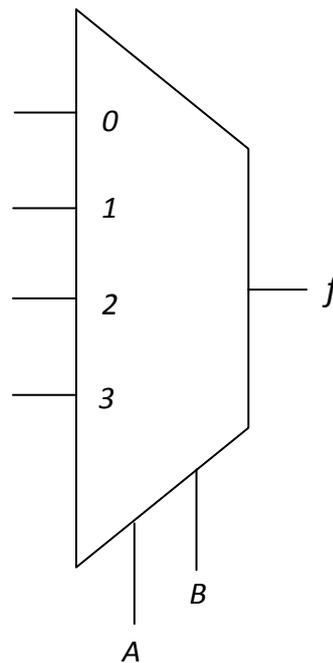Logic design (2016 spring)
Quiz # 9
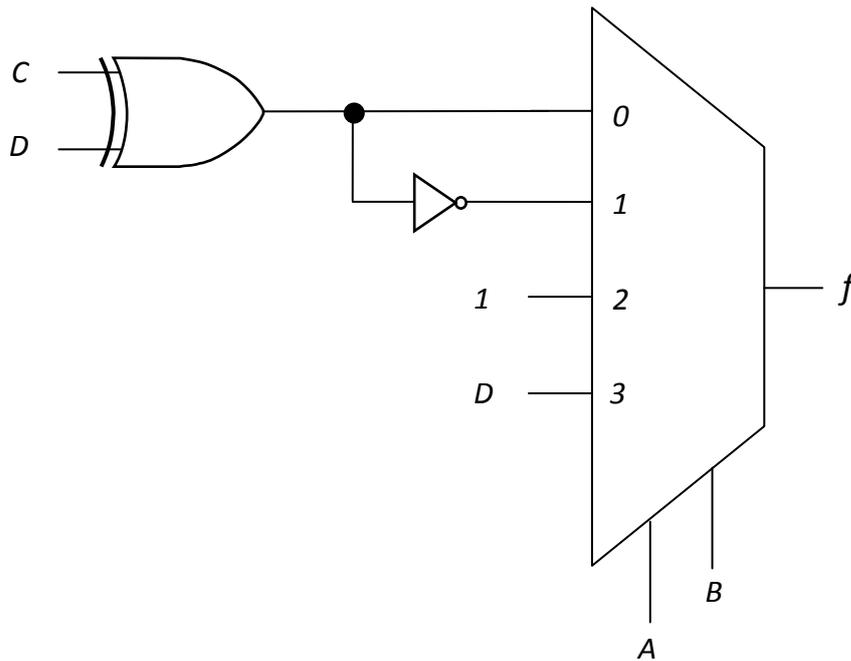
Name:_____ID:_____

1. (40%) Realize the function $f(A,B,C,D) = AD + AB'C' + BCD + B'CD' + A'BC'D' + A'B'C'D$ using only a XOR gate, a NOT gate and a 4-to-1 multiplexer with A and B as the select inputs where A is the most significant bit and B is the least significant bit. Note that complement inputs are not allowed.

Ans:

$f(A,B,C,D) = AD + AB'C' + BCD + B'CD' + A'BC'D' + A'B'C'D$

$\qquad = A'B' \cdot (C'D + CD') + A'B \cdot (C'D' + CD) + AB' \cdot (C' + CD' + D) + AB \cdot (CD + D)$

$\qquad = A'B' \cdot (C'D + CD') + A'B \cdot (C'D' + CD) + AB' \cdot (1) + AB \cdot (D)$

2. (60%) Implement the following equations using the PLA with four product terms only.

$f1(A,B,C,D) = \Pi\, M(0, 1, 3, 4, 6, 8, 9, 11)$

$f2(A,B,C,D) = \Pi\, M(1, 3, 6, 9, 11, 13, 14, 15)$

(a) (40%) List the four product terms used in the PLA

(b) (20%) Following shows the PLA structure, of which left and right side are AND array and OR array respectively. The intersection of a row and input or output lines indicates the presence of a switching element in the array. Indicate the connections which will be made to program the PLA

A   B   C   D

f1   f2

Ans:

(a)

