

# 國立臺北科技大學九十九學年度碩士班招生考試

系所組別：2240 電腦與通訊研究所丁組

## 第一節 數位邏輯設計 試題

第一頁 共一頁

### 注意事項：

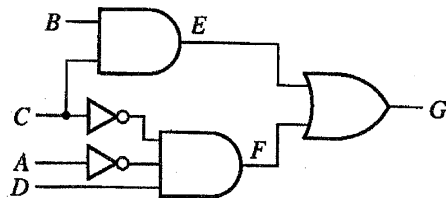
1. 本試題共 6 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Please substrate  $(65)_{10} - (80)_{10}$  in 8-bit 2's complement form. (10%)
2. Please use the rules of Boolean algebra to simplify the following expressions as much as possible.

(a)  $Y = \overline{ABCD} + (\overline{A+B})\overline{C+D} + \overline{A+B}$  (10%)

(b)  $K = (\overline{LM} + \overline{LM})(\overline{MN} + \overline{LMN}) + M(\overline{N} + L)$  (10%)

3. For the following circuit:



- (a) Assume that the inverters have a delay of 1 ns and the other gates have a delay of 2 ns. Initially  $A = 0$  and  $B = C = D = 1$ , and C changes to 0 at time = 2 ns. Draw a timing diagram and identify the hazard that occurs. (10%)
- (b) Modify the circuit to eliminate the hazard. (10%)

4. Design a circuit which will perform the following function on three 4-bit numbers:

$$(X_3X_2X_1X_0 + Y_3Y_2Y_1Y_0) - Z_3Z_2Z_1Z_0$$

It will give a result  $S_3S_2S_1S_0$ , a carry, and a borrow. Using eight full adders and any other type of gates. Assume that negative numbers are represented in 2's complement. (15%)

5. Design an array multiplier circuit which will perform the following function on two 4-bit numbers:

$$P_7P_6P_5P_4P_3P_2P_1P_0 = (X_3X_2X_1X_0) \times (Y_3Y_2Y_1Y_0)$$

It will give a result  $P_7P_6P_5P_4P_3P_2P_1P_0$ . Using full adders and any other type of gates. (15%)

6. Design a 3-bit counter which counts in the sequence:

001, 011, 010, 110, 111, 101, 100, (repeat) 001, 011,.....

- (a) Use J-K flip flops. (8%)
- (b) Use S-R flip flops. (8%)
- (c) In each case, what will happen if the counter is started in state 000? (4%)