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.

Use ILT actuarial assumptions to determine the APV of the insurance product given.

1. a 1-year discrete endowment insurance of 100,000 issued to (50)

\[
\begin{align*}
\text{APV} &= 100000 \cdot v = \frac{100000}{1.00} = 94,340
\end{align*}
\]

2. a 3-year term discrete insurance issued to (40), with a benefit of 1000 if death occurs in the first year, 2000 if death occurs in the second year, and 3000 if death occurs in the third year.

\[
\begin{align*}
\text{APV} &= 1000 \cdot (IA)_{40}^{31} \cdot VEP \cdot \left(1000 \cdot 2 \cdot 11 \cdot 2 + 2000 \cdot 2^2 \cdot 21 \cdot 2 + 3000 \cdot 2^3 \cdot 21 \cdot 2 \right) \\
&= \frac{1}{2} \cdot 11 \cdot 2 \cdot 21 \cdot 2 \cdot 2 \cdot 21 \cdot 2 \cdot 21 \cdot 2 \cdot 21 \cdot 2 \cdot 21 \cdot 2 \cdot 21 \cdot 2 \cdot 21 \cdot 2 \cdot 21 \cdot 2 \cdot 21 \cdot 2 \cdot 21 \cdot 2 \cdot 21 \cdot 2 \cdot 21 \cdot 2 \cdot 21 \cdot 2 \cdot 21 \cdot 2 \cdot 21 \cdot 2
\end{align*}
\]

\[
\begin{align*}
\therefore \text{APV} &= 15,926 \ldots
\end{align*}
\]

3. a whole-life discrete insurance of 100 issued on the last-survivor status on independent lives, both age 35; i.e. the benefit is payable at the end of the year of the second death.

\[
\begin{align*}
\text{APV} &= 100 \cdot A_{35:35} \\
&= 100 \left( 2 \cdot A_{35} - A_{35:35} \right) \\
\therefore \text{APV} &= 7.05
\end{align*}
\]
4. a 10-year deferred, 20-year term insurance issued to (25), with a benefit of 1000 paid at the end of the year of death if (25) dies between ages 35 and 55.

\[
\text{APV} = 1000 \cdot A_{35.25}^{t-1} = 1000 \cdot (A_{35} - a_0 \cdot E_{35} \cdot A_{55})
\]

\[
\text{APV} = 10 \cdot E_{25} \cdot \text{APV}_35 = 10 \cdot E_{25} \cdot 1000 \cdot (A_{35} - a_0 \cdot E_{35} \cdot A_{55})
\]

\[
\text{APV} \quad \text{ILT} \quad 22.796 \ldots
\]

Alternative Solution (among many)

\[
\text{APV} = 1000 \cdot A_{25.30}^{t-1} - 1000 A_{25.30}^{t-1}
\]

5. a discrete 10-year endowment insurance of 500 issued on the joint-life status on independent lives, ages 30 and 40.

\[
\text{APV} = 500 \cdot A_{30.40;15}^{t-1} = 500 \cdot (A_{30}^{t-1} + a_0 \cdot E_{30}^{t=1})
\]

\[
A_{30.40;15}^{t-1} = A_{30.40}^{t-1} - a_0 \cdot E_{30}^{t=1} \cdot A_{40.50}^{t-1}
\]

\[
10 \cdot E_{30.40}^{t=1} = (1+i)^{10} \cdot a_0 \cdot E_{30}^{t=40} \cdot E_{40}^{t=30} \quad \text{ILT} \quad 526 \ldots \quad \text{(many other correct ways)}
\]

\[
\text{APV} \quad \text{ILT} \quad 284
\]