ICT 1019Y Computer Architecture

Week 02 Tutorial/Lab Exercise

Binary Number & Integers, Binary Number Operations, Floating Point Numbers

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 (integers) 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) signed magnitude
(ii) one's complement
(iii) two's complement

9. For a 10-bit group, what range of integers can be represented using
(i) signed magnitude
(ii) one's complement
(iii) two's complement

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

1010 1010 1011
- 1011 0000 1101

What is the result in decimal (i.e. base 10)?

11. Given the bit pattern: 1010 1100 1011 0101 0011 0000 0011 1000,
what value does it represent, assuming that it is,
(a) a two's complement integer?
(b) an unsigned integer?
(c) a single precision floating-point number?

12: Convert (- 110011.1011) in binary to single precision IEEE format
(a) State the normalized number.
(b) Write the number in IEEE format (sign, exponent and mantissa).
(c) IEEE format number in HEX.

13: Show the binary representation for the following decimal floating point values in IEEE
single and double precision format.
(a) 7.4 (b) -13/64 (c) 6.125

14: Convert the hexadecimal numbers to IEEE single precision format, and then to decimal.
(a) B54B7F10 (b) 43D00000 (c) C20C0000 (d) 42055555

15: Give the IEEE 754 single precision encoding for the following numbers:
(a) $3.022 * 2^{13}$
(b) $8.123 * 2^{-14}$

16. Convert the following binaries into decimal numbers:

01111_2 =

110101_2 =

101.10_2 **=**

010.101_2 **=**

17. Convert the following octal numbers into decimal numbers:

177_8 **=**

777_8 **=**

18. Convert the following hexadecimal numbers into decimal numbers:

$0x1FF_{16}$ **=**

$0xFFF_{16}$ **=**

19. Convert the following decimal numbers into binary/octal/hexadecimal numbers:

105_{10} = (binary)

= (octal)

105.625_{10} = (binary)

683_{10} = (hexadecimal)

20. Show the steps in converting the following floating numbers into single-precision binaries according to the IEEE 754 standard.

-31.1875_{10} =