1. (10 pts) Convert the following hexadecimal representations of 2's complement binary numbers to decimal number.
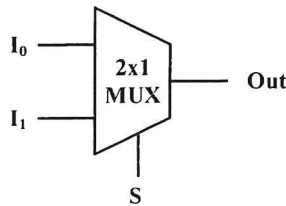   - (a) xF0
   - (b) x7FF
   - (c) x16
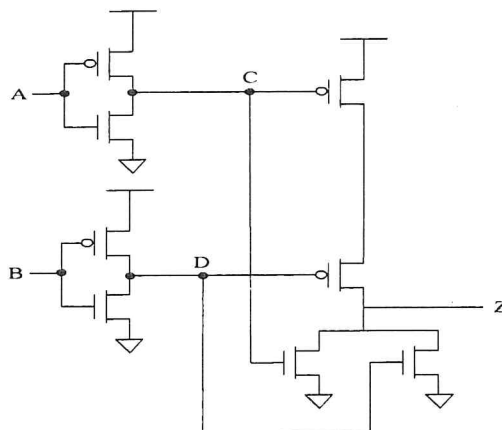   - (d) x8000
   - (e) x1

2. (10 pts) A symbol of 2-to-1 mux is listed below. Please draw the gate-level circuit of 2-to-1 mux.

3. (10 pts) Implement the XOR function by means of :
   (a) (5pts) NAND gates only.
   (b) (5pts) NOR gates only.
   Please draw the gate-level circuit.

4. (20 pts) For the transistor-level circuit shown below:
   (a) (10 pts) Fill in the truth table below.
   (b) (10 pts) What is Z in terms of A and B?

A	B	C	D	Z

5. (10 pts) Given an array A of length N with sorted elements of N integers. Given a number X, write a program in C or Java to determine whether X is an element in the array. What is the time complexity O(N) of your program?

6. (10 pts) Consider an array of length N with elements of N integers. Write an algorithm to sort the elements. What is the name of the method of your algorithm? What is the time complexity O(N) of your algorithm?

7. (10 pts) Consider to write a program in assembly language to run on a computer system with an operating system. There are three sequential steps of how an assembly language is transformed to run on the development board. The first step is done with an assembler. The second step is done with a linker. The third step is done with a loader.
   Describe what is done at each step.

8. (10 pts) Consider a MIPS processor. There are five stages in an execution cycle. Describe each stage in detail. If you know another RISC (reduced instruction set computing) processor, then you can answer this question with the processor you know instead of MIPS.

9. (10 pts) 有一部 Arduino 驅動的玩具車，車子前面兩個輪子可以移動讓車子左轉、右轉與往前直行，車子只有這三種移動方式。車子前面有兩個光感測器去感測地板上的亮度，地板白的時候回傳 1 的訊號、地板黑的時候回傳 0 的訊號。地板上有一條粗黑線，玩具車被放在黑線上時，兩個光感測器相隔的寬度剛好是在黑線兩旁的白背景上。請你設計一個有限狀態機，目標是要車子沿著黑線往前移動。請畫圖說明各個狀態代表的意義，以及該狀態下車子要做哪個動作。例如，車子在黑線上的正中央，兩個光感回傳的訊號是 11，這時候車子應該往前直行。