Computer Systems - Architecture
Tutorial 2 – Representations of Integers

1. Convert 188_{10} into binary, octal and hexadecimal.

2. Convert ABC_{16} into binary, octal and decimal.

3. Add the following two 20-bit binary numbers. Spaces embedded in the numbers are for readability only.

1st number	1111 0000 1111 0000 1111
2nd number	1010 1010 1011 1111 1111

4. Using the two numbers in question 3, subtract the second binary number above from the first.

5. What is the square of 10101_2 in base 2?

6. What is 14_5 in base 1 (Unary) ?

7. How many natural numbers can be represented by

   (i) 8-bits
   (ii) 10-bits
   (iii) 16-bits

8. For an 8-bit group, work out the representation for $–37_{10}$ in

   (i) sign & magnitude
   (ii) one's complement
   (iii) two's complement
   (iv) excess-256
   (v) excess-128

9. For a 10-bit group, what range of integers can be represented using

   (i) sign & magnitude
   (ii) one's complement
   (iii) two's complement
   (iv) excess-512

10. Subtract the following 12-bit two’s complement numbers (2nd from 1st)

$$\begin{array}{r} 1010\ 1010\ 1011 \\ -\ \underline{1011\ 0000\ 1101} \end{array}$$

What is the result in decimal?

12. Express 98765_{10} in binary coded decimal (BCD)

13. Translate the following 6-character string A:= q*t to 8-bit ASCII codes (List your codes as binary and hex values).

Solutions

This page is upside down to discourage you from peeking.

Remember to show your working and to carry out your conversions and calculations without a calculator.

1. 188$_{10}$ = 1011_1100$_2$ = 274$_8$ = BC$_{16}$

2. ABC$_{16}$ = 1010 _1011_1100$_8$ = 5274$_8$ = 2748$_{10}$

3. Sum = 1_1001_1011_1011_0000_1110

4. Diff = 0100_0110_0011_0001_0000

5. Square = 1_1011_1001

6. 1_1111_1111$_1$

7. (i) 2^8 = 256, (ii) 2^{10} = 1024, (iii) 2^{16} = 65536

8. (i) 1010_0101, (ii) 1101_1010, (iii) 1101_1011, (iv) 1101_1011, (v) 0101_1011

9. (i) -511 to +511, (ii) -511 to +511, (iii) -512 to +511, (iv) -512 to +511

10. 1111_1001_1110 = decimal –98

11. 1001_1000_0111_0110_0101

12.

Char	**A**	**:**	**=**	**q**	*****	**t**
Binary	0100 0001	0011 1010	0011 1101	0111 0001	0010 1010	0111 0100
Hex	4 1	3 A	3 D	7 1	2 A	7 4