't peek!)

1. 677210

2. 3BD916

3. 0011 1101 0101 10012

4. 2D2E16