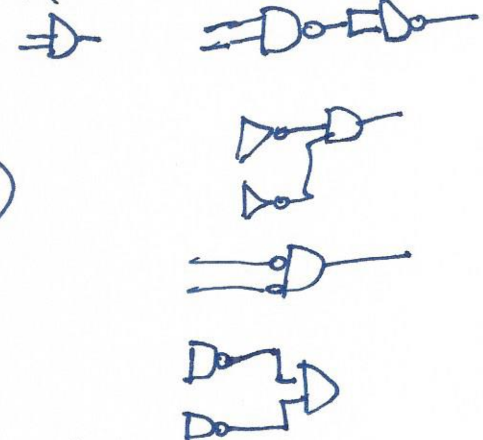
$(a_1a_0)'(a_2a_3')'(a_2'a_3)'$

AND ⇄ NAND



b3 = (a3 + a2'+ a1'+ a0') (a3'+ a2 + a1'+ a0')

$= ((a_3'a_2)' + (a_0a_1)')((a_2'a_3)' + (a_0a_1)')$

$= (a_3'a_2a_0a_1)'(a_2'a_3a_0a_1)'$

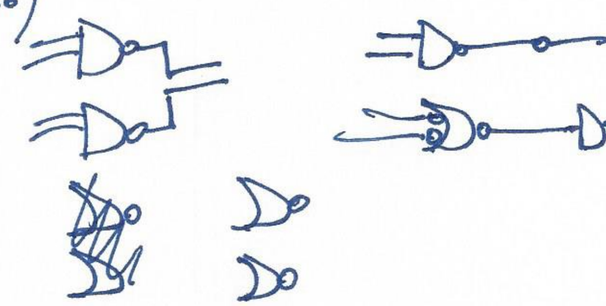
$A'B' = (A+B)'$

b2 = (a3 + a2 + a1 + a0') (a3 + a2 + a1'+ a0)

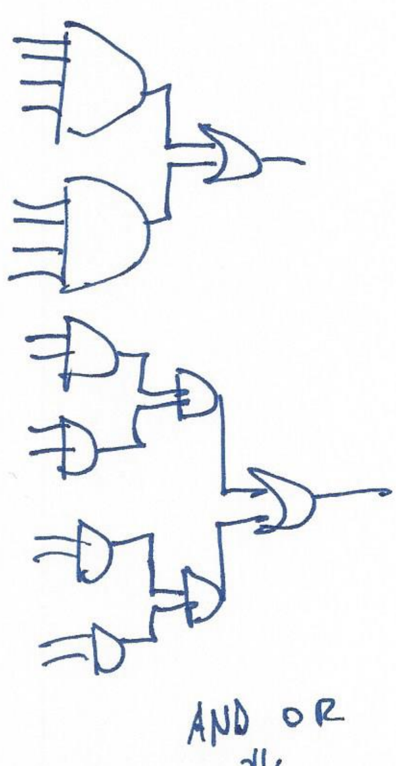
$= ((a_3'a_2')' + a_1 + a_0')(\quad) + a_1' + a_0)$

$= (a_3'a_2')'(a_1+a_0')(a_1'+a_0)$

$= (a_1'a_0)'(a_1a_0')'$.



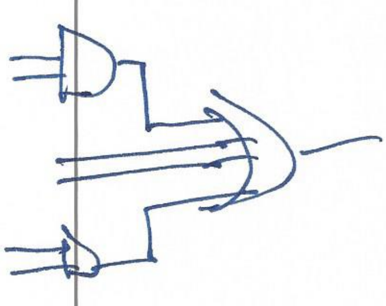
b1 = (a1')



b0 = (a0) (a3 + a1') (a2') (a3'+ a1)

