Exercise 6.2

(a) Let $P$ be the net single premium. The loss-at-issue random variable can be written as

$$L_0 = PVF_B_0 - PVF_P_0 = 1000000v^{K+1}I(K < 5) - P$$

(b) Solving for $P$, we get

$$P = 1000000 \times \bar{A}_{[40]:5}$$

$$= 1000000 \times \frac{i}{\delta} (A_{[40]} - 5E_{[40]}A_{45})$$

$$= 1000000 \times \frac{0.05}{\log(1.05)}[0.12097 - 0.78121(0.15161)] = 2593.506$$

(c) The event $L_0 < 0$ is equivalent to the event

$$1000000v^{K+1}I(K < 5) - P < 0.$$ 

When $K = 4$, we can verify that $L_0 = 780932.7$ so that $K > 5$. Therefore, we have

$$\Pr[L_0 < 0] = \Pr[K > 5] = \frac{\ell_{45}}{\ell_{[40]}} = \frac{99033.94}{99327.82} = 0.9970413.$$

The contract makes a profit only if the person select age 40 will survive another 5 years, or will never die during the term of the policy.