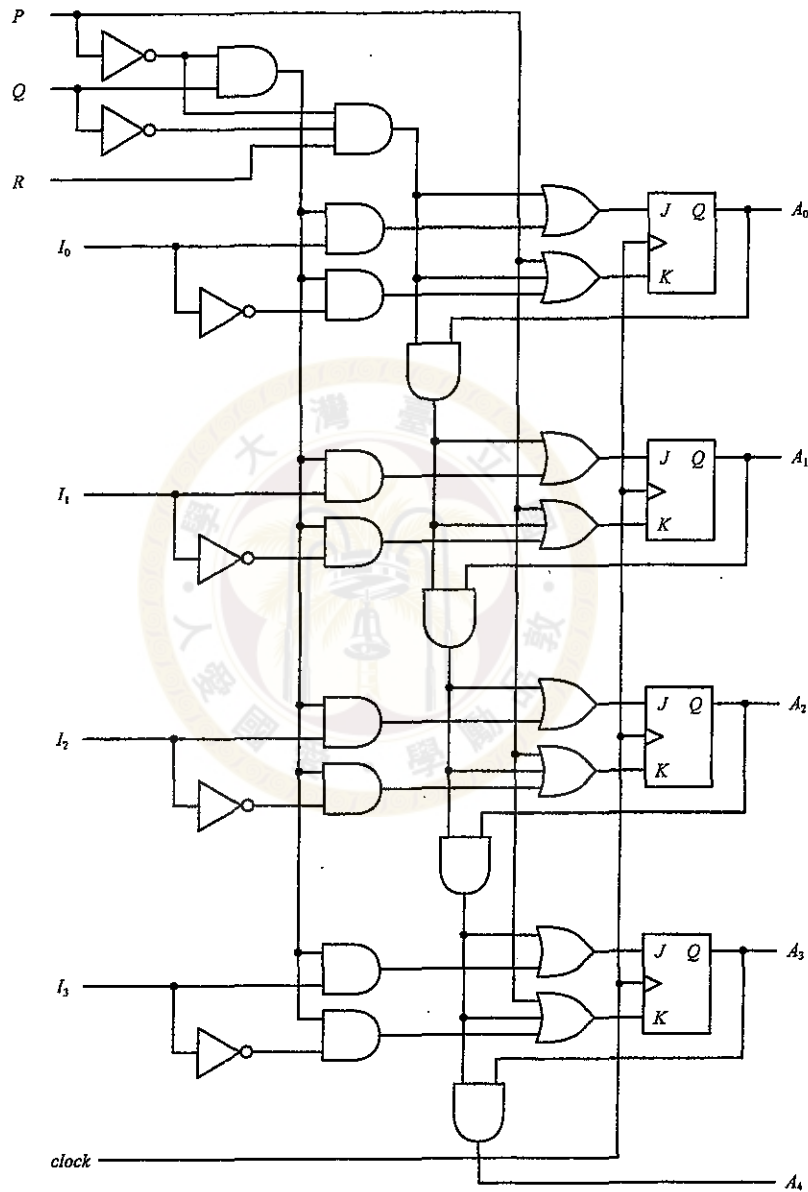※ 注意：請於試卷上依序作答，並應註明作答之大題及其題號。

Prob. 1 (15%)

Let $I = I_3 I_2 I_1 I_0$ and $A = A_4 A_3 A_2 A_1 A_0$ be the data input and output respectively, and P, Q, and R be the control inputs. Specify the functionalities of the circuit below by completing the following table. (Add rows if necessary.)

clock	P	Q	R	Operation

見背面

Prob. 2 (10%)
What is the radix of the numbers if the solution to the equation

$$x^3 - x^2 - 72x + 180 = 0$$

is $x = 3$, $x = 8$, and $x = -10$?

Prob. 3 (10%)
Simplify the following Boolean function by algebraic methods. You MUST show the rules or theorems you use in each step.

$$f(A,B,C,D) = \overline{A \cdot (\overline{B} + C)} + \overline{B} \cdot \overline{D} + A \cdot \overline{(\overline{C} + \overline{D})} \cdot \overline{B} \cdot \overline{(C+B) \cdot A}$$

Prob. 4 (20%)
A sequential circuit N has one input X and one output Y. The output Y is 1 if and only if exactly two of the following three conditions are true.
    1. An odd number of 0's have been received.
    2. An even number of 1's have been received.
    3. An odd number of "01" sequences have been received.
An example is given below.
    input: 001011101100...
   output: 000110100101...
Note that the circuit does NOT reset to the start state when an output of $Y = 1$ occurs. Find a minimized Mealy state graph for the circuit.

Prob. 5 (20%)
Design a sequential circuit that realizes the function described in Prob. 4 using D flip-flops and NOR gates. Use as few logic elements as possible.

Prob. 6 (15%)
Complete the timing diagram for the circuit below. Note that both D flip-flops have asynchronous, active-low clear input.
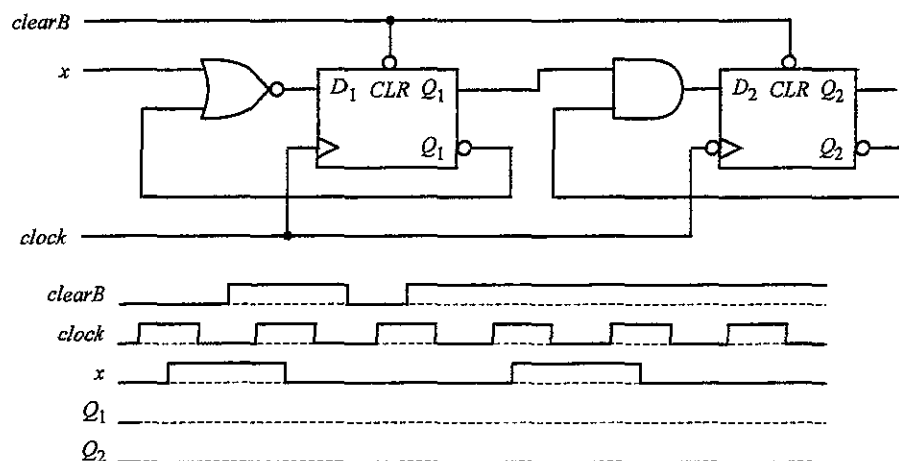
Prob. 7 (10%)
Use a 4-to-1 multiplexer and a minimal number of gates to realize the following function.

$$f(A,B,C,D) = A \cdot C + A \cdot \overline{B} \cdot \overline{C} + B \cdot \overline{C} \cdot D$$

試題隨卷繳回