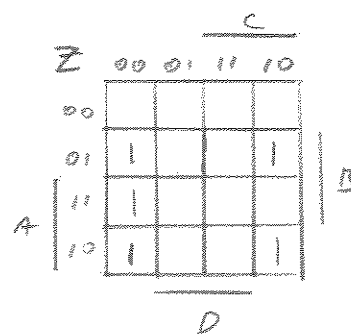
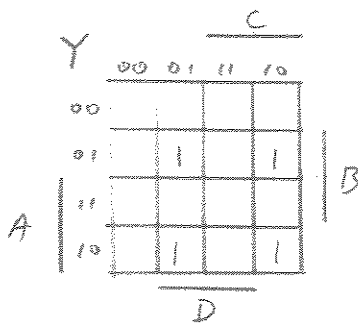
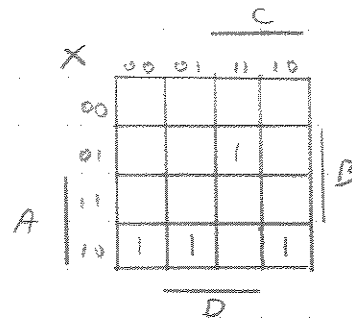
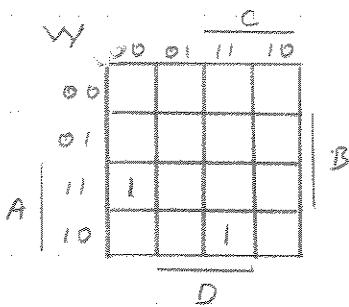


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3-3) Excess-3-to-BCD Code Converter

		EXCESS-3				BCD			
		A	B	C	D	W	X	Y	Z
ILLEGAL INPUT	{	0	0	0	0	0	0	0	0
		0	0	0	1	0	0	0	0
		0	0	1	0	0	0	0	0
		0	0	1	1	0	0	0	0
		0	1	0	0	0	0	0	1
		0	1	0	1	0	0	1	0
		0	1	1	0	0	0	1	1
	1	0	0	0	0	1	0	0	
	1	0	0	1	0	0	1	1	
	1	0	1	0	1	1	0	0	
	1	0	1	1	1	0	0	0	
ILLEGAL INPUT	{	1	1	0	0	1	0	0	1
		1	1	0	1	0	0	0	0
		1	1	1	0	0	0	0	0



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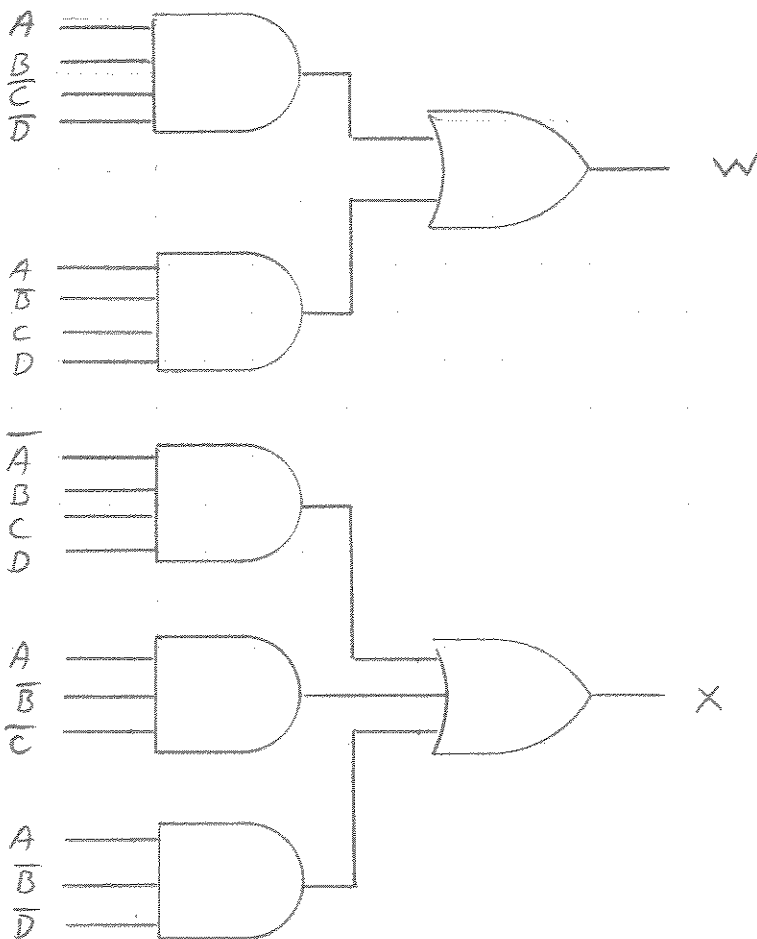
3-3) (cont.)

