

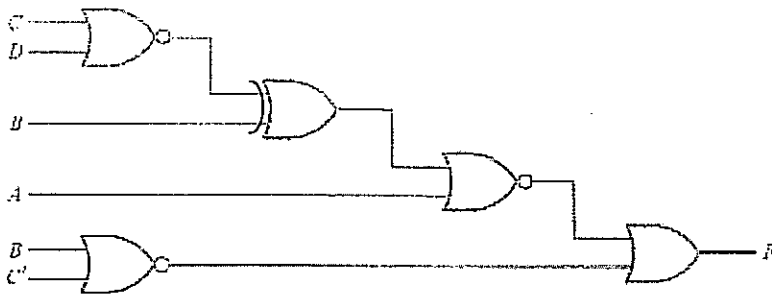
**American University of Beirut**  
**Department of Electrical and Computer Engineering**

EECE 320 – Digital Systems Design

Test 2

24-10-11

For the following circuit, write an algebraic expression for F as a minimum sum of product.



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

$$\begin{aligned} F &= (A + BC + BD + \bar{B}\bar{C}\bar{D}) + \bar{B}C ; \text{ De Morgan's} \\ &= \bar{A} \cdot (\bar{B} + \bar{C}) (\bar{B} + \bar{D}) (B + C + D) + \bar{B}C ; (X+Y)(X+Z) = X + YZ \\ &= \bar{A} (\bar{B} + \bar{C}\bar{D}) (B + C + D) + \bar{B}C ; (X+Y)(\bar{X}+Z) = XZ + \bar{X}Y \\ &= \bar{A} (\bar{B}(C+D) + B\bar{C}\bar{D}) + \bar{B}C \\ &= \bar{A}\bar{B}C + \bar{A}\bar{B}D + \bar{A}B\bar{C}\bar{D} + \bar{B}C ; XY + X = X \\ &= \bar{A}\bar{B}D + \bar{A}B\bar{C}\bar{D} + \bar{B}C \end{aligned}$$

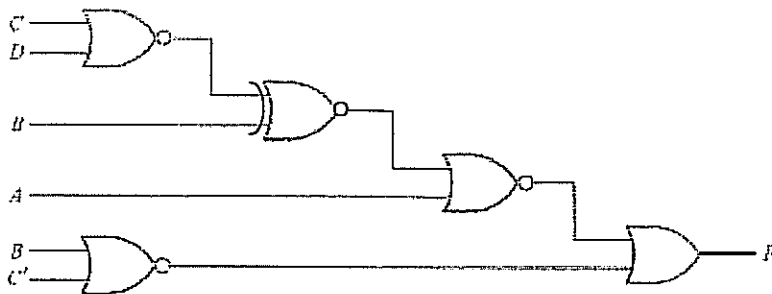
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For the following circuit, write an algebraic expression for F as a minimum sum of product.



$$F = \overline{[\overline{C} \overline{D} B + (C + D), \overline{B}]} \cdot \overline{A} + \overline{(B + \overline{C})}$$

$$F = \overline{[\overline{C} \overline{D} B + \overline{B} C + \overline{B} D]} \cdot \overline{A} + \overline{B \cdot C} \quad ; \text{De Morgan's}$$

$$F = (\overline{C + D + \overline{B}})(\overline{B + \overline{C}})(\overline{B + \overline{D}}) \cdot \overline{A} + \overline{B C} \quad ; (X + Y)(X + Z) = X + YZ$$

$$= (\overline{C + D + \overline{B}})(\overline{B + \overline{C} \overline{D}}) \cdot \overline{A} + \overline{B C} \quad ; (X + Y)(\overline{X} + Z) = XZ + \overline{X}Y$$

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

$$= \overline{A} \overline{B} \overline{C} \overline{D} + \overline{A} B C + \overline{A} B D + \overline{B C}$$

$$= \overline{A} \overline{B} \overline{D} + \overline{B C} + \overline{A} B C + \overline{A} B D$$

$$F = \overline{A} \overline{B} \overline{D} + \overline{B C} + \overline{A} C + \overline{A} B D$$

$$\begin{cases} \overline{B}(\overline{A} \overline{C} \overline{D} + C) \\ \overline{B}(\overline{C + \overline{C}})(C + \overline{A} \overline{D}) \\ \overline{B C} + \overline{A} \overline{B} \overline{D} \end{cases}$$

$$\begin{cases} C(\overline{B} + \overline{A} B) = C(\overline{B} + \overline{A}) \end{cases}$$