Actuarial Mathematics II
MTH5125

Useful formulae

Dr. Melania Nica

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Whole life insurance benefit:

$$A