$(a_3'a_1')'$ $(a_3a_1')'$

4/X AND



AND OR

⇓

NAND NAND

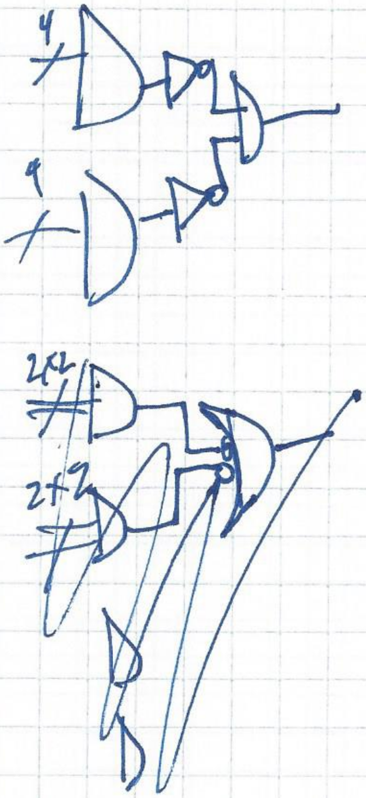
AND NADN

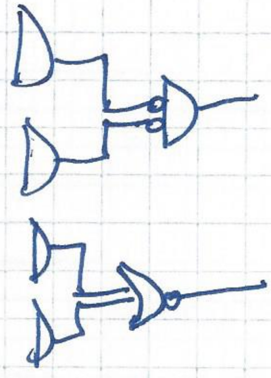
Truth_Table4

```
Input Variable Names:  a3  a2  a1  a0
Output Function Names:  b3  b2  b1  b0

0000     11-0
0001     1011
0010     10-0
0011     11-0
0100     11-0
0101     11-0
0110     11-0
0111     01-0
1000     11-0
1001     11-0
1010     11-0
1011     0101
1100     11-0
1101     11-0
1110     11-0
1111     11-0
```

Truth_Table4_O

```
     Simplification Routine:  PI Chart

b3  =  a3'a2' + a1' + a0' + a3 a2

     Input Cost = 8          Gate Cost  = 3

b2  =  a1'a0' + a1 a0 + a2 + a3

     Input Cost = 8          Gate Cost  = 3

b1  =  a3'

     Input Cost = 0          Gate Cost  = 0

b0  =  a3'a2'a1'a0 + a3 a2'a1 a0

     Input Cost = 10         Gate Cost  = 3
```





4,4 and = 1

OR = 1

 = 1

$$(((a_1'a_0')'(a_1a_0)')(a_2'a_3'))'$$

$$((a_1'a_0')'(a_1a_0)')' + (a_2'a_3')'$$

$$(a_1'a_0') + (a_1a_0) + a_2 + a_3$$

$$(a_0a_1)' = c_0$$
$$(a_2a_3)' = c_1$$
$$(a_2'a_3')' = c_2$$

$$b_3 = (c_2'c_1')' + c_0' = (c_2'c_1')c_0$$

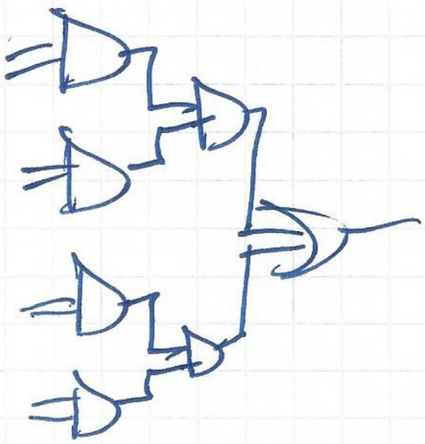
$$= c_2 + c_1 + c_0'$$

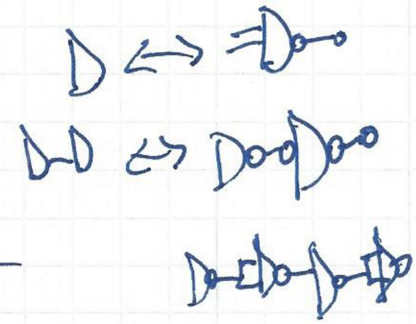
$$a_0' + a_1' = (a_0a_1)'$$

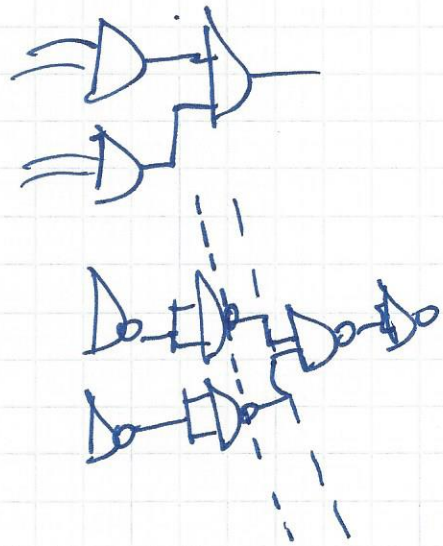
ABCD

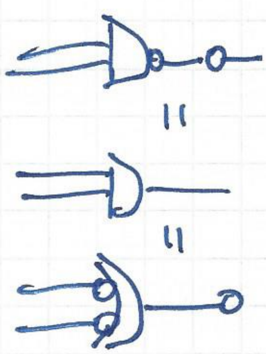
(AB)'

