

EE 2720, Spring 07

Solutions of HW#5

Problem 1:

(a) Algebraic approach:

$$\begin{aligned}
 F &= A \cdot B' + C' \cdot D + E' = \\
 &= \left[(A \cdot B' + C' \cdot D + E')' \right]' \\
 &= \left[(A \cdot B')' \cdot (C' \cdot D)' \cdot E \right]' \quad (1)
 \end{aligned}$$

From (1) we get the following figure

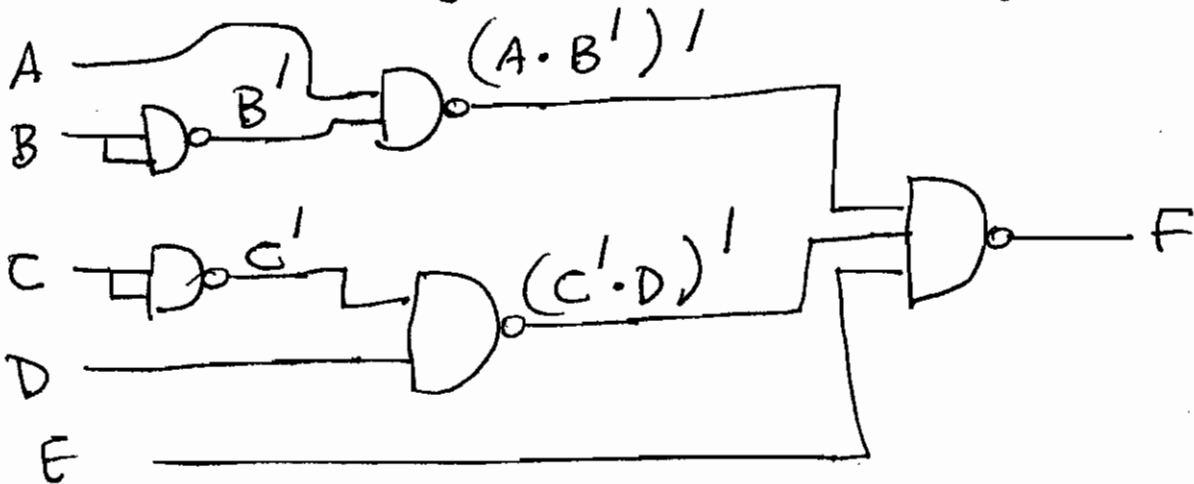


Fig. 1

Problem 1 cont.:

(b) Graphical approach: I first provide a logic circuit showing an AND-OR realization shown below

