**Decimal to Binary**

Key words

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| --- | --- | --- |
| Term | Description | Summary |
| Binary  (base 2) | **Binary** is a base 2 number system made up of 0s and 1s. It is the native language of the computer and is used to represent things such as the instructions for the processor, text characters known as ASCII, and IP addresses. |  |
| Byte/Octet  (8 bits) | A **byte** is a unit of data that is eight binary digits long |  |
| Nibble  (4 bits) | **4**-**bit** integers, memory addresses, or other data units are those that are **4 bits** wide. ... A group of **four bits** is also called a nibble and has 2**4** = 16 possible values making them ideal to represent hex numbers. |  |
| Bit | A **bit** (short for "binary digit") is the smallest unit of measurement used to quantify computer data. It contains a single binary value of 0 or 1. ... Since a **byte** contains eight **bits** that each have two possible values, a single **byte** may have 28 or 256 different values. |  |
| Decimal  (base 10) | A **decimal** is a number expressed in the scale of tens. It is the most familiar number system often used in finance and everyday mathematics |  |
| Hexadecimal  (base 16) | The **hexadecimal** (**hex**) is a number system made up of 16 symbols. It uses the decimal numbers 0-9 and six extra symbols A-F to represent 10-15. Each hex character can be represented by 4 bits (nibble) and so hex is preferred over decimal for representing binary. The MAC address of a computer NIC and IPv6 use Hex. |  |
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Exercise 1

Calculate the place value of each octet by Doubling 2 eight times (^ means raised to the power)

2**0** =

2**1** =

2**2** =

2**3** =

2**4** =

2**5** =

2**6** =

2**7** =

Exercise 2

Convert the follow numbers from binary to decimal form

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 | Answer (in decimal) |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | e.g. 128+16+8+1=153 |
| 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |  |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |  |
| 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |  |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |  |
| 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |  |
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Exercise 3

Convert the following numbers from decimal to binary

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| 224 (e.g.) | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 192 |  |  |  |  |  |  |  |  |
| 100 |  |  |  |  |  |  |  |  |
| 52 |  |  |  |  |  |  |  |  |
| 199 |  |  |  |  |  |  |  |  |
| 255 |  |  |  |  |  |  |  |  |
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Question:

What is a Byte

What is a bit

What is a nibble

What is the maximum number that an octet ( byte) can represent?

Give Examples of operations that require binary numbers

Why do we need the binary system and where is it used?

What is the purpose of hexadecimal number system,

How many bits represent a hexadecimal character