EXAM MLC QUESTIONS OF THE WEEK

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Week of February 4/08

Which of the following relationships are correct?

I. $A_{\overline{x:\overline{n}|}} = 1 - d \cdot \ddot{a}_{\overline{x:\overline{n}|}}$ ($A_{\overline{x:\overline{n}|}}$ is the single benefit premium for a payment on the later of the end of year of (x)'s death and n years, and $\ddot{a}_{\overline{x:\overline{n}|}}$ is an annuity due which continues for at least n years or as long as (x) survives, whichever is later).

II. ${}_{n|}A_x = 1 - d \cdot {}_{n|}\ddot{a}_x$

III. $(IA)_x = \ddot{a}_x - d \cdot (I\ddot{a}_x)$

The solution can be found below.

Week of February 4/08 - Solution

I. Correct.

$$A_{\overline{x:\overline{n}|}} = A_x + v^n - A_{x:\overline{n}|} = 1 - d \cdot \ddot{a}_x + (1 - d \cdot \ddot{a}_{\overline{n}|}) - (1 - d \cdot \ddot{a}_{x:\overline{n}|})$$
$$= 1 - d \cdot (\ddot{a}_x + \ddot{a}_{\overline{n}|} - \ddot{a}_{x:\overline{n}|}) = 1 - d \cdot \ddot{a}_{\overline{x:\overline{n}|}}$$

II. Incorrect.

$${}_{n|}A_x = A_x - A_{\frac{1}{x:\overline{n}|}} = A_x - (A_{x:\overline{n}|} - A_{\frac{1}{x:\overline{n}|}})$$
$$= (1 - d \cdot \ddot{a}_x) - (1 - d \cdot \ddot{a}_{x:\overline{n}|}) + A_{\frac{1}{x:\overline{n}|}} = A_{\frac{1}{x:\overline{n}|}} - d \cdot (\ddot{a}_x - \ddot{a}_{x:\overline{n}|})$$
$$= A_{\frac{1}{x:\overline{n}|}} - d \cdot {}_{n|}\ddot{a}_x \neq 1 - d \cdot {}_{n|}\ddot{a}_x \text{ (unless } A_{\frac{1}{x:\overline{n}|}} = v^n {}_np_x = 1\text{).}$$

III. Correct.

$$(IA)_x = A_x + {}_{1|}A_x + {}_{2|}A_x + \cdots = \sum_{k=0}^{\infty} {}_{k|}A_x = \sum_{k=0}^{\infty} v^k {}_kp_x \cdot A_{x+k}$$
$$= \sum_{k=0}^{\infty} v^k {}_kp_x \cdot (1 - d \cdot \ddot{a}_{x+k}) = \sum_{k=0}^{\infty} v^k {}_kp_x - d \cdot \sum_{k=0}^{\infty} v^k {}_kp_x \cdot \ddot{a}_{x+k}$$
$$= \ddot{a}_x - d \cdot \sum_{k=0}^{\infty} {}_{k|}\ddot{a}_x = \ddot{a}_x - d \cdot (\ddot{a}_x + {}_{1|}\ddot{a}_x + {}_{2|}\ddot{a}_x + \cdots) = \ddot{a}_x - d \cdot (I\ddot{a}_x)$$