$$W = ABC\bar{D} + A\bar{B}CD$$

$$X = \bar{A}BCD + A\bar{B}\bar{C} + A\bar{B}\bar{D}$$

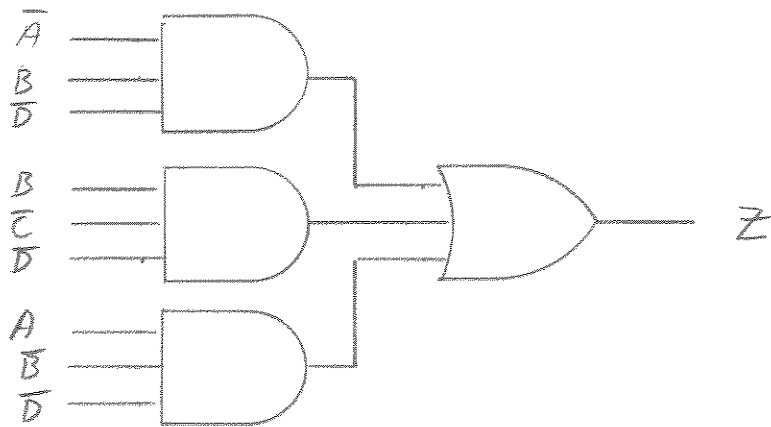
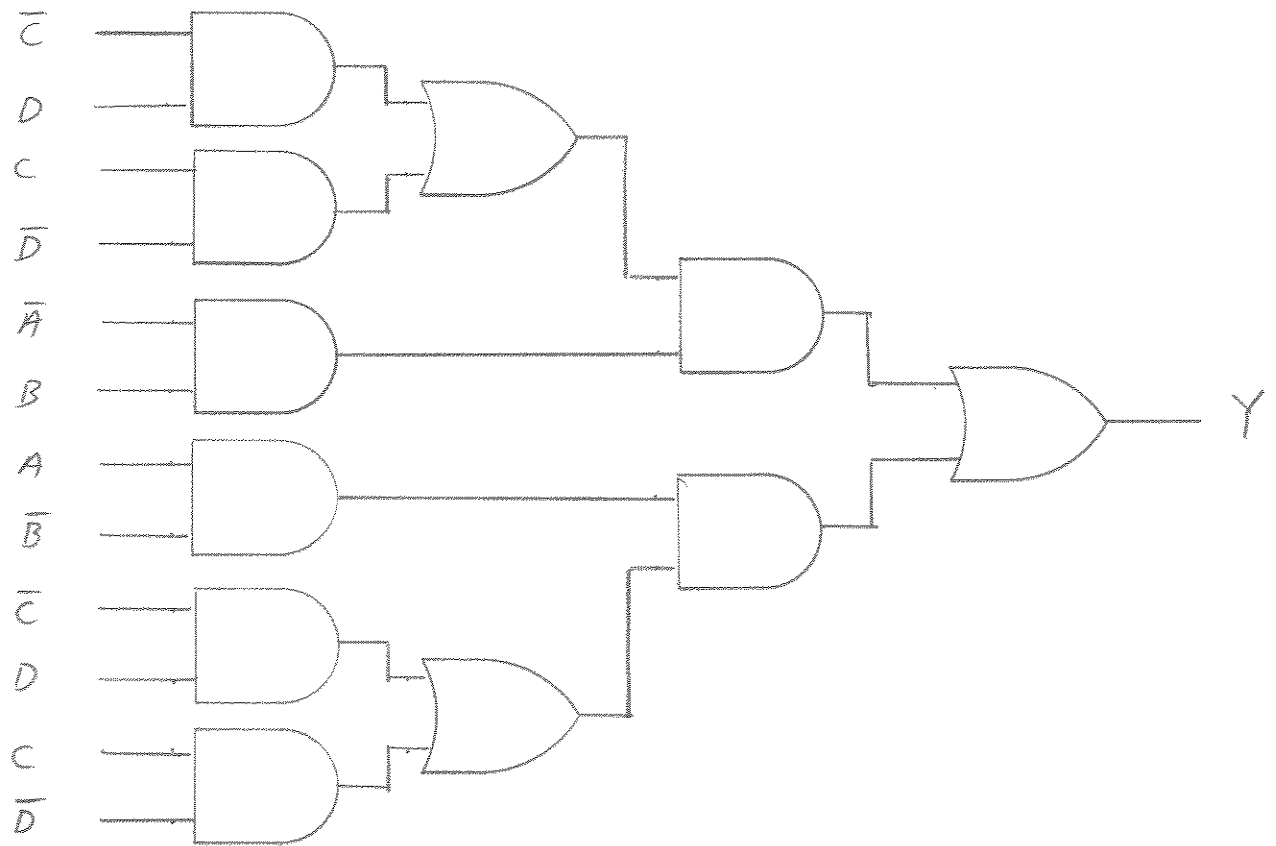
$$Y = \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D + A\bar{B}\bar{C}\bar{D} + A\bar{B}C\bar{D}$$
$$= \bar{A}B(\bar{C}\bar{D} + C\bar{D}) + A\bar{B}(\bar{C}\bar{D} + C\bar{D})$$