$f1 = AB + A'BD + B'CD'$

$f2 = C'D' + A'BD + B'CD'$
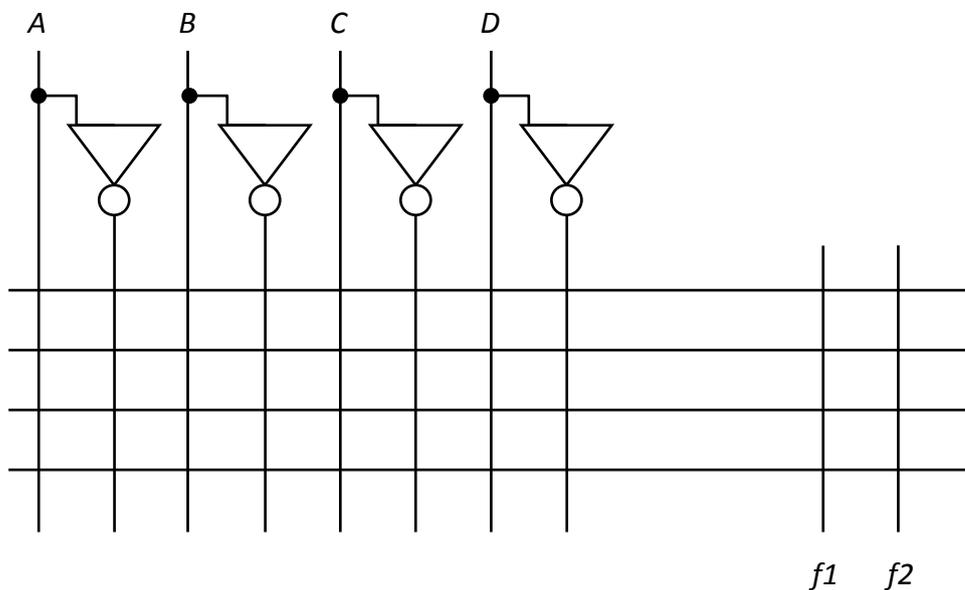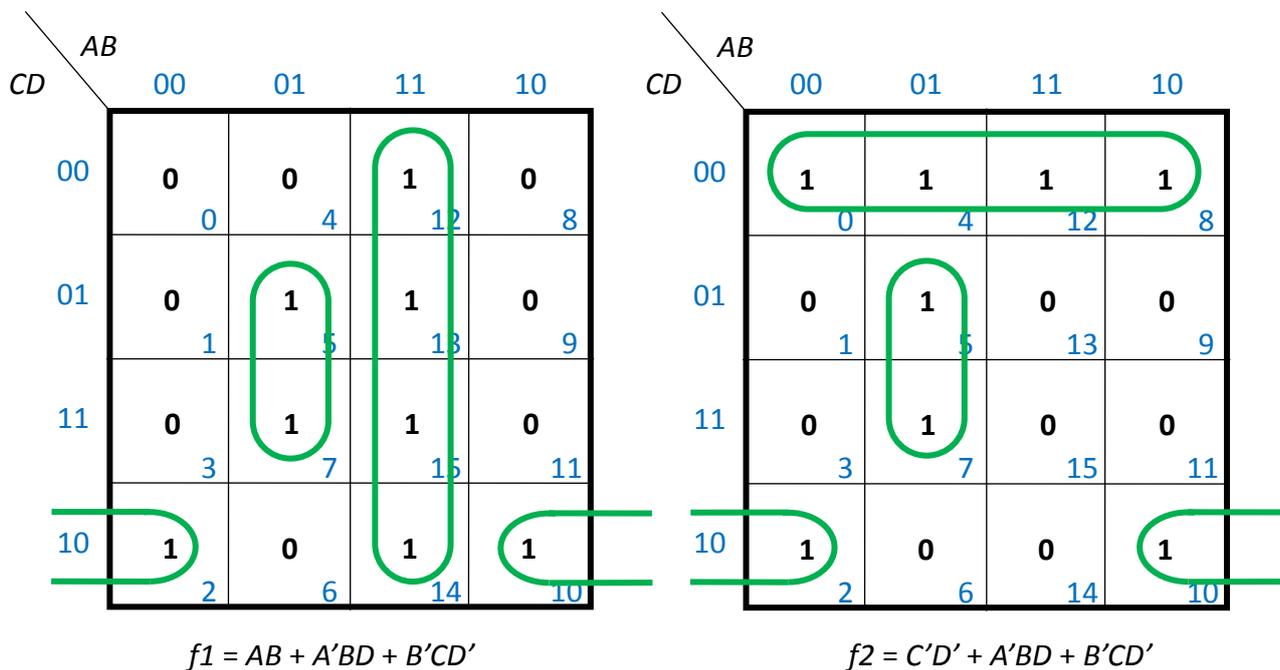
A B C D	$f_1 f_2$
1 1 – –	1 0
– – 0 0	0 1
0 1 – 1	1 1
– 0 1 0	1 1

(b)

$f1$ $f2$