CM1101: COMPUTATIONAL THINKING

TUTORIAL – DATA REPRESENTATION

02 October 2018

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1. Count from 0 up to 15 in binary, octal, hexadecimal, and base 5.

Answer:

Binary: 0, 1, 10, 11, 100, 101, 110, 111, 1000, 1001, 1010, 1011, 1100, 1101, 1110, 1111

Octal: 0, 1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 16, 17

Hexadecimal: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

Base 5: 0, 1, 2, 3, 4, 10, 11, 12, 13, 14, 20, 21, 22, 23, 24, 30

2. Convert the following integers to binary:

   (a) 27_{10}

Answer: 11011

   (b) 34_{10}

Answer: 100010

   (c) 55_{10}

Answer: 110111

   (d) 451_{10}

Answer: 111000011

   (e) 987_{10}

Answer: 1111011011

   (f) 2016_{10}

Answer: 11111100000

3. Convert the integers from question 2 to octal.

Answer:
33_8
42_8
67_8
703_8
1733_8
3740_8

4. Convert the integers from question 2 to hexadecimal.

Answer:
$1B_{16}$
22_{16}
37_{16}
$1C3_{16}$
$3DB_{16}$
$7E0_{16}$

5. Convert the following numbers to binary, accurate to four binary places after point:

(a) 18.25_{10}

Answer: 10010.0100_2

(b) 19.625_{10}

Answer: 10011.1010_2

(c) 12.125_{10}

Answer: 1100.0010_2

(d) 14.11_{10}

Answer: 1110.0010_2

(e) 2314.34_{10}

Answer: 100100001010.0101_2

(f) 21.97

Answer: 10110.0000_2

6. Carry out the following binary arithmetic:

   (a) 101101 + 10101

Answer: 1000010

   (b) 100111 – 11100

Answer: 1011

   (c) 1101110 + 111100 + 100101

Answer: 11001111

7. Show how the following decimal numbers would be represented in a 12-bit register, using sign and magnitude and two's complement representation:

   (a) +14

Answer: S&M, 2's complement: 000000001110

   (b) +63

Answer: S&M, 2's complement: 000000111111

   (c) – 256

Answer: S&M: 100100000000, 2's complement: 111100000000

   (d) – 1032

Answer: S&M: 110000001000, 2's complement: 101111111000

8. Interpret the following bit pattern in the different ways requested below:

   1011001110101000

   (a) as four hexadecimal digits.

Answer: B3A8

   (b) as two 8-bit two's complement integers, interpreting your answer in decimal.

Answer: -77 & -88

9. An 8-bit register is used to store non-negative numbers using the fixed point representation. The first 6 most significant bits of the register represent the integer part, and the remaining 2 bits represent the fractional part. What is the range of the register? What is the precision of the register?

Answer: range: [0, 63.75], precision: 0.25

END OF QUESTIONS