Quiz #2

Question #1

Design a priority encoder with five active high input ***(0, 1, 2, 3, 4)***, and four active high output, ***W, X, Y*** and Z. ***W*** indicating no active request. While, ***X, Y*** and ***Z*** indicating the number of the highest priority device requesting service. The OUTPUT LINES ***X, Y*** and ***Z*** are indicated in excess three **BCD** code.

Input ***0*** is the highest priority and ***4*** is the lowest.

**Show the truth table and write the output functions** (for *W, X, Y* and *Z*).

1. Truth table

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | W | X | Y | Z |
| 0 | 0 | 0 | 0 | 0 | 1 | X | X | X |
| 1 | X | X | X | X | 0 | 0 | 1 | 1 |
| 0 | 1 | X | X | X | 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | X | X | 0 | 1 | 0 | 1 |
| 0 | 0 | 0 | 1 | X | 0 | 1 | 1 | 0 |
| 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |

1. Functions :

W= 0’ 1’ 2’ 3’ 4’

X= ∑m( 1,2,3,4,5,6,7,8,9,10,11`,12,13,14,15) + ∑d(0)= 0’

Y = ∑m(1,2,3,16-- 31) + ∑d(0)= 1’2’ + 0

Z= ∑m(1,4,5,6,7,16-- 31) + ∑d(0)= 1’2 + 1’3’4 + 0

Minimize each using a 5-variable k-map

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Question 2:

We have found the minimum sum of products expression for each of two functions F and G, minimizing them individually.

F= w’x’y’ + xy’z + w’z

G= wy’z + x’y’

1. Implement them using Programmable Logic Arrays (PLA) with four inputs, two outputs, and five internal AND gates.
2. Implement them using as many of the decoder described below. All inputs are available both complemented and uncomplemented.

0

1

2

3

A

B

EN1

EN2’

A

B

EN1 EN2’ A B 0 1 2 3

X 1 X X 0 0 0 0

0 X X X 0 0 0 0

1 0 0 0 1 0 0 0

1 0 0 1 0 1 0 0

1 0 1 0 0 0 1 0

1 0 1 1 0 0 0 1

Sol:

1. PLA implementation

F= w’x’y’ + w’z + wxy’z G= w’x’y’ + wx’y’ + wxy’z

Z

W

Y

X

G

F

1. Decoder

F= sm(0,1,3,5,7,13) G= ∑m(0,1,8,9,13)

NOTICE THAT ***YZ’ TERM IS NOT PART OF EITHER FUNCTIONS***

En1’ En2 output

Y Z A B En1’ En2

0 0 0,4,8,12 W X Y Z’ 🡪 DEC 1

0 1 1,5,9,13 W X Y Z 🡪 DEC 2

1 1 3,7,11,15 W X Y’ Z 🡪 DEC 3

F= sm(0,1,3,5,7,13) G= ∑m(0,1,8,9,13)

0

4

8

12

W

X

Y

Z’

A

B

1

5

9

13

W

X

Y’

Z’

A

B

3

7

11

15

W

X

Y

Z’

A

B

G

F

Question # 3 (3 points)

Given the following circuit, write an algebraic equation for F.

W X F .

F

A

B

C

D

W X

0 0 A

0 1 B

1 0 C

C 1 1 D

F = W’X’A + W’XB+ WX’C + WXD