

INTERVIEW QUESTION

Question 2.1: Sketch a schematic for the two input XOR function using only NAND gate. How few can you use?

A	B	$A \oplus B$	minterm
0	0	0	$\overline{A}\overline{B}$
0	1	1	$\overline{A}B$
1	0	1	$A\overline{B}$
1	1	0	AB

Sum-of-products:

$$A \oplus B = \overline{A}B + A\overline{B}$$

$$= \overline{\overline{A}B} + \overline{A\overline{B}} \quad (\text{Involution})$$

$$= \overline{\overline{A}B} \cdot \overline{A\overline{B}} \quad (\text{De Morgan})$$

$$= \overline{(A+\overline{B})(\overline{A}+B)} \quad (\text{De Morgan})$$

$$= \overline{(A+\overline{B})A + (A+\overline{B})B} \quad (\text{Distributivity})$$

$$= \overline{A\overline{A} + \overline{A}B + AB + \overline{B}B} \quad (\text{Distributivity})$$

$$= \overline{0 + \overline{A}B + AB + 0} \quad (\text{Complements})$$

$$= \overline{\overline{A}B + AB} \quad (\text{Identity \& Associativity})$$

$$= \overline{\overline{A}B} \cdot \overline{AB} \quad (\text{De Morgan})$$

$$= \overline{\overline{A}B} \cdot \overline{A+B} \quad (\text{De Morgan})$$

$$= \overline{\overline{A}BA + \overline{A}BB} \quad (\text{Distributivity})$$

$$= \overline{\overline{A}BA + \overline{A}BB} \quad (\text{Involution})$$

$$= \overline{\overline{A}B} \cdot \overline{A} \cdot \overline{B} \quad (\text{De Morgan})$$

Circuit:

