EXAM MLC QUESTIONS OF THE WEEK

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Week of August 6/07

A fully discrete whole life insurance is issued to (35) with face amount 100,000.
Mortality is based on the Exam MLC Illustrative Life Table (available at the SOA website)
with an annual effective interest rate of 6%. The annual contract premium is 20% larger than the
annual benefit premium. Assuming that the policy is still in force at the end of 10 years, find the
probability that the 10-th year terminal prospective loss $_{10}L$ is positive.

A) Less than .45   B) At least .045 but less than .46   C) At least .46 but less than .47
D) At least .47 but less than .48   E) At least .48

The solution can be found below.

Week of August 6/07 - Solution

The benefit premium is $100,000 P_{35} = 1000 \cdot \frac{A_{35}}{\ddot{a}_{35}} = 836.25$, and the contract premium is $1.2(836.25) = 1003.50$.

$_{10}L = 100,000 v^{K+1} - 1003.5 \ddot{a}_{\overline{K+1}|.06}$, where K is the curtate future lifetime of (45) .

We first solve for K to make $_{10}L = 0$:

$100,000 v^{K+1} - 1003.5 \ddot{a}_{\overline{K+1}|.06} = 0 \rightarrow \frac{100,000}{1003.50} = \ddot{s}_{\overline{K+1}|.06} = \frac{(1.06)^{K+1} - 1}{.06/1.06}$.

Solving for $K+1$ results in $K+1 = 32.49$. Alternatively, we can use the unknown time function on a calculator to solve for $K+1$.

If (45) survives 32 complete years and dies between ages 78 and 79, then

$_{10}L = 100,000 v^{33} - 1003.50 \ddot{a}_{\overline{33}|.06} = -518 < 0$,

but if (45) survives 31 complete years and dies between ages 77 and 78, then

$_{10}L = 100,000 v^{32} - 1003.50 \ddot{a}_{\overline{32}|.06} = 514 > 0$.

The conditional probability that $_{10}L$ is positive given that the policy is still in force at age 45 is the probability that (45) survives at most 31 complete years, or equivalently, dies within 32 years. This probability is $_{32}q_{45} = 1 - \frac{\ell_{77}}{\ell_{45}} = 1 - \frac{4,828,182}{9,164,051} = .473$.