Binary, Denary and Hexadecimal Numbers

Lesson Objectives

- To understand what binary, denary and hexadecimal numbers are
- To learn the conversion between binary, denary and hexadecimal numbers
- To understand the importance of hexadecimal numbers in computer science

Binary numbers

- A binary number is a number expressed in the base 2 numeral system
- The two values are “0” and “1”
- These are also known as bits of data
- 8 bits grouped together in any way is known as a byte
- Binary numbers are very important as they get the computer to function properly due to the transistors in a computers’ circuit.

Denary Numbers

- Denary/Decimal number system or “base 10” is the standard number system used all around the world.
- It uses ten digits (0,1,2,3,4,5,6,7,8, and 9) to represent all numbers
- It is used everywhere and is the most common number system used in the world.

Hexadecimal numbers

- Hexadecimal is the name of the number system that is “base 16”
- Digits are from 0 and 15 inclusive.
- This means the double digit values (10,11,12,13,14, and 15) have to be represented in a letter form.
- For example 2D, BA, etc.

Conversion from binary to denary form

- Given a byte-:
- Above bits, write numbers from 1 and double it every place (start with 1 from the right most bit)
- Any bits that have a “true” value, which is 1 – the corresponding numbers above them must be added together.

Conversion from denary form to binary form

- Make 8 blank spaces to write your binary numbers on
- Make the same markings as last time on top - 1 to 128 – doubling each time as you move from one binary digit to another (starting from right)
- Subtracts the largest possible number you can from the given denary number and add a “1” in that column. Then find the largest value that can be subtracted from the new value… all the way till the end.

Binary to hexadecimal

- A given binary number will usually be a byte. The main thing to do here is to split the byte into two sets of 4 bits.
- The numbers on top will change as, instead of 1 to 128, it will be 1 to 8 for each set of bits.
- Then you carry out simple denary deduction and if the value is 10 or more, it is replaced with hex digits.
- For hexadecimal to binary – you take one of the two hex digits and find the combination of numbers that would add up to make that digit. For example, for the hex digit C (12) on a binary scale, you would have to add 8 and 4. So you would put 1 in both those columns and the other two would be 0. Hence the binary equivalent of the hex digit C is - 1100

Denary to hexadecimal

- Divide the denary number by 16
- The 1st digit of your quotient is the first part of the hexadecimal number.
- The second part of your hexadecimal number will be the remainder
- Remember that 10-15 inclusive is represented as A-F in hexadecimal.
- So 56 in hexadecimal – you divide 56/16 – the first part of the hexadecimal is the number of times 16 goes into 56 (3 times) and the second part of the hex number is the remainder of this division (8) – so 56 in hexadecimal is 38. (38 can be hexadecimal also)