Total: 100 points

CS2115 Computer Organization

Midterm Exam
October 25, 2018

NAME: _____ **ID**: _____

This exam has 4 problems, for a total of 100 points.

Closed book. No calculators. No electronic devices.
Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.
Please, write your name and ID on the top of each loose sheet!
GOOD LUCK!

Problem	Points
1	
2	
3	
4	
Total	

Problem 1 (30 points)

a) For the decimal number $(10.25)_{10}$, convert it to the **binary**, **octal** and **hexadecimal** forms, respectively (12 points).

b) Write the decimal numbers $(3)_{10}$ and $(-6)_{10}$ in **4-bit** 2's complement form (8 points).

c) The following binary number is written in IEEE 754 standard for binary floating point numbers (the format is shown as follows). What is the decimal number it represents? Describe your conversion procedure. It's sufficient to write it in form of $a \times 2^b$ (10 points).

1	0001, 0001	0011, 0000, 0000, 0000, 0000, 000

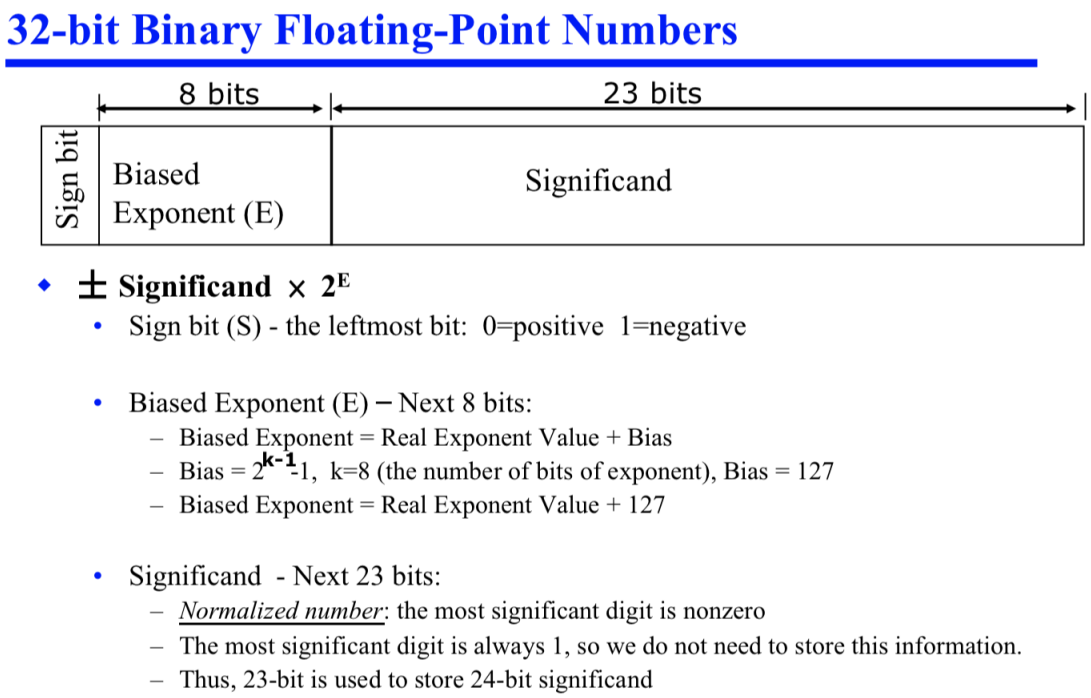


Figure 1: This is a slide from the lecture note for your reference

Problem 2 (30 points)

We have a truth table in the following:

A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

a) Write the function F in the canonical SOP and POS form. (8 points)

b) Construct the K-Map and write the simplified function. (10 points)

c) Draw the circuit based on the SOP form in (a) **or** based on the simplified function in (b). (12 points)

Problem 3 (30 points)

a) Given the following D latch and D flip-flop, please complete the timing diagram below for D latch and D flip-flop. The initial values of both states of Q (D latch) and Q (D flip-flop) are 0 (low edge). (14 points)

