



EXAM I

110 MINUTES

WORK ALL PROBLEMS

OPEN BOOK

(25 pts)

1) Consider the following expression :

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

a) Draw the corresponding gate network, by assuming **single-rail** inputs as shown in class. Do **not** do any algebraic manipulations on the above expression. Do **not** change the expression ! Just draw its gate network.

b) Obtain the **truth table** of the above expression as done **in class** and **homework**. Then, obtain the maxterm list from the truth table. Again, do **not** change the expression !

(25 pts)

2) Consider the following expression :

$$f(a, b, c, d) = [a + (a d + a)(\bar{a} b + \bar{a})][\bar{b} + (\bar{b} + \bar{d})] + cd + abcd + \bar{a}bcd + \overline{(b + d)}$$

a) Simplify the expression to obtain the **minimal SOP** expression by using **Switching Algebra** as shown in class.

b) Then, draw the corresponding minimal 2-level *NAND-NAND* gate network, by assuming **single-rail** inputs as shown in class.

(25 pts)

3) Consider the following **fixed-point** addition on two **2's complement Binary** numbers :

$$\begin{array}{r}
 110001.11 \\
 + 111111.10 \\
 \hline
 ?
 \end{array}$$

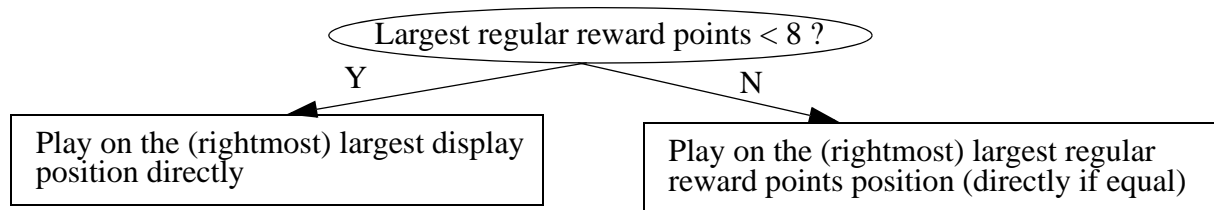
Remember :
These numbers are
fixed-point numbers !

Without using a calculator, perform the **fixed-point 2's Complement Binary** addition as shown in class. Make observations on the overflow.

Then, convert the result to a **decimal** number and also code the result in **Hexadecimal** as shown in class.

(25 pts)

4) Consider the **Ppm** term project. The graph of the playing strategy of an imaginary machine player is as follows :



Consider the following table that shows the random digit, position displays **before** and **after** the **machine** player plays, whether the random digit is played directly or added, the number of adjacencies, the points earned by the **machine** player and whether the machine player plays again :

RD	Displays Before Play				Displays After Play				D/A	The Adjacency	Points Earned (Decimal)	Machine player plays again ?
	PD3	PD2	PD1	PD0	PD3	PD2	PD1	PD0				
5	4	9	9	E								
7	C	C	C	C								
4	6	0	6	3								
6	5	F	8	1								
9	F	6	5	F								

Assume that the code is **E7**.

The meaning of **D/A** is Direct/Add which is whether the machine player plays the random digit **directly** on a position or by **adding** to a position. A **circle** is drawn on a position if it is played on.

Note that the cases are **independent** of each other. That is, they do not necessarily follow each other with respect to time.

Work on the rows.

You can complete the table on this sheet

Write your name on this sheet