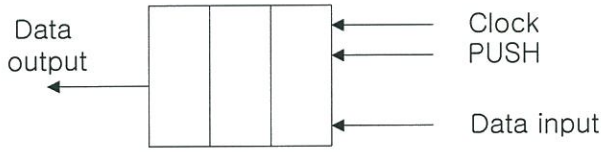
QE in Computer Engineering

(2013. 8. 1.)

- You have two parts: "Digital system design" and "Microprocessors".
- Each part accounts for 50 points.

Digital System Design

1. **(15 points)** Design a 3 ***word*** by 1 ***bit*** FIFO (first in first out) queue such that the earliest pushed data is the first to be popped. The block diagram is given below. Here, ***word*** means the length of the queue and ***bit*** means the number of input bits in parallel. The popped data (output) must be held unless a new push signal is applied. Draw your logic schematic, indicating the components used. To simplify the design, assume that POP=PUSH, and do not implement the ***FIFO empty*** and ***FIFO full*** signals. Explain the operation.



2. **(15 points)** Boolean expressions.

   2.1 (5 points) Write the minimum-SOP form for the following K-map.

CD \ AB	00	01	11	10
00				1
01	1	1	1	1
11		1		
10		1		1

   2.2 (5 points) Write the consensus theorem and explain what the consensus term is.

   2.3 (5 points) Circle all consensus term(s) on the given K-map and explain how you can get the above consensus term(s) from the consensus theorem.

3. **(10 points)** Explain the Minterm expansion and the Maxterm expansion.
4. **(10 points)** Design a 4-bit adder/subtractor that uses a 2's complement number system, assuming you have many 1-bit adders and all other types of primitive logic gates such as NAND, NOR, XOR, MUX, etc. To select the operation (i.e., addition or subtraction), use a control signal ADD=SUB'. You need to design an overflow signal, too. Draw your logic schematic, and explain its operation. You don't need to show the design process.

Microprocessors

1. What are the major differences between microprocessor, embedded processor, and GPU?
2. What are the differences between CISC and RISC?
3. Name 3 differences between real mode and protection mode in microprocessor and explain them.
4. Explain the difference of process and thread.
5. Draw the internal structure of a microprocessor, connecting major components, and explain the principle with a simple assembly code.