A+B

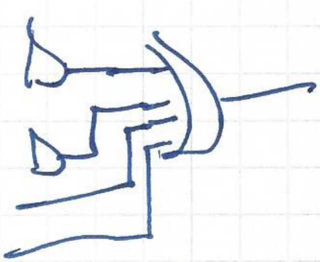


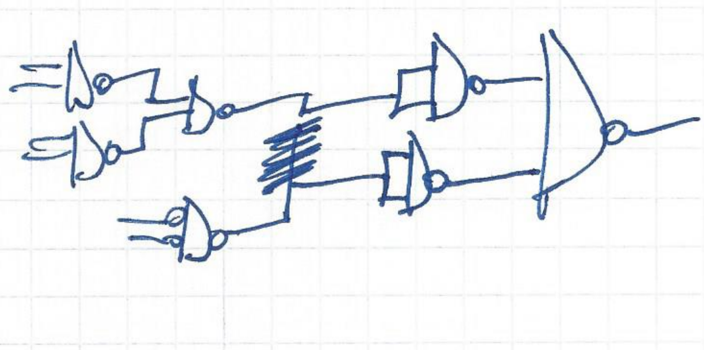


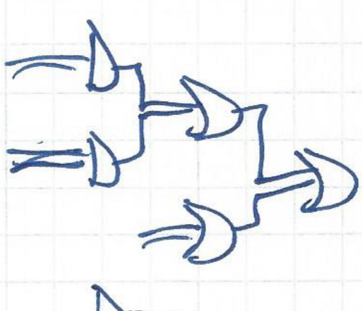


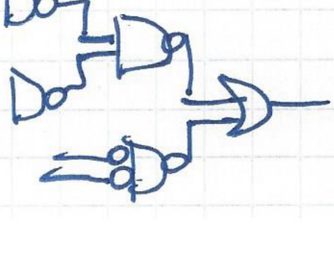


NOR AND









$A+B = (A'B')'$ 5

b3 = a3'a2' + a1' + a0' + a3 a2 $= ((a_3'a_2')'(a_3a_2)')' + (a_1'a_0')' (a_1a_0)'$

$= ((a_3'a_2')(a_1')')'$

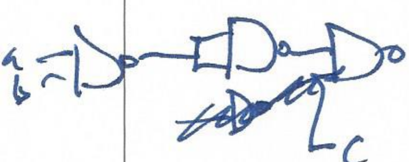
b2 = a1'a0' + a1 a0 + a2 + a3 $= ((a_1'a_0')'(a_1a_0)')' + (a_2'a_3')'$

$(((a_1'a_0')'(a_1a_0)')(a_2'a_3'))'$

b1 = a3'

b0 = a3'a2'a1'a0 + a3 a2'a1 a0 $= (x'y')'$ invert 2 → Nand

$(a'b')'$



$(ab)'$

$((a'+b')(a'+b'))'$

$(a'b')' + (a'b')'$

$a+b+a+b$

$Z_0 = a_1 a_7 a_3 a_4 = ;0' \, \bar{o}0 \, i1' \, \overline{o1'}$ $\qquad ;0 + i1 = (;0' \, i1')'$

$Z_1 = a_1 a_7 a_2 a_5 = ;0' \, \bar{o}0 \, i1 \, \bar{o}1$

$Z_0 + Z_1 = 3sn$ ✓

$Z_3 = a_5 + a_7$

$Z_4 = (z_3 (a_6 a_4)')' = (z_3(a_6' + a_4'))' = z_3' + (a_6' + a_4')'$

$= (a_5 + a_7)' + a_4 a_6 = a_4 a_6 + a_5' a_7'$

$Z_5 = (a_1 a_3)' = a_1' + a_3'$

$3sn = Z_0 + Z_1 =$ ✓

$rn = Z_2 + Z_3 =$

$Z_2 = (((a_0 a_2)')(Z_5))' = ((a_0' + a_2')(a_1' + a_3'))' = (a_0' + a_2')' + (a_1' + a_3')'$

$= a_0 a_2 + a_1 a_3$

$r_n = Z_2 + Z_3 = a_0 a_2 + a_1 a_3 + a_5 a_7 = ;0;1 + ;0';1' + \overline{o1} \, \overline{o0}$

