ELEC8550: Computer Arithmetic

Assignment 3

Due: 10pm, Monday, Nov 16, 2020

1. (Chapter 3) Represent $X = -6$ and $A = -7$ in 4-bit 2's complement representation and then use sequential multiplication algorithm to obtain the product $X \cdot A$. (12 marks)

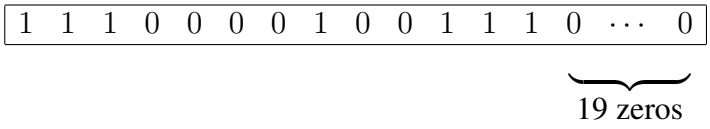
2. (Chapter 3) Let $X = (0.110000)_2 = 3/4$ and $D = (0.101)_2 = 5/8$. Use restoring division algorithm to obtain the quotient $Q = 0.q_1 \cdots q_m$ and the remainder $R = 2^{-m} r_m$. Note: This problem is a bit advanced. (12 marks)

3. (Chapter 4) Find the normalized floating-point representations of the number 6400 (16 marks)

   i). in the single-precision IEEE format;

   ii). in the double-precision IEEE format.

4. (Chapter 4) Find the value for the following IEEE single-precision representation. The final result should be in the form $1.a \times 2^b$, where $1.a$ is a decimal number with integer digit of 1 and four fractional digits, and b is a decimal integer. (16 marks)



5. (Chapter 4) Suppose that the input is $X = x_1 x_0 . x_{-1} x_{-2}$, and the output is an integer. List the truth table and then draw a block diagram using adder and/or necessary logic gates for an implementation of round-to-the-nearest scheme. (16 marks)

6. (Chapter 4) Find the maximal positive and negative errors and the bias for ROM rounding scheme with $l = 3$ and $d = 2$. (12 marks)

7. (Chapter 5) Give two different designs for a 12-bit CLA (carry-lookahead adder) using 4-bit CLA and/or carry generator as building blocks. One has one-level carry lookahead architecture and the other uses two-level carry lookahead. Show a critical path and the critical path delay for both designs. (16 marks)