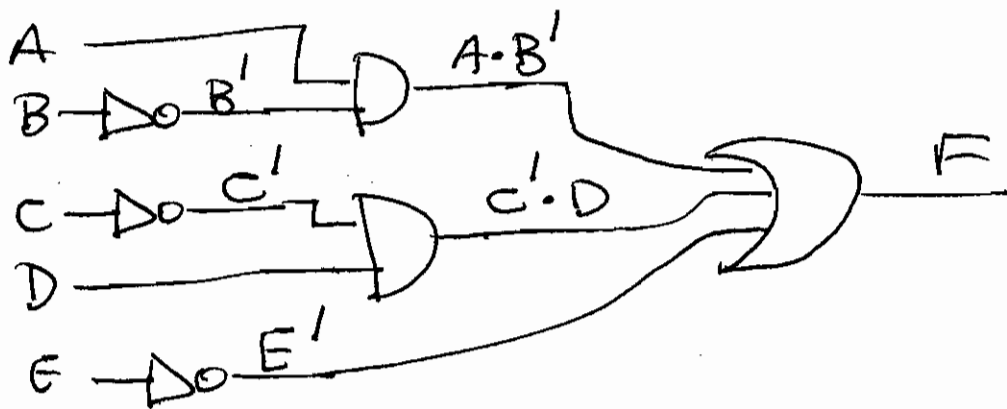


Fig. 2

From the above Fig. 2 one gets

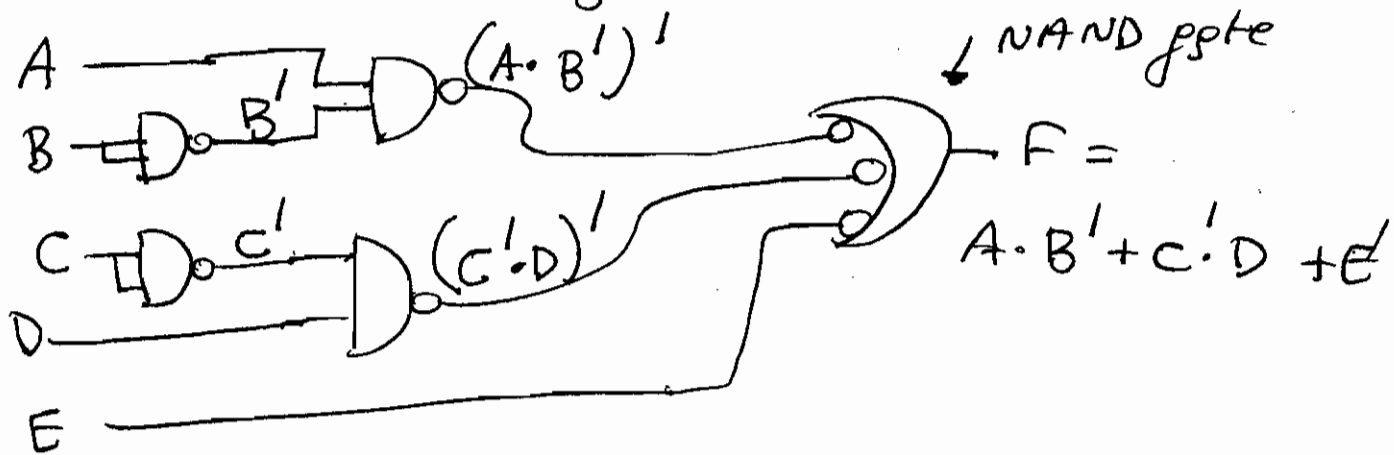


Fig 3

Problem 2:

(a) Algebraic approach:

$$\begin{aligned} F &= (A+B') \cdot (C'+D) \cdot E' \\ &= \left[(A+B') \cdot (C'+D) \cdot E' \right]' \\ &= \left[(A+B')' + (C'+D)' + E \right]' \quad (2) \end{aligned}$$

From (2) we get the following figure.

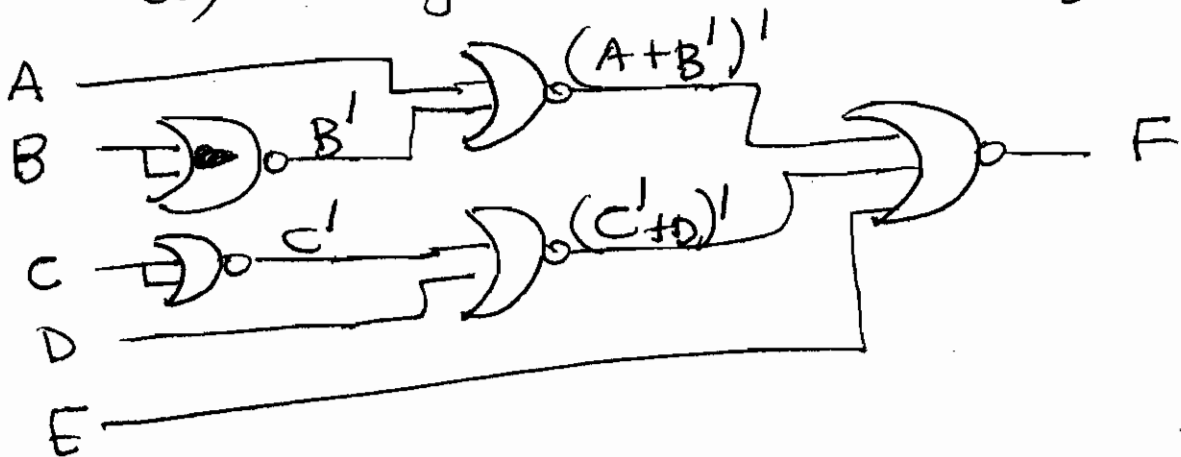
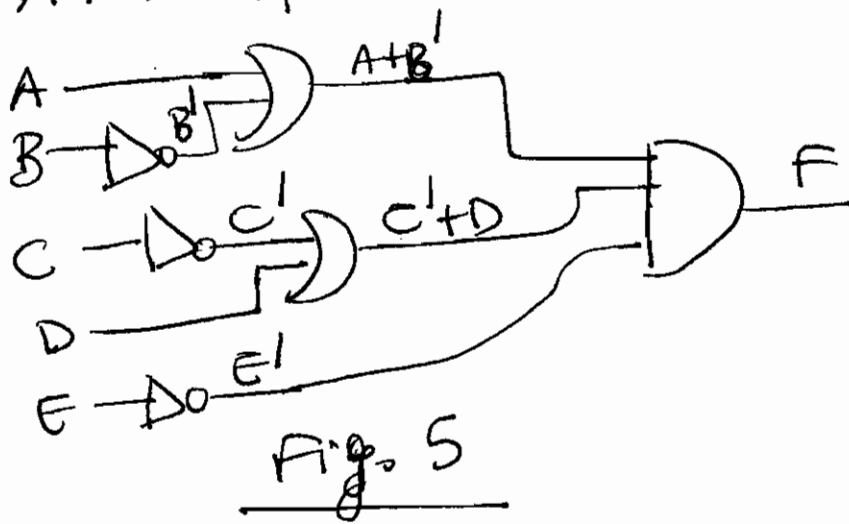


