Solution to 16.1

1. $\text{Premium} = 11.80 \cdot 50 = 590.00$
2. $\text{Premium} = 9.90 \cdot 150 = 1,485.00$
3. $\text{Premium} = 8.50 \cdot 750 = 6,375.00$

Solution to Exercise 16.2

Using the premiums in Table 16.5, 925,000 of insurance would cost Ryan:

$$\text{Premium} = 8.25 \cdot 925 = 7,631.25$$

He would be able to purchase this amount as there is no higher band with a lower premium.

However, let's consider the situation where Ryan wanted to purchase 475,000 of death benefit. In this case, the insurance would cost him:

$$\text{Premium} = 9.00 \cdot 475 = 4,275.00$$

But, he could purchase 500,000 of insurance for a premium of

$$\text{Premium} = 8.25 \cdot 500 = 4,125.00$$

So he would not purchase 475,000 as he could get more (500,000) for a lower premium.

Solution to 16.3

1. $\text{Premium} = 9.80 \cdot 50 + 125 = 615.00$
2. $\text{Premium} = 8.90 \cdot 150 + 125 = 1,460.00$
3. $\text{Premium} = 8.25 \cdot 750 + 125 = 6,312.50$

Solution to Exercise 16.4

Using the premiums in Table 16.6 with a policy fee of 125, Ryan could purchase 925,000 of insurance for $\text{Premium} = 8.00 \cdot 925 + 125 = 7525.00$

Solution to Exercise 16.6

$$Prem_t = \left(9.80 + \frac{125.00}{200}\right)(0.525) = 5.47 \text{ for semi-annual premium mode.}$$

$$Prem_t = \left(9.80 + \frac{125.00}{200}\right)(0.265) = 2.76 \text{ for quarterly premium mode.}$$

$$Prem_t = \left(9.80 + \frac{125.00}{200}\right)(0.090) = 0.94 \text{ for semi-annual premium mode.}$$

Solution to Exercise 16.7

$$Prem_t = \left(10.05 + \frac{0.00}{600}\right)(0.525) = 5.28 \text{ for semi-annual premium mode.}$$

$$Prem_t = \left(10.05 + \frac{0.00}{600}\right)(0.265) = 2.66 \text{ for quarterly premium mode.}$$

$$Prem_t = \left(10.05 + \frac{0.00}{600}\right)(0.090) = 0.90 \text{ for semi-annual premium mode.}$$

Solution to Exercise 16.8

Start with the Book Profit formula from Section 16.4 which was

$$\begin{aligned} BP_t = ({}_{t-1}V + RS_{t-1} + P_{t-1})(1+i) - DB_t \cdot q_t (1+i)^{0.5} - CV_t \cdot w_t - Div_t(1-q_t) \\ - E_t^{BOP}(1+i) - E_t^{MOP}(1+i)^{0.5} - E_t^{EOP} - ({}_tV + RS_t)(1-q_t-w_t) \end{aligned}$$

Now rewrite the book profit formula by adding and subtracting ${}_tV$ in the last line.

$$\begin{aligned} BP_t = ({}_{t-1}V + RS_{t-1} + P_{t-1})(1+i) - DB_t(1+i)^{0.5} \cdot q_t - CV_t \cdot w_t - Div_t(1-q_t) \\ - E_t^{BOP}(1+i) - E_t^{MOP}(1+i)^{0.5} - E_t^{EOP} - ({}_tV + RS_t)(1-q_t-w_t) \\ + {}_tV - \{({}_{t-1}V + {}^{V}P_{t-1})(1+i^G) - q_t^G[DB_t(1+i^G)^{0.5} - {}_tV] - w^G(CV_t - {}_tV)\} \end{aligned}$$

Now rearrange the book profit formula to get

$$\begin{aligned} BP_t = ({}^{V}P_{t-1} + {}_{t-1}V)(i - i^G) \\ + q_t^G(DB_t(1+i^G)^{0.5} - {}_tV) - q_t(DB_t(1+i)^{0.5} - {}_tV) \\ + (P_{t-1} - {}^{V}P_{t-1})(1+i) - E_t^{BOP}(1+i) - E_t^{MOP}(1+i)^{0.5} - E_t^{EOP} \\ + (w_t - w_t^G)({}_tV - CV_t) \\ + RS_{t-1}(1+i) - RS_t(1-q_t-w_t) \\ - Div_t(1-q_t) \end{aligned}$$