$= ;0 i1 + ;0' i1' + \cancel{(\bar{o}1' + \bar{o}0')'}$

$= a_0 a_2 + a_1 a_3 + a_4 a_6$

$+ \bar{o}1' \bar{o}0'$

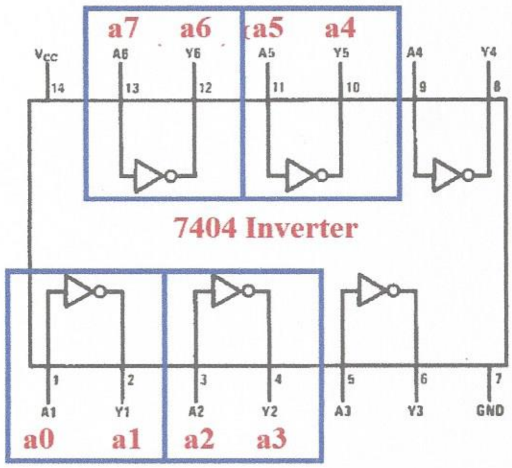
$= \qquad + (\bar{o}1' + \bar{o}0')'$

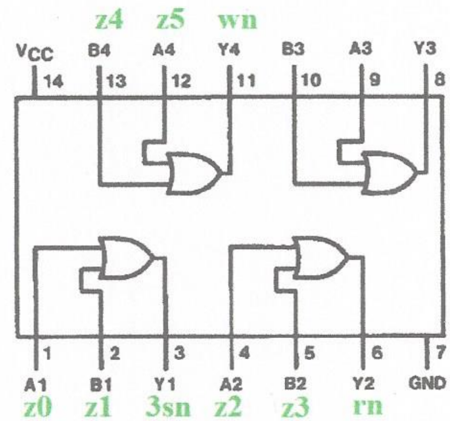
$+ a_4 + a_6$

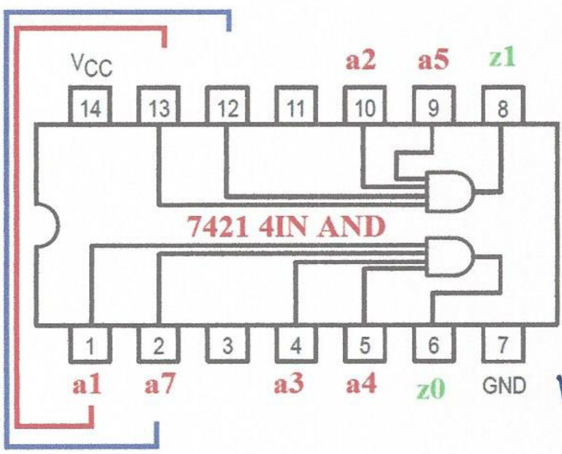
$(\bar{o}1' + \bar{o}0')'$

$a_4 + a_6$

$\overline{a_0 a_2}$

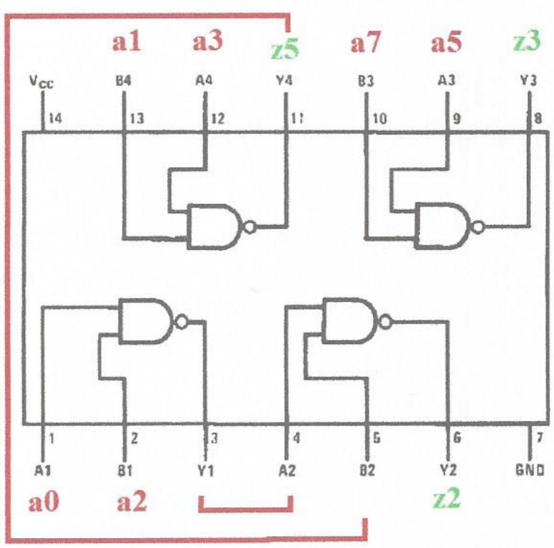


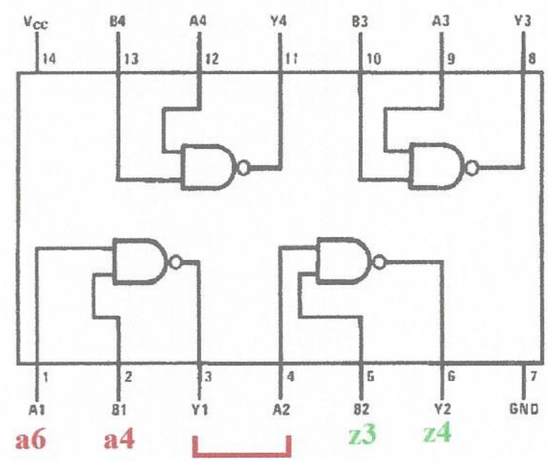




a0 i0
a1 i0'
a2 i1
a3 i1' = 3dir
a4 o1n'
a5 o1n
a6 o0n'
a7 o0n

$w_n = z_4 + z_5$
$= z_5 + (z_3 (a_4 a_6)')'$
$= z_5 + ((a_5 a_7)'(a_4 a_6)')'$ " "
$=$ [illegible] $(a_1 a_3)' +$ "





$(a_1 a_3)' + ((a_5 a_7)'(a_4 a_6)')'$

$a_1' + a_3' + (a_5 a_7 + a_4 a_6) = W_n$

$= 10' + 11' + \overline{01}\,\overline{00} + \overline{01'}\,\overline{00'} = W_n$

$= (10 \cdot 11)'$