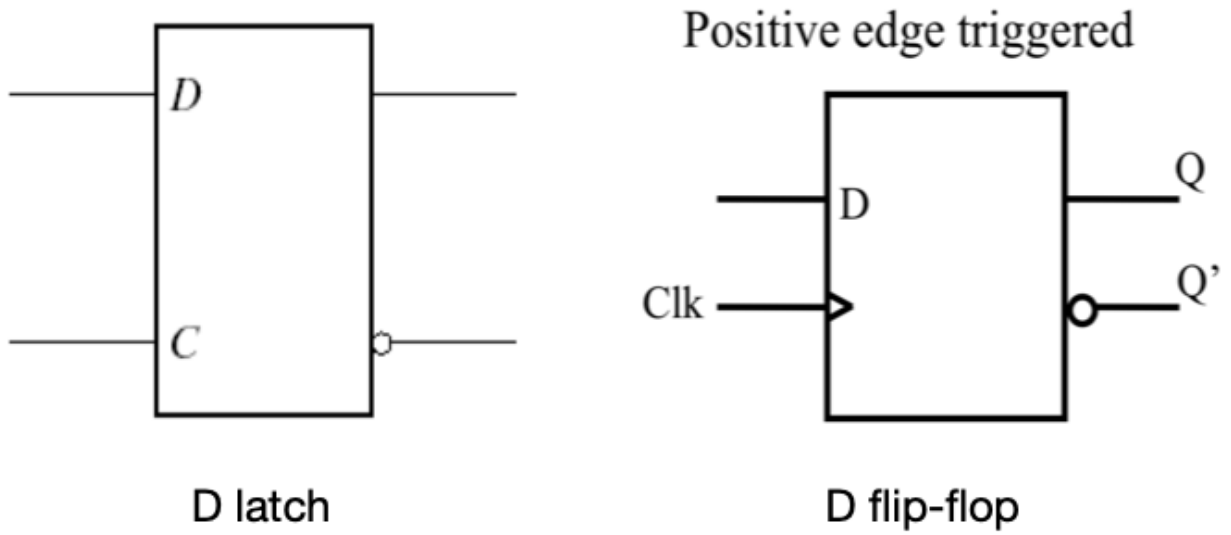
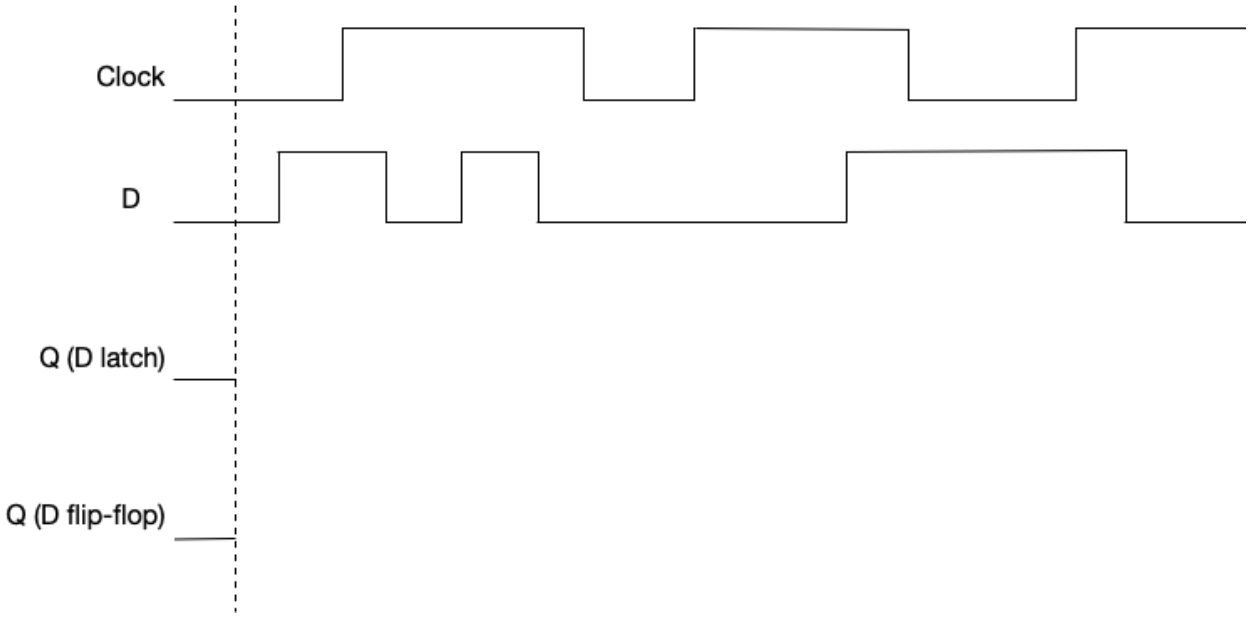


Figure 2: D latch and D flip-flop.



b) Write the **state table** and draw the **state transition diagram** for the two-bit shift register in the below diagram with different initial values in the shift register. (16 points)

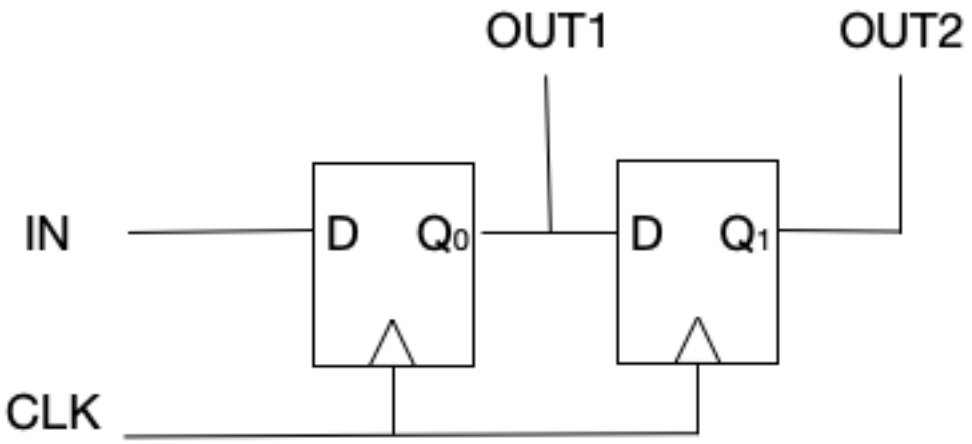


Figure 3: Two-bit shift register.

Problem 4 (10 points)

a) What are the five components in the von Neumann Architecture? Draw the structure of the von Neumann Architecture and clearly label them in your drawing. (6 points)

b) [Open Question] You have learned many different number systems in this course, but only binary is wildly used in modern computer systems. What makes binary system so special? Please give at least one reason. (4 points)