

Rosen, Discrete Mathematics and Its Applications, 6th edition  
Extra Examples

Section 11.1—Boolean Functions



— Page references correspond to locations of Extra Examples icons in the textbook.

---

**p.754, icon at Example 10**

#1. Prove the idempotent law  $x = x \cdot x$  using the other identities of Boolean algebra listed in Table 5 of Section 11.1 the textbook.

**Solution:**

$$\begin{aligned}x &= x \cdot 1 && \text{identity law} \\ &= x \cdot (x + \bar{x}) && \text{unit property} \\ &= x \cdot x + x \cdot \bar{x} && \text{distributive law} \\ &= x \cdot x + 0 && \text{zero property} \\ &= x \cdot x. && \text{identity law}\end{aligned}$$

---

**p.754, icon at Example 10**

#2. Prove the domination law  $x \cdot 0 = 0$  using the other identities of Boolean algebra listed in Table 5 in Section 11.1 of the textbook.

**Solution:**

$$\begin{aligned}x \cdot 0 &= x \cdot (x \cdot \bar{x}) && \text{zero property} \\ &= (x \cdot x) \cdot \bar{x} && \text{associative law} \\ &= x \cdot \bar{x} && \text{idempotent law} \\ &= 0. && \text{zero property}\end{aligned}$$

---

**p.754, icon at Example 10**

#3. Using the properties of Boolean algebra, prove that

$$yz + x(\overline{xz}) + y(\bar{z} + 1) + \bar{z}x$$

can be simplified to give  $y + \bar{z}x$ .

**Solution:**

$$\begin{aligned}yz + x(\overline{xz}) + y(\bar{z} + 1) + \bar{z}x &= yz + x(\bar{x} + \bar{z}) + y(\bar{z} + 1) + \bar{z}x && \text{De Morgan's law} \\ &= yz + x\bar{x} + x\bar{z} + y\bar{z} + y + \bar{z}x && \text{distributive law; identity law} \\ &= yz + 0 + x\bar{z} + y\bar{z} + y + \bar{z}x && \text{zero property} \\ &= yz + x\bar{z} + y\bar{z} + y + \bar{z}x && \text{identity law} \\ &= y + yz + y\bar{z} + x\bar{z} + \bar{z}x && \text{commutative law} \\ &= y + y(z + \bar{z}) + x\bar{z} + \bar{z}x && \text{distributive law} \\ &= y + y1 + x\bar{z} + \bar{z}x && \text{unit property} \\ &= y + y + x\bar{z} + \bar{z}x && \text{identity law}\end{aligned}$$

$$\begin{aligned} &= y + x\bar{z} + \bar{z}x \\ &= y + \bar{z}x + \bar{z}x \\ &= y + \bar{z}x. \end{aligned}$$

idempotent law  
commutative law  
idempotent law

---