

# Computer Architecture

## Tutorial 3 – Number Representation and Binary Arithmetic

- 1) Convert the following binary numbers to decimal:  
(a) 0110, (b) 1011, (c) 10101010
- 2) Convert the following binary numbers to hexadecimal:  
(a) 1110, (b) 11011, (c) 1010111101110010
- 3) Convert the following decimal numbers to binary and hexadecimal:  
(a) 12, (b) 27, (c) 96
- 4) For an 8-bit group, work out the representation for  $-37_{10}$  in
  - a) Sign & Magnitude
  - b) One's Complement
  - c) Two's Complement
  - d) Excess-255 (Note: The n in Excess-n does not have to equal  $2^n - 1$ , where m is the number of bits in the bit-group)
  - e) Excess-12
- 5) Express 9876
- 6) Form the negative equivalent of the following  $n$ -bit numbers  
(a) 00011001, (b) 00011110, (c) 01101000, (d) 10101010  
by comparing the resulting bit-patterns to the originals, can you spot a “short cut” method for the conversion?
- 7) Perform the following 12-bit two's complement subtraction
$$\begin{array}{r} 1010\ 1010\ 1011 \\ -1011\ 0000\ 1101 \\ \hline \end{array}$$
- 8) Perform the binary multiplication  $10011 \times 1101$
- 9) Divide the binary number 1011111 by 101

For questions 7 - 9, check the answer by conversion to decimal