Solution to Exercise 18.3

Contract 1

$$V=\sum_{t=1}^{4}5{,}000v^{t}+\sum_{t=5}^{\infty}5{,}000\,{}_{t}p_{70}v^{t}$$
$$=5{,}000a_{\overline{4|}}+5{,}000\,{}_{5|}\ddot{a}_{70}=17,729.75+38,281.20=56,010.95.$$

We can use the information in Example 18.3. Since $a_{\overline{4|}}=\ddot{a}_{\overline{5|}}-1$, from Example 18.3, we know that $\ddot{a}_{\overline{5|}}=4.54595$ and ${}_{5|}\ddot{a}_{70}=7.65624$.

Contract 2

This is an interest only contract so we can calculate the reserves using interest functions.

$$V=\sum_{t=0}^{119}100v^{t}=100\ddot{a}_{\overline{120|}}=9,515.17.$$

Since the payments are made monthly, the interest rate used to calculate the reserve would be the monthly effective interest rate of 0.4074124%.

Contract 3

This is also an interest only contract so we can calculate the reserves using interest functions.

$$V=\sum_{t=0}^{7}2{,}500v^{t+1/2}=2,500\cdot \mathrm{v}^{0.5}\cdot\ddot{a}_{\overline{8|}}=16,557.06.$$

Since the payments are made annually, the interest rate used to calculate the reserve would be 5.0%

Contract 4

$$V=\sum_{t=1}^{\infty}9,000\,{}_{t}p_{80}v^{t}=9,000a_{80}=68,717.25.$$

We can use the information in Example 18.3. Since $a_{80}=\ddot{a}_{80}-1$, from Example 18.3, we know that $a_{80}=7.63525$.

Contract 5

$$V=\sum_{t=1}^{4}1{,}000v^{t}+\sum_{t=5}^{\infty}1{,}000\,{}_{t}p_{70}v^{t}$$
$$=1{,}000a_{\overline{4|}}+1{,}000\,{}_{5|}\ddot{a}_{70}=3,545.95+7,656.24=11,202.19.$$

We can use the information in Example 18.3. Since $a_{\overline{4|}}=\ddot{a}_{\overline{5|}}-1$, from Example 18.3, we know that $\ddot{a}_{\overline{5|}}=4.54595$ and ${}_{5|}\ddot{a}_{70}=7.65624$.

Solution to Exercise 18.6

$$AAI = \frac{200+450+750+7(1000)}{10} = 840$$

Solution to Exercise 18.13

The commuted value is the present value of the certain payments. Since there are 120 certain payments and 36 payments have been paid, there are 84 remaining payments. These payments are not life contingent so the present value is calculated at interest only. The interest rate is the monthly effective rate which is $(1.0625)^{\frac{1}{12}} - 1 = 0.005064835.$

The commuted value is $1000\ddot{a}_{\overline{84|}} = 68,624.40$.

