EECS 151/251A Homework 2

Due Friday, Feb 11th, 2022

Problem 1: Moment of Truth Table

Please translate the following expressions/sentence/diagram into a truth table (you don't have to simplify the expressions in your solution)

(a) $Y = \overline{A\bar{B} + \bar{A}\bar{B}C} + \bar{C}$

$Y = \overline{A\bar{B}}\ \overline{(\bar{A}\bar{B}C)} + \bar{C}$

$Y = (\bar{A} + B)\ (A + B + \bar{C}) + \bar{C}$

$(distribute) Y = \bar{A}A + BA + \bar{A}B + BB + \bar{A}\bar{C} + B\bar{C}$

$(A\bar{A} = 0) Y = BA + B + B\bar{C} + \bar{C} = \bar{C}$

$(absorb) Y = B + \bar{C}$

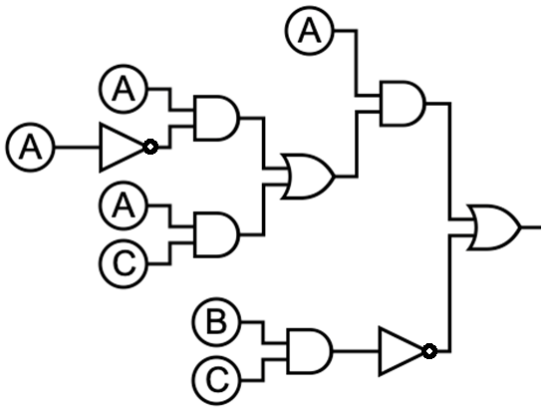
A	B	C	Out
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

(b) If A, then either both B and C or neither, else not B.

$Y = A(BC + \bar{B}\bar{C}) + \bar{A}\bar{B}$

A	B	C	Out
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

(c)



A	B	C	Out
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Problem 2: Boo…lean

Simplify the following expression to minterms (sum of product) expression (Hint: consider starting with De Morgan's Law to simplify the inversions)

(a) $Y = \overline{\left(DC + \overline{(\overline{DC} + B\bar{A})D}\right)} + B\overline{(A + \bar{C})}$

$(de\ morgan) Y = (\bar{D} + \bar{C})(\overline{DC} + B\bar{A})D + B\bar{A}C$

$(de\ morgan) Y = (\bar{D} + \bar{C})(\bar{D} + \bar{C} + B\bar{A})D + \bar{A}BC$

$(distribute) Y = (\bar{D}\bar{D} + \bar{C}\bar{D} + \bar{D}\bar{C} + \bar{C}\bar{C} + \bar{D}B\bar{A} + \bar{C}B\bar{A})D + \bar{A}BC$

$Y = (\bar{D}D + \bar{C}\bar{D}D + \bar{C}D + \bar{D}B\bar{A}D + \bar{C}B\bar{A}D) + \bar{A}BC$

$(D\bar{D} = 0) Y = 0 + 0 + \bar{C}D + 0 + \bar{C}B\bar{A}D + \bar{A}BC$

$(absorb) Y = \bar{C}D + \bar{A}BC$

Problem 3: K for Karnaugh Map

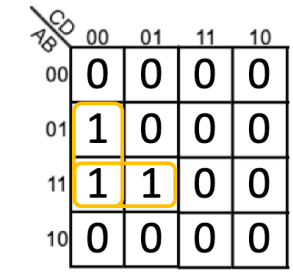
Derive the minterm/maxterm expressions for the following K-maps, whichever is simplified the most

(a)

AB \ CD	00	01	11	10
00	0	0	0	0
01	1	0	0	0
11	1	1	0	0
10	0	0	0	0

Answer: (student not required to draw the kmap in answer)

$Y = B\bar{C}\bar{D} + AB\bar{C}$

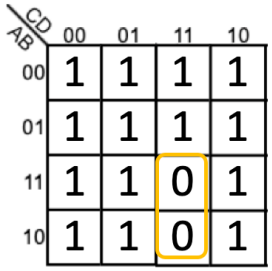


(b)

AB \ CD	00	01	11	10
00	1	1	1	1
01	1	1	1	1
11	1	1	0	1
10	1	1	0	1

Answer:

$Y = \overline{AD}$



(c)

CD \ AB	00	01	11	10
00	0	1	0	0
01	0	1	1	1
11	0	1	0	0
10	0	1	0	0

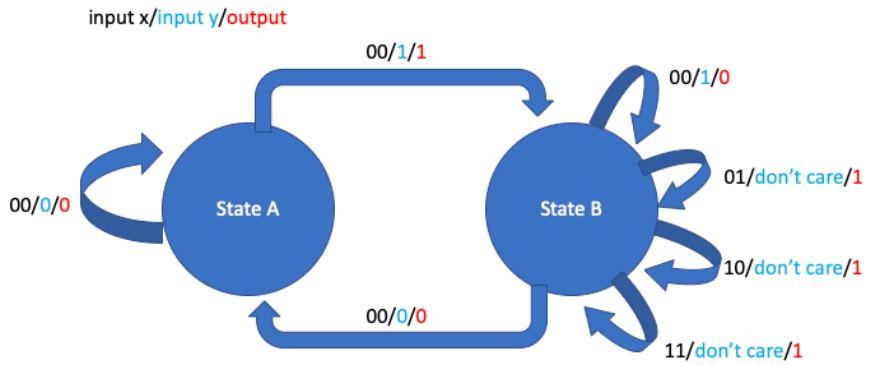
Answer:

$Y = \bar{C}D + \bar{A}BC$

CD \ AB	00	01	11	10
00	0	1	0	0
01	0	1	1	1
11	0	1	0	0
10	0	1	0	0

Problem 4: Mealy or Moore

Identify whether the following diagram represents a Mealy Machine or a Moore Machine, and then convert it to the other type (mealy to moore, and moore to mealy)



Answer: It's a Mealy machine (output depends on both state and input)

Its Moore Machine form is: (key is to split state B into 2 states based on output value)