EXAMPLE 5.16 YET ANOTHER IMPLEMENTATION USING NORS Let us derive an implementation based on two-input NOR gates for the function $\overline{AB} + C + D$. Assume that both the true and complement version of each of the inputs is available:

$$\overline{AB} + C + D = \overline{AB} + (\overline{C + D}) \quad (5.35)$$

$$= \overline{A + B + C + D + C + D} \quad (5.36)$$

$$= ((\overline{A + B}) + ((C + D) + C + D)). \quad (5.37)$$

Implementing each of the expressions within parentheses using two-input NOR gates, we get the circuit shown in Figure 5.24.

Notice that the algebraic simplification process was quite cumbersome. We can actually perform the same transformation directly on a gate-level circuit with greater ease. Figure 5.25 shows how the original circuit for $\overline{AB} + C + D$ from one of the implementations in Figure 5.18 can be transformed into a two-input NOR implementation. The transformations exploit the fact that two inverters (or circles) in series cancel each other.

FIGURE 5.24 NOR implementation of $\overline{AB} + C + D$.

FIGURE 5.25 NOR transformations for $\overline{AB} + C + D$. 

267b