

Module 3 Assignment 2

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September 20, 2016

1 Problem 1

Write the Boolean function implemented in Canonical Sum of Products format and in Canonical Product of Sums format.

$$\sum m(2, 4, 5) = \bar{x}y\bar{z} + x\bar{y}\bar{z} + x\bar{y}z$$

$$\prod M(0, 1, 3, 6, 7) = (x + y + z)(x + y + \bar{z})(x + \bar{y} + \bar{z})(\bar{x} + \bar{y} + z)(\bar{x} + \bar{y} + \bar{z})$$

2 Problem 2

Write a simplified Boolean function for the function performed by the circuit below.

$$= \bar{C}\bar{D}\bar{A} + CD\bar{A} + A$$

3 Problem 3

Write a truth table for the outputs, then use Boolean identities to find the simplified Boolean function for the outputs S_a and S_b .

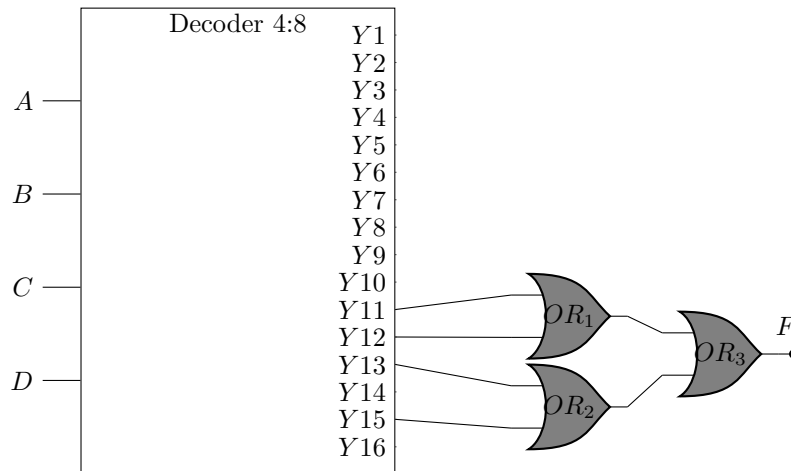
<i>Inputs</i>	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>
0000	1	1	1	1	1	1	0
0001	0	1	1	0	0	0	0
0010	1	1	0	1	1	0	1
0011	1	1	1	1	0	0	1
0100	0	1	1	0	0	1	1
0101	1	0	1	1	0	1	1
0110	1	0	1	1	1	1	1
0111	1	1	1	0	0	0	0
1000	1	1	1	1	1	1	1
1001	1	1	1	0	0	1	1
1010	0	0	0	0	0	0	0
1011	0	0	0	0	0	0	0
1100	0	0	0	0	0	0	0
1101	0	0	0	0	0	0	0
1110	0	0	0	0	0	0	0
1111	0	0	0	0	0	0	0

$$\begin{aligned}
S_a &:= \sum m(0, 2, 3, 5, 6, 7, 8, 9) = \bar{w}\bar{x}\bar{y}\bar{z} + \bar{w}\bar{x}y\bar{z} + \bar{w}\bar{x}yz + \bar{w}x\bar{y}z + \bar{w}xy\bar{z} + \bar{w}xyz + w\bar{x}\bar{y}\bar{z} + w\bar{x}\bar{y}z \\
&= \bar{w}(\bar{x}\bar{y}\bar{z} + \bar{x}y\bar{z} + \bar{x}yz + x\bar{y}z + xy\bar{z} + xyz) + w(\bar{x}\bar{y}\bar{z} + \bar{x}\bar{y}z) \\
&= \bar{w}(\bar{x}(\bar{y}\bar{z} + y\bar{z} + yz) + x(\bar{y}z + y\bar{z} + yz)) + w(\bar{x}\bar{y}) \\
&= \bar{w}(\bar{x}(\bar{z} + y) + x(z + y)) + w\bar{x}\bar{y} \\
&= \bar{w}(\bar{x}y + \bar{x}\bar{z} + xy + xz) + w\bar{x}\bar{y} \\
&= \bar{w}(y + \bar{x}\bar{z} + xz) + w\bar{x}\bar{y} \\
&= \bar{w}xz + \bar{w}\bar{x}\bar{z} + \bar{w}y + w\bar{x}\bar{y} \\
S_b &:= \sum m(0, 1, 2, 3, 4, 7, 8, 9) = \bar{w}\bar{x}\bar{y}\bar{z} + \bar{w}\bar{x}\bar{y}z + \bar{w}\bar{x}y\bar{z} + \bar{w}\bar{x}yz + \bar{w}x\bar{y}\bar{z} + \bar{w}xyz + w\bar{x}\bar{y}\bar{z} + w\bar{x}\bar{y}z \\
&= \bar{w}(\bar{x}(\bar{y}\bar{z} + \bar{y}z + y\bar{z} + yz) + x\bar{y}\bar{z} + xyz) + w\bar{x}\bar{y} \\
&= \bar{w}(\bar{x} + x\bar{y}\bar{z} + xyz) + w\bar{x}\bar{y} \\
&= \bar{w}\bar{x} + \bar{w}x\bar{y}\bar{z} + \bar{w}xyz + w\bar{x}\bar{y} \\
&= \bar{w}(\bar{x} + \bar{y}\bar{z} + yz) + w\bar{x}\bar{y} \\
&= \bar{w}\bar{x} + w\bar{x}\bar{y} + \bar{w}yz + \bar{w}\bar{y}\bar{z}
\end{aligned}$$

4 Problem 4

Using a 4×16 decoder module and a an OR gate to implement the Boolean function $f(a, b, c, d) = ab\bar{c} + acd$

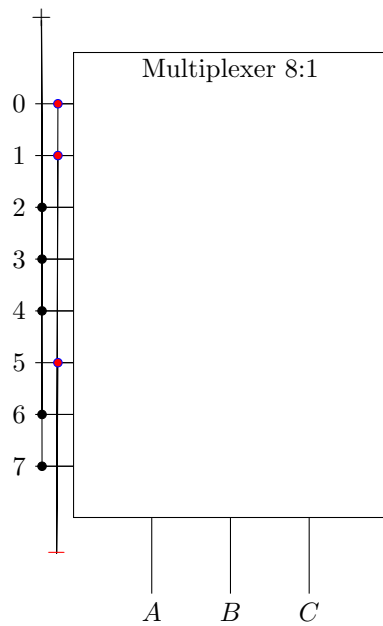
$$\sum m(11, 12, 13, 15)$$



5 Problem 5

Using an 8×1 multiplexer module and a OR gate to implement the Boolean function $f(a, b, c) = b + a\bar{c}$

$$\sum m(2, 3, 4, 6, 7)$$



6 Problem 6

Write Boolean functions for the circuit below in Canonical Sum of Product form.