Exercise 7.2

First we calculate the premium. Let P be the required annual benefit premium and based on the equivalence principle, we have

$$P = \frac{50000 \times A_{40} + 50000 \times {}_{20}E_{40}\, A_{60}}{\ddot{a}_{40:\overline{20}|}} = 50000 \times \frac{A_{40} + {}_{20}E_{40}\, A_{60}}{\ddot{a}_{40} - {}_{20}E_{40}\, \ddot{a}_{60}}$$

where from the SUSM tables in the book, we get

$$\ddot{a}_{40} = 18.458, \quad \ddot{a}_{60} = 14.904 \quad A_{40} = 0.12106, \quad A_{60} = 0.29028 \quad \text{and} \quad {}_{20}E_{40} = 0.36663$$

Thus, it follows that

$$P = 50000 \times \frac{0.12106 + (0.36663)(0.29028)}{18.458 - (0.36663)(14.904)} = 50000 \times \frac{0.2274854}{12.99375} = 875.3648.$$

The net premium reserve at the end of 10 years is

$$\begin{aligned}
{}_{10}V &= \text{APV}(\text{FB}_{10}) - \text{APV}(\text{FP}_{10}) \\
&= 50000 \times (A_{50} + {}_{10}E_{50}\, A_{60}) - P \times (\ddot{a}_{50} - {}_{10}E_{50}\, \ddot{a}_{60}) \\
&= 50000 \times (0.18931 + (0.60182)(0.29028)) - 875.3648 \times (17.025 - (0.60182)(14.904)) \\
&= 18200.32 - 7051.479 = 11,148.84
\end{aligned}$$