$$Z = \bar{A}B\bar{D} + B\bar{C}\bar{D} + A\bar{B}\bar{D}$$



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3-3) (cont.)

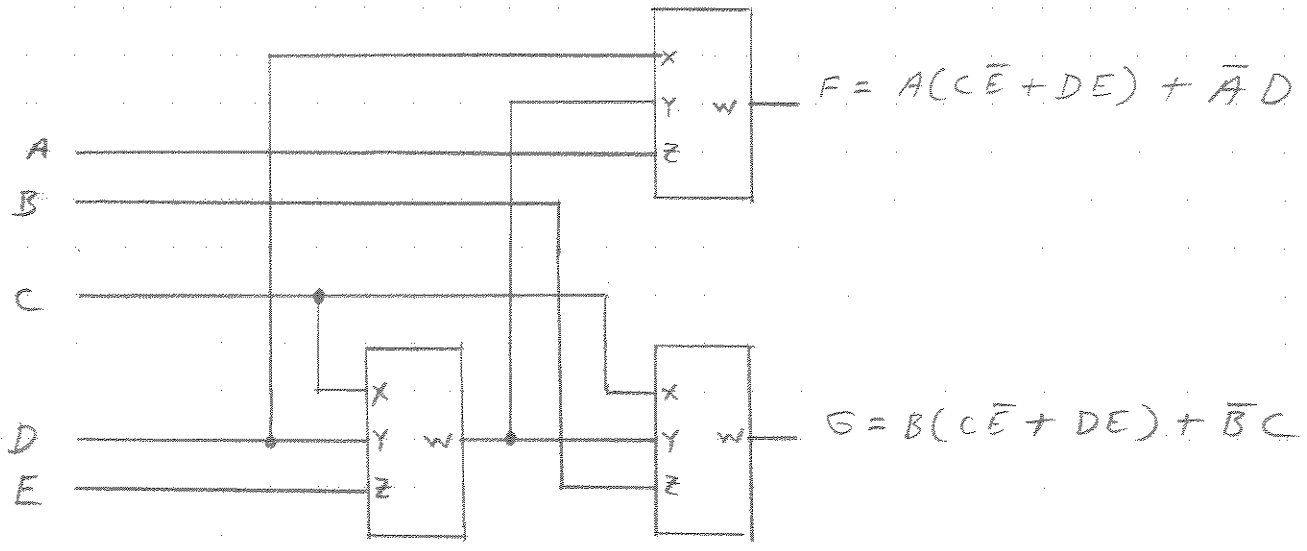
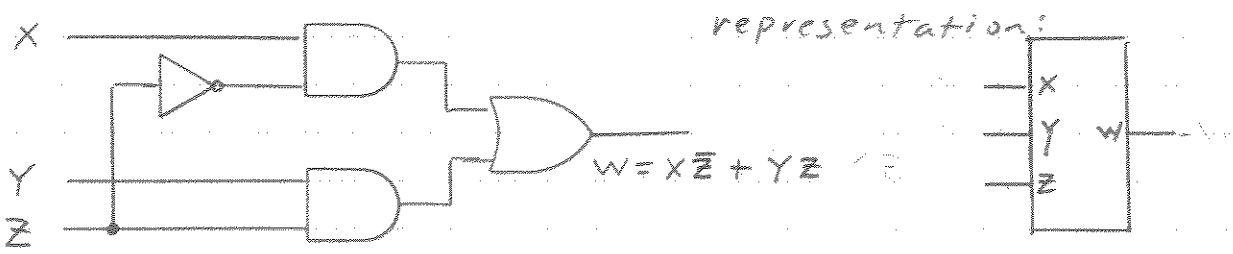


