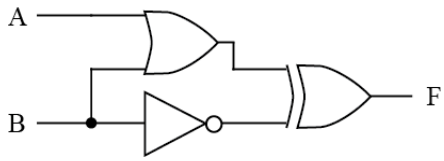
Exam #3 Prob 2a solution

EX: For the circuit below, write a Boolean expression for F in terms of A and B in the simplest possible way.



SOL'N: From the diagram, we write a Boolean expression for F.

$$F = (A + B) \oplus \overline{B}$$

Expanding the X-OR, we have

$$F = (\overline{A + B})\overline{B} + (A + B)B\,.$$

Using De Morgan's theorem, we can rewrite the first NOR as an AND.

$$F = \overline{A}\,\overline{B}\,\overline{B} + AB + BB$$

Eliminating redundant terms, we have an OR function and one inversion.

$$F = \overline{A}\,\overline{B} + AB + B = \overline{A}\,\overline{B} + B = \overline{A} + B$$

Using De Morgan's theorem, we could use a NAND gate, but we would have one additional gate input. Thus, the OR gate is a better solution.

$$F = \overline{A\overline{B}}$$