Each problem is worth 10 points. Show all work for full credit, and use correct notation. Simplify answers completely. See other side for additional problems.

1. Using ILT actuarial assumptions, determine \(1000P_{50:10|}^{1}\)

\[
1000P_{50:10|}^{1} = \frac{1000A_{50:10|}^{1}}{\ddot{a}_{50:10}} = \frac{1000 \cdot E_{50}}{\ddot{a}_{50} - \ddot{10}E_{50} \cdot \ddot{a}_{10}} \quad \text{ILT} \quad 67.445 \ldots
\]

2. Using ILT actuarial assumptions, use the equivalence principle to determine the level annual premium for an insurance that pays 25000 at the end of the year of the last death of independent lives, ages 40 and 50, with premiums paid at the beginning of each year that both are alive.

\[\Pi \cdot \ddot{a}_{40:50} = 25000 A_{40:50} = 25000 \cdot (A_{40} + A_{50} - A_{40:50})\]

\[\Rightarrow \Pi = 233,783 \ldots\]

3. Using ILT actuarial assumptions and the UDD assumption throughout, use the equivalence principle to determine the level monthly premium for a whole life insurance issued to (30) that pays 100,000 at the moment of death.

\[12 \Pi \cdot \ddot{a}_{30}^{(12)} = 100000 A_{30}\]

\[\text{UDD} \quad \Pi = \frac{100000 \cdot \ddot{12}A_{30}}{12 \cdot (\alpha(12) \cdot \ddot{a}_{30} - \beta(12))} \quad \text{ILT} \quad 57,130 \ldots\]
4. A 20-year deferred whole life insurance of 50000 issued to (x) with benefit paid at the end of the year of death, and premiums paid at the beginning of each year during the deferred period, has a premium refund feature that returns premiums without interest if death occurs during the deferred period. You are given:

(i) \( z_{0|A_x} = 0.108 \)

(ii) \( (IA)_{x:20|} = 1.85 \)

(iii) \( \ddot{a}_{x:20|} = 11.36 \)

Determine the annual premium using the equivalence principle.

\[
EP \Rightarrow \Pi \cdot \ddot{a}_{x:20|} = \Pi \cdot (IA)_{x:20|} + 50000 \cdot z_{20|A_x}
\]

\[
\Rightarrow \Pi = \frac{50000 \cdot z_{20|A_x}}{\ddot{a}_{x:20|} - (IA)_{x:20|}} = 567.823\ldots
\]

5. For a fully discrete 15-year endowment insurance of 100,000 on (x), you are given:

(i) \( \ddot{a}_{x:15|} = 10 \)

(ii) \( d = 0.04 \)

(iii) Expenses are incurred at the beginning of the year.

(iv) Percent of premium expenses are 10% in the first year and 2% thereafter.

(vi) A settlement expense of 1000 occurs when the benefit is paid.

Determine the gross annual premium using the equivalence principle.

\[
EP \Rightarrow \Pi \cdot \ddot{a}_{x:15|} = 101000 \cdot A_{x:15|} + 0.08\Pi + 0.02\Pi \ddot{a}_{x:15|}
\]

\[
\Rightarrow \Pi = \frac{101000 \cdot A_{x:15|}}{0.98 \ddot{a}_{x:15|} - 0.08} = \frac{101000 (1-d \ddot{a}_{x:15|})}{0.98 \ddot{a}_{x:15|} - 0.08} = 6234.567\ldots
\]