Name:

**Binary – Denary – Hexadecimal**

Hexadecimal is the base 16 number system. How did this come about? A byte has 8 bits and can be split into two nibbles (4 bits), the column headings for a 4-bit number add up to 15, we can represent the range of numbers 0 – 15 (ie 16 numbers: 0, 1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, )15

Add together

**= 15**

|  |  |  |  |
| --- | --- | --- | --- |
| **8** | **4** | **2** | **1** |
| 1 | 1 | 1 | 1 |

**Converting binary to hexadecimal:**

11110011 into hex:

Split the 8 bits into two nibbles: 1111 0011

|  |  |  |  |
| --- | --- | --- | --- |
| **8** | **4** | **2** | **1** |
| 0 | 0 | 1 | 1 |

|  |  |  |  |
| --- | --- | --- | --- |
| **8** | **4** | **2** | **1** |
| 1 | 1 | 1 | 1 |

Put into the column headings:

Add the column headings together: 15 3

In hexadecimal this becomes: 3F

**Converting denary to hexadecimal:**

45 denary into hex:

Divide the number by 16 repeatedly and note the remainder:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **45** | **/16** | **= 2** | **Remainder** | **13 = D** |
| **2** | **/16** | **= 0** | **Remainder** | **2** |

The number is placed before the letter so 45 is converted to 2D

**Converting hexadecimal into binary:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **128** | **64** | **32** | **16** | **8** | **4** | **2** | **1** |
| **~~0~~** | **~~0~~** | **~~0~~** | **~~0~~** | **0** | **0** | **1** | **1** |

3B hex into binary:

3 in binary = 0011

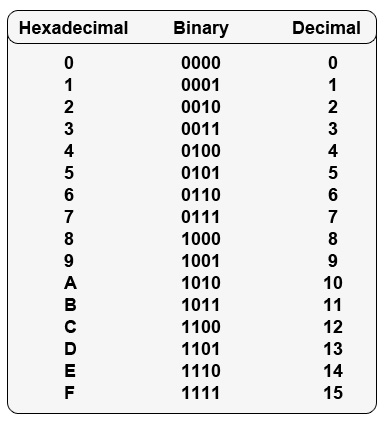
|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **128** | **64** | **32** | **16** | **8** | **4** | **2** | **1** |
| **~~0~~** | **~~0~~** | **~~0~~** | **~~0~~** | **1** | **0** | **1** | **1** |

B = 11 = 1011

Put the two nibbles together to get a byte and this gives **111011**

*NB: you do not need to include any 0s at the beginning so 00111011 is the same as 111011*

**Hexadecimal:**

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**Homework:**

1. **Convert 28, 72, 131, 235 and 255 from denary to binary**
2. **Convert 1011, 11011, 10001010 and 11001000 to denary**
3. **How many kilobytes are there in a gigabyte?**
4. **Add the following numbers in binary and show your working:**
   1. **1010 + 101**
   2. **10001 + 11001**
   3. **111001 + 100011**
5. **Convert the following binary numbers into hexadecimal:**
6. **10010011 b) 10101000 c) 111011**
7. **Convert the following hexadecimal numbers into binary AND denary:**
8. **1A b) 35 c) BC**