Fig. 4

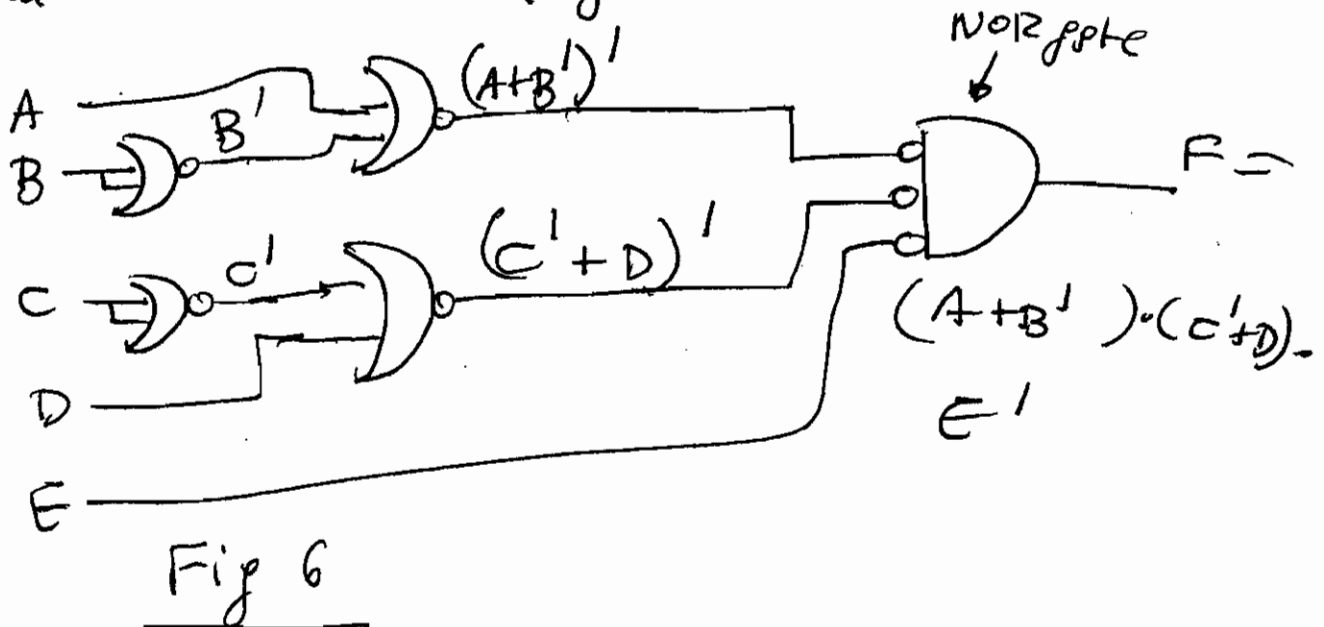
EE 2720, HW #5 sol. cont (4)

Problem 2 cont:

(b) Graphical approach: First provide a logic circuit showing an OR-AND realization of F . This is shown below



From the above Fig. 5 we get



EE 2720, HW # 5 sol. cont. (5)

Problem 3:

(a) Proof of (5) or proof of $X \oplus 0 = X$

- Case $X=0$: $0 \oplus 0 = 0$
- Case $X=1$: $1 \oplus 0 = 1$

(b) Proof of (6) or proof of $X \oplus 1 = X'$

- Case $X=0$: $0 \oplus 1 = 1$
- Case $X=1$: $1 \oplus 1 = 0$

(c) Proof of (7) or proof of $X \oplus X = 0$

- Case $X=0$: $0 \oplus 0 = 0$
- Case $X=1$: $1 \oplus 1 = 0$

(d) Proof of (8) or proof of $X \oplus X' = 1$

- Case $X=0$: $0 \oplus 1 = 1$
- Case $X=1$: $1 \oplus 0 = 1$

Note: The above eqs. (5) - (8) can also be proved algebraically. How?

(e) Proof of (11) or proof of

$$X \cdot (Y \oplus Z) = X \cdot Y \oplus X \cdot Z$$

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Problem 3 cont.:

The right side of (11) is:

$$X \cdot Y \oplus X \cdot Z = X \cdot Y \cdot (X \cdot Z)' + (X \cdot Y)' \cdot X \cdot Z$$

$$= X \cdot Y \cdot (X' + Z') + (X' + Y') \cdot X \cdot Z =$$

$$\cancel{X \cdot Y \cdot X'} + X \cdot Y \cdot Z' + \cancel{X' \cdot X \cdot Z} + Y' \cdot X \cdot Z =$$

$$= X \cdot Y \cdot Z' + X \cdot Y' \cdot Z = X \cdot (Y \cdot Z' + Y' \cdot Z) =$$

$$= X \cdot (Y \oplus Z) = \text{left side of (11)}$$

\Rightarrow proven

Problem 4: This is the last
example (last page) of
handout # 11