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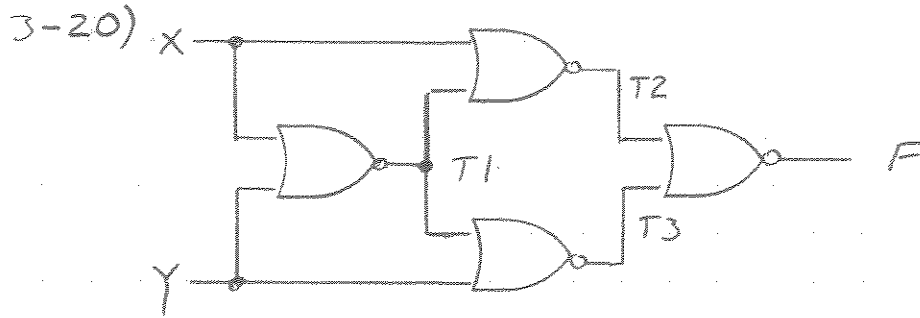
3-13)

The common factor is of the form:

$$W = X\bar{Z} + YZ$$



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$$T1 = \overline{X+Y} = \bar{X}\bar{Y}$$

$$T2 = \overline{X + \bar{X}\bar{Y}} = \bar{X} \cdot \overline{\bar{X}\bar{Y}} = \bar{X}(X+Y) = \bar{X}Y$$

$$T3 = \overline{Y + \bar{X}\bar{Y}} = \bar{Y} \cdot \overline{\bar{X}\bar{Y}} = \bar{Y}(X+Y) = X\bar{Y}$$

$$\begin{aligned} F &= \overline{\bar{X}Y + X\bar{Y}} = \overline{\bar{X}Y} \cdot \overline{X\bar{Y}} \\ &= (X+Y)(\bar{X}+\bar{Y}) \\ &= X\bar{X} + X\bar{Y} + \bar{X}Y + Y\bar{Y} \\ F &= X\bar{Y} + \bar{X}Y \end{aligned}$$

Q.E.D.

$$\text{Note that } X \text{ NOR } Y \equiv \overline{X \oplus Y} = X\bar{Y} + \bar{X}Y$$

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7.) Inputs C and \bar{D} will experience 4 gate delays of t_{pd} to propagate through the circuit to F. This is the longest path.

$$\begin{aligned} T_{PD} &= 0.073 \text{ ns} + 0.073 \text{ ns} + 0.048 \text{ ns} + 0.073 \text{ ns} \\ &= 0.267 \text{ ns} \end{aligned}$$