

Logic design (2018 fall)

Quiz # 4

Name: \_\_\_\_\_ ID: \_\_\_\_\_

1. A combinational circuit has four binary inputs (A, B, C, D) and two binary outputs (X, Y). The output X is 1 iff the inputs have at least two consecutive 1's. The output Y is 1 iff the input have at least two consecutive 0's. For example, if ABCD = 0001 then XY = 01.
- (a) (15%) Complete the truth table for the circuit.
- (b) (15%) Find the minterm expansions for X using *m*-notation.
- (c) (15%) Find the maxterm expansions for Y using *M*-notation.
- Note that the order of literals for *m*-notation and *M*-notation is ABCD.

ABCD	X	Y
0000	0	1
0001	0	1
0010	0	1
0011	1	1
0100	0	1
0101	0	0
0110	1	0
0111	1	0
1000	0	1
1001	0	1
1010	0	0
1011	1	0
1100	1	1
1101	1	0
1110	1	0
1111	1	0

truth table

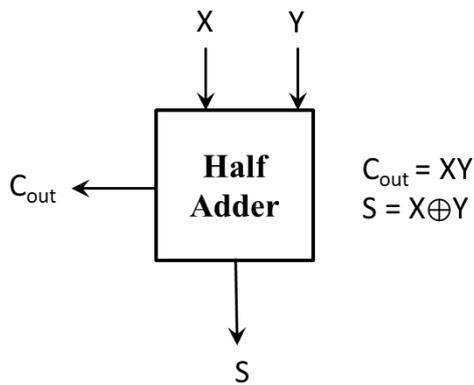
$$X = m(3, 6, 7, 11, 12, 13, 14, 15)$$

$$Y = M(5, 6, 7, 10, 11, 13, 14, 15)$$

2. Fig.1 shows the functionality of a half adder with two binary inputs ( $X, Y$ ) and two outputs ( $S, C_{out}$ ).

(a) (15%) Complete the truth table for a half adder.

(b) (40%) Design a circuit with 4 inputs ( $A_3, A_2, A_1, A_0$ ) and 4 outputs ( $B_3, B_2, B_1, B_0$ ) by using only half adders and NOT gates, where the output ( $B_3, B_2, B_1, B_0$ ) represents the 2's complement of the 4-bit number ( $A_3, A_2, A_1, A_0$ ).



X	Y	$C_{out}$	S
0	0	0	0
0	1	0	1
1	0	0	1
1	1	1	0

truth table

Fig.1

