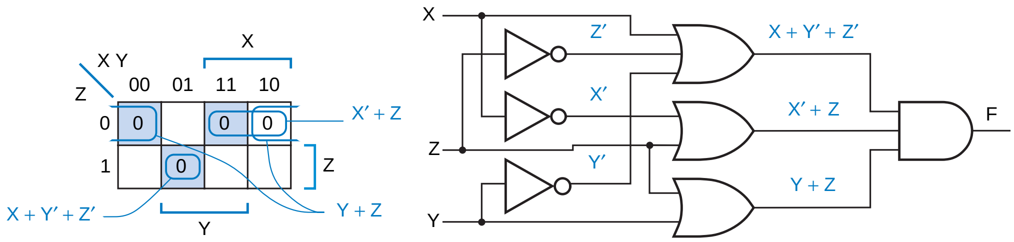
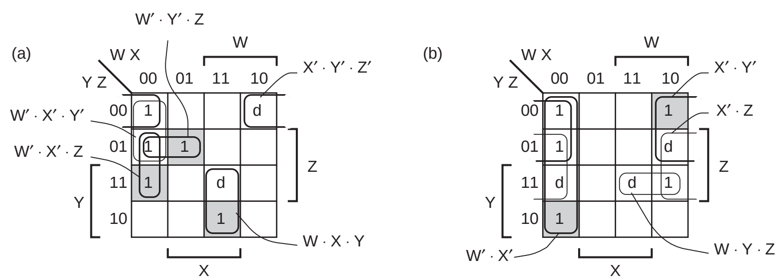
For exclusive use of adopters of the book *Digital Design Principles and Practices*, Fourth Edition, by John F. Wakerly, ISBN 0-13-186389-4.

3e4.15 Min.3(a) Cost is less —one less gate input.



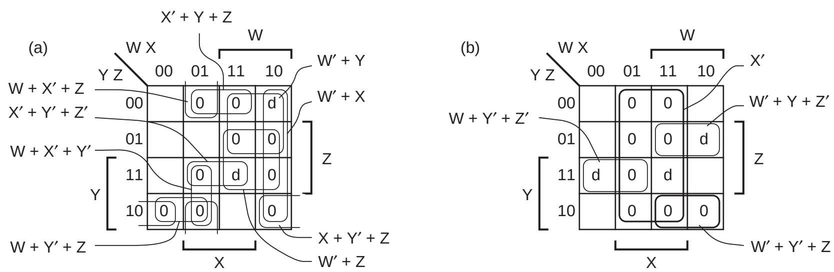
3e4.19 Min.5



F = W′ · Y′ · Z + W′ · X′ · Z + W · X · Y
+ W′ · X′ · Y′ or X′ · Y′ · Z′

F = W′ · X′ + X′ · Y′ + X′ · Z

3e4.20 Min.6



F = (W + X′ + Y′) · (X′ + Y + Z) · (W′ + Z′) · (X + Y′ + Z)

F = X′ · (W′ + Y′ + Z)

3e4.21 Min.7 For the minimal sum-of-products expression to equal the minimal product-of-sums expression, the corresponding maps must have the opposite don't-cares covered, so that the expressions yield the same value for the don't-care input combinations.

(a) Both mininal sum-of-products expressions cover cell 15; they are equal. The minimal product-of-sums expression also covers cell 15, so the expressions are not equal. The s-of-p and p-of-s expressions require the same number of gates, but the p-of-s requires one fewer input.

(b) Both mininal sum-of-products expressions cover cell 3 and 9 and not 15; they are equal. The minimal product-of-sums expression covers cell 15, and not 3 or 9, so the expressions are equal. The p-of-s expression requires fewer gates and inputs.

For exclusive use of adopters of the book *Digital Design Principles and Practices*, Fourth Edition, by John F. Wakerly, ISBN 0-13-186389-4.

3e4.61 Min.17 To make it easier to follow, we'll take the dual, multiply out, and then take the dual again. Also, we'll simplify using theorems T3′ and T6′, otherwise we'll get a nonminimal result for sure. For Figure 4-29:

$$\begin{aligned} F &= X \cdot Z + Y' \cdot Z + X' \cdot Y \cdot Z' \\ F^D &= (X + Z) \cdot (Y' + Z) \cdot (X' + Y + Z') \\ &= X \cdot Y' \cdot Z' + X \cdot Z \cdot Y + Z \cdot Y' \cdot X' + Z \cdot Y' \cdot X' + Z \cdot Z \cdot X' + Z \cdot Z \cdot Y \text{ (T8, T5′, T2′)} \\ &= X \cdot Y' \cdot Z' + X \cdot Y \cdot Z + X' \cdot Y' \cdot Z' + X' \cdot Z + Y \cdot Z \text{ (T3′, T6′)} \\ F &= (X + Y' + Z') \cdot (X + Y + Z) \cdot (X' + Y' + Z) \cdot (X' + Z) \cdot (Y + Z) \text{ (not minimal)} \end{aligned}$$

For Figure 4-30:

$$\begin{aligned} F &= X \cdot Z' + Y' \\ F^D &= (X + Z') \cdot Y' \\ &= X \cdot Y' + Z' \cdot Y' \text{ (T8)} \\ &= X \cdot Y' + Y' \cdot Z' \text{ (T6′)} \\ F &= (X + Y') \cdot (Y' + Z') \text{ (minimal)} \end{aligned}$$