Denary Floating Point Representation using Mantissa and Exponent

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| ***Definitions***  ***Integer****: An integer is a whole number (not a fraction) that can be positive, negative, or zero. Therefore, the numbers 10, 0, -25, and 5,148 are all integers. Unlike floating point numbers, integers cannot have decimal places.*  ***Floating point numbers****: Numbers that contain floating decimal points. For example, the numbers 5.5, 0.001, and -2,345.6789 are floating point numbers. Numbers that do not have decimal places are called integers. Computers recognize real numbers that contain fractions as floating point numbers.*  ***Real number****: A real number is any positive or negative number that contains values after the decimal point.*  ***Mantissa****: The mantissa is the part of a number located after the point. It is normally used when dealing with scientific notation.*  ***Exponent****: The exponent, in scientific notation is the power that is used to determine how far the point has moved.* |

The structure of a floating point number is:

mantissa x base exponent

To work out the mantissa and exponent you need to:

1. move the point all the way so the number is a fractional value
2. the entire number without the point is the mantissa
3. the number of places the point was moved (expressed as a two’s complement binary number) is the exponent.

Examples:

|  |  |  |  |
| --- | --- | --- | --- |
| **Original Number** | **Scientific Notation** | **Mantissa** | **Exponent** |
| 217.46 | 0.21746 x 103 | 21746 | 3 |
| 105786.924 | 0.105786924 x 106 | 105786924 | 6 |

Let’s look at the **first example 217.46**

* To represent this number using scientific notation, the decimal point is moved to the start of the number to give 0.21746
* The decimal point has now moved three places to the left
* Therefore, this can be represented in scientific notation as 0.21746 x 103

For the **second example 105786.924**

* To represent this number using scientific notation, the decimal point is moved to the start of the number to give 0.105786924
* The decimal point has now moved six places to the left
* Therefore, this can be represented in scientific notation as 0.105786924 x 106

**Exercise 1**

Complete the table below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Original Number** | **Scientific Notation** | **Mantissa** | **Exponent** |
| 217.46 | 0.21746 x 103 | 21746 | 3 |
| 105786.924 | 0.105786924 x 106 | 105786924 | 6 |
| 3524.789 |  |  |  |
| 212256.3457 |  |  |  |
|  | 0.5689 x 102 |  |  |
|  | 0.254784169 x 105 |  |  |
|  |  | 123456789 | 4 |
|  |  | 64894368979146 | 6 |

(NOTE: You can also represent 102 as 10^2)