# Homework 1 Number systems Answers

1. Natural numbers are used for counting amounts of objects and are described as the set of values = {0, 1, 2, 3, ... }.
   1. Explain how the definition of integer values is an extension of the one above for natural numbers: [2]

**1 mark** for each point:

* Natural numbers are positive numbers whereas integers can include negative values.
* The set could be extended to = {…, -3, -2, -1, 0, 1, 2, 3, …}.
  1. A positive integer can be represented as a binary value.   
       
     Show that 14910 is equivalent to 100101012: [3]

**1 mark for each point:**

* Indicates place values are powers of 2. Either:

27, 26, 25, 24, 23, 22, 21, 20 or

128, 64, 32, 16, 8, 4, 2, 1

* Values used are 27 (128), 24 (16), 22 (4), 20 (1).
* Sum of values gives answer 149.
  1. Hexadecimal is a convenient way to express binary values in groups of four bits..   
       
     Convert 100101012 to a hexadecimal value and show that this value to equivalent to 14910: [5]

**1 mark for each point:**

* Converted left-most hex value is 9.
* Converted right-most hex value is 5.
* Works out left-most value is 161 x 9 = 144.
* Works out right-most value is 160 x 5 = 5.
* Therefore sum of values is 149.

1. Real numbers, represented by the set ℝ include natural, rational and irrational numbers.
   1. Give an example of a rational number. [2]

Allow any value that can be expressed as a fraction or ratio.

* 1. Give one example of an irrational number. [1]

Pi (**π**), , Euler’s number ***e*** and the golden ratio **φ** are examples.

* 1. Explain what makes a number irrational. [1]

An irrational number is a real number that cannot be written as a simple fraction.

It cannot have an endlessly repeating set of digits.

* 1. Define what an **ordinal number** is, by use of an example. [2]

An ordinal number is used to determine position and place  
In an ordered list, items in the list would be 1st, 2nd, 3rd, 4th etc.  
1st, 2nd, 3rd, 4th are examples of ordinal numbers.

1. MAC addresses are used to uniquely identify network enabled hardware devices. They are written in the format of six pairs of hexadecimal digits: 3A:D2:48:9E:61:AC.
   1. Convert the first pair of digits 3A to binary. [2]

0011 1010. **1 Mark** for each nibble.

* 1. How many bytes will this MAC address occupy in a computer’s memory? [1]

6 bytes

* 1. Explain why a MAC address is expressed in hexadecimal rather than pure binary. [1]

Hexadecimal is easier to read, type accurately and remember than binary.

[Total 20 Marks]