1. A whole life insurance policy on (20) pays a death benefit of 100,000 at the end of the year of death. Net annual benefit premiums are payable for life.

You are given that mortality follows the Illustrative Life Table with interest at 6%.

Calculate $40.7 V^1$ for this policy.

Solution:

$$PVP = PVB$$

$$P\bar{a}_{20} = (100,000)A_{20} \implies P = \frac{(100,000)(0.06528)}{16.5133} = 395.32$$

$$40 V = (100,000) \left[ 1 - \frac{\bar{d}_{60}}{\bar{d}_{20}} \right] = (100,000) \left[ 1 - \frac{11.1454}{16.5133} \right] = 32,506.53$$

$$40 V = (100,000) \left[ 1 - \frac{\bar{d}_{61}}{\bar{d}_{20}} \right] = (100,000) \left[ 1 - \frac{10.9041}{16.5133} \right] = 33,967.77$$

$$40.7 V = (1 - 0.3)(32,506.53 + 395.32) + (0.7)(33,967.77) = 33,647.99$$
2. A whole life insurance policy to (50) pays a death benefit of 250,000 at the end of the year of
death. The policy has a gross premium of 5500 payable for life.

You are given:

a. Mortality follows the Illustrative Life Table.

b. \( i = 6\% \)

c. Commissions are 40% the first year and 7% thereafter.

d. Issue expenses are 1000 at the time the policy issued.

e. Maintenance expenses are 42 at the beginning of every year including the first year.

f. A termination expense of 600 will be incurred at the end of the year of death.

Calculate the Asset Share at the end of the second year.

Solution:

\[
\begin{align*}
AS_0 &= 0 \\
(AS_0 + P(1 - e_0) - X_{0}^{BOY})(1 + i) &= (S_1 + E_1)q_{50} + AS_1 \cdot p_{50} \\
(0 + 5500(1 - 0.4) - 1000 - 42)(1.06) &= (250,000 + 600)(0.00592) + AS_1(1 - 0.00592) \\
\end{align*}
\]

\[
\begin{align*}
AS_1 &= \frac{(0 + 5500(1 - 0.4) - 1000 - 42)(1.06) - (250,000 + 600)(0.00592)}{1 - 0.00592} = 915.3468534 \\
\end{align*}
\]

\[
\begin{align*}
AS_2 &= \frac{(AS_1 + P(1 - e_1) - X_{1}^{BOY})(1 + i) - (S_2 + E_2)q_{51}}{1 - q_{51}} \\
&= \frac{(915.3468534 + 5500(1 - 0.07) - 42)(1.06) - (250,000 + 600)(0.00642)}{1 - 0.00642} = 4769.42
\end{align*}
\]
1. A whole life insurance policy on (20) pays a death benefit of 100,000 at the end of the year of death. Net annual benefit premiums are payable for life.

You are given that mortality follows the Illustrative Life Table with interest at 6%.

Calculate \(30.4 V^n\) for this policy.

**Solution:**

\[PVP = PVB\]

\[P\ddot{a}_{20} = (100,000)A_{20} \implies P = \frac{(100,000)(0.06528)}{16.5133} = 395.32\]

\[40 V = (100,000)\left[1 - \frac{\ddot{a}_{30}}{\ddot{a}_{20}}\right] = (100,000)\left[1 - \frac{13.2668}{16.5133}\right] = 19,659.91\]

\[40 V = (100,000)\left[1 - \frac{\ddot{a}_{31}}{\ddot{a}_{20}}\right] = (100,000)\left[1 - \frac{13.0803}{16.5133}\right] = 20,789.30\]

\[40.4 V = (1 - 0.4)(19,659.91 + 395.32) + (0.4)(20,789.30) = 20,348.86\]
2. A whole life insurance policy to (70) pays a death benefit of 250,000 at the end of the year of death for the first five years of the policy. Thereafter, the death benefit varies each year.

The policy has a gross premium of 17,200 payable for life. The premium was determined such that $E[L_0^e] = -200$.

You are given:

- g. Mortality follows the Illustrative Life Table.
- h. $i = 6\%$
- i. Commissions are 40% the first year and 7% thereafter.
- j. Issue expenses are 1000 at the time the policy issued.
- k. Maintenance expenses are 42 at the beginning of every year including the first year.
- l. A termination expense of 600 will be incurred at the end of the year of death.

Calculate the gross premium reserve at the end of two years.

**Solution:**

\[
0 V^g + P(1 - e_0) - X_0^{boy} (1 + i) = (S_1 + E_i) q_{70} + i V^g \cdot p_{70}
\]

\[
-200 + (17,200)(1 - 0.4) -1000 - 42)(1.06) = (250,000 + 600)(0.03318) + j V^g (1 - 0.03318)
\]

\[
j V^g = \frac{-200 + (17,200)(1 - 0.4) - 1000 - 42)(1.06) - (250,000 + 600)(0.03318)}{(1 - 0.03318)} = 1352.65
\]

\[
2 V^g = \frac{1352.65 + (17,200)(1 - 0.07) - 42)(1.06) - (250,000 + 600)(0.03626)}{(1 - 0.03625)} = 9606.63
\]