CS2020 FALL Assignment 5

October 16, 2020

Question 1

Electrical and electronic systems could be classified as (i) an analog system, (ii) a digital system or (iii) a mixed analog-digital system. Give at least one exemplar system for each of these systems.

Question 2

Let A, B and C be the inputs of a digital logic circuit. X and Y be the outputs. Suppose the logical operation of the circuit is given by

$$
\begin{aligned}
X &= AB + BC + CA, \\
Y &= A + \bar{B} + C.
\end{aligned}
$$

What is the truth table of this logic circuit?

Question 3

In the following questions, the numbers are represented in 16-bit sign-magnitude integer format.

`sxxxxxxxxxxxxxxx`

(a) What is the smallest number (in decimal form) of a binary number in 16-bit unsigned integer format?

(b) What is the second smallest number (in decimal form) of a binary number in 16-bit unsigned integer format?

(c) What is the largest number (in decimal form) of a binary number in 16-bit unsigned integer format?

Question 4

Suppose a number represented in the following 16-bit sign-magnitude fix-point format.

`xxxxxxxxxxx.xxxx`

(a) What is the maximum number (in decimal form) that can be represented?

(b) What is the second smallest number (in decimal form) that can be represented?

(c) What is the precision error of this fix-point format?

Question 5

Suppose a binary number is represented by the following 8-bit sign-magnitude fix-point format.

`sxxxx.xxx`

What are the values of the following binary numbers?

(a) 00011100.

(b) 10011100.

(c) 10011001.

(d) 00111101.

Question 6

(a) What is the advantage of representing a negative number in 2's compliment format?

(b) How does a processor perform multiplication of two unsigned integers, say 0011×0010?

(c) How does a processor perform division of two unsigned integers, say $0110 \div 0010$?

Question 7

Each processor must have a huge number of logic gates. Apart from logic gate, two additional types of components can be found in a processor. One type of components controls the flow of electrical signals in a processor. Another type of components acta as temporary storage for data. What are these two types of components?