MULTIMEDIA UNIVERSITY

PDS0101 Introduction to Digital Systems

Tutorial 4

Tutorial outcomes

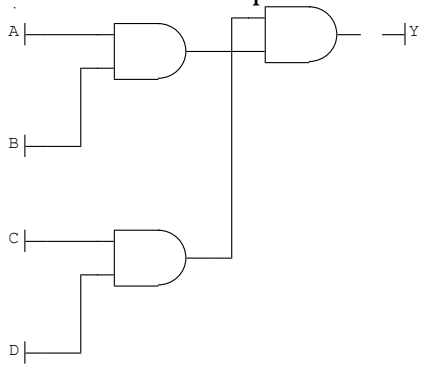
By the end of today's tutorial, you should be able to

- apple the basic laws and rules of boolean algebra
- apply DeMorgan's theorems to boolean expressions
- simplify boolean expressions using boolean algebra

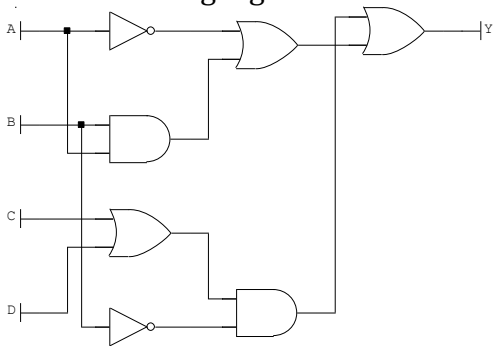
Theory based questions

1. Write the boolean expressions for the outputs from the following logic circuits

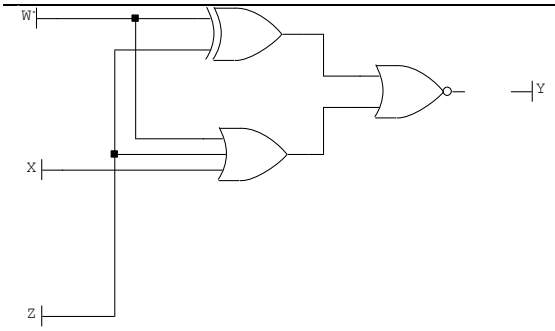
a)



b)



c)



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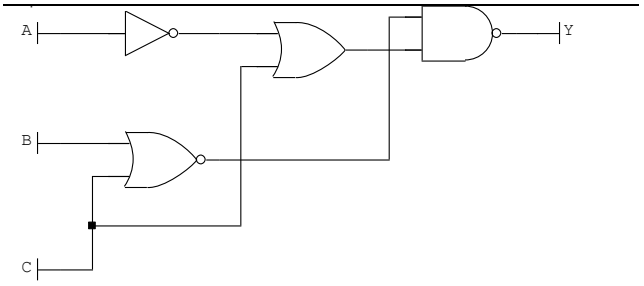
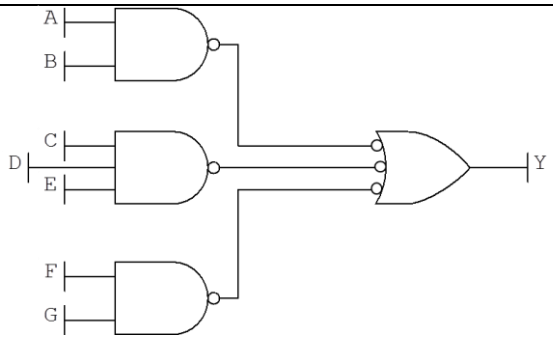


e)



2. Draw the logic circuit represented by the following boolean expressions

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

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

c) $Y = \overline{[(AB + C)D]} + [(CD + B)\bar{A}]$

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3. Define and describe De Morgan's first and second theorem

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4. Apply DeMorgan's theorems to the following expressions

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

b) $\overline{\bar{A}B}$

c) $\overline{(A + \bar{B} + C + \bar{D})} + \overline{(ABC\bar{D})}$

d) $\overline{(A\bar{B}(C + \bar{D}))}$

e) $\overline{\overline{(\bar{A}B\bar{C})}\,\overline{(\bar{E}FG)}} + \overline{\overline{(HI\bar{J})}\,\overline{(KLM)}}$

f) $\overline{\overline{(A + B)}\,\overline{(C + D)}\,\overline{(E + F)}\,\overline{(G + H)}}$

Applied knowledge questions

6. Using boolean algebra rules, simplify the following expressions as much as possible

a) $A(\bar{A} + AB)$

b) $(A + \bar{B})(A + C)$

c) $AB + (\bar{A} + \bar{B})C + AB$

d) $\bar{A}B + \bar{A}B\bar{C} + \bar{A}BCD + \bar{A}B\bar{C}\bar{D}E$

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

f) $(a' + b' + c')(a + b + c)$

7. Using boolean algebra rules, simplify the following functions and draw the resulting logic circuit of f

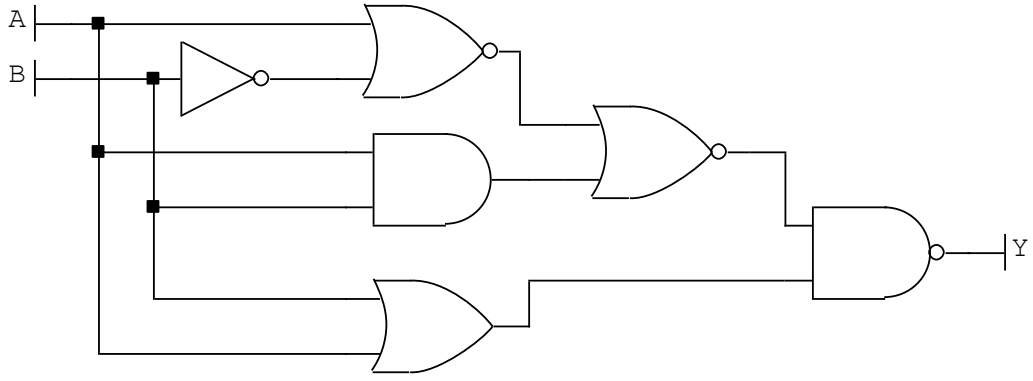
a) $f(w, x, y, z) = x + xyz + \bar{x}yz + wx + \bar{w}x + \bar{x}y + \bar{x}yw$

b) $f(x, y, z) = y\bar{z}(\bar{z} + \bar{z}x) + (\bar{x} + \bar{z})(\bar{x}y + \bar{x}z)$

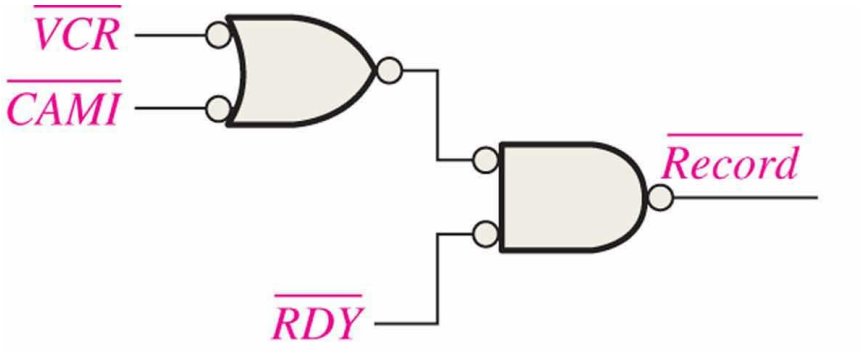
c) $f(w, x, y, z) = (w + x)(\bar{w} + y)(x + y + z)$

8. Derive the truth table for the circuits shown below

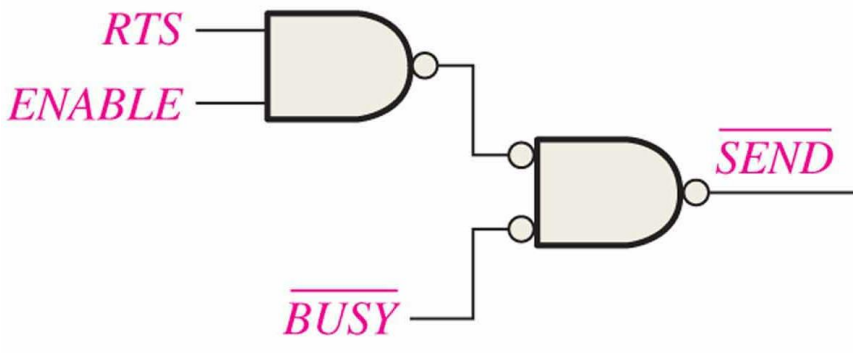
a)



b)



c)



9. The Boolean expression of a logic circuit is given as:

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

(a) Draw the implementation of the logic circuit given above

(b) If the inputs A, B, C and D are varying according to the timing diagram below, what should be waveform at Y?