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the logical product of the maxterms (product-of-sums) for which the dependent variable was a 0. Earlier in this section we combined groups of adjacent 1-cells in K-maps to obtain simplified *products* (terms) that were logically *added* together to produce the final simplified logic equation. Similarly we can also combine groups of adjacent 0-cells in K-maps to obtain simplified *sums* (terms) that are logically *multiplied* together to produce the final simplified logic equation. Recall that for minterms, a variable that represented a 0 was barred and a variable that represented a 1 was unbarred, but for maxterms a barred variable represented a 1 and an unbarred variable represented a 0.

To illustrate the procedure for obtaining a simplified product-of-sums equation from a K-map, consider the K-map shown in Figure 3–54. For convenience, the K-map has been redrawn and shown in Figure 3–60 with the two groups of adjacent 0-cells identified. The variables P and R remain constant in the group made up of cell nos. 4 and 6, and since their values are 1 and 0, respectively, the term that corresponds to this group is

$$(\bar{P} + R)$$

Notice that since we are combining 0's, the term is a *sum* rather than a product with variables that have values of 0 left unbarred and variables that have values of 1 barred. Similarly, for the group made up of cell nos. 0 and 4, the variables Q and R remain constant with values of 0, and therefore this group yields the term

$$(Q + R)$$

The simplified logic equation for the K-map in Figure 3–60 is obtained by taking the product of the simplified terms (sums)

$$Z = (\bar{P} + R) \cdot (Q + R) \qquad \text{Equation (3–53)}$$

Equation 3–53 and the simplified sum-of-products equation (Equation 3–51) obtained from the K-map in Figure 3–54 are logically equivalent. This can be verified by applying the distributive law to Equation 3–51

$$Z = R + \bar{P}Q$$
$$Z = (R + \bar{P})(R + Q)$$

The following example illustrates various other K-map configurations and their simplified product-of-sums equations.

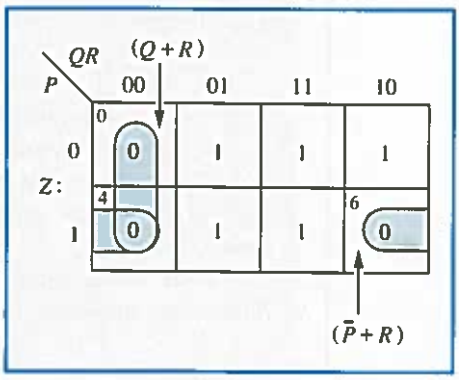

Figure 3–60
Combining 0-cells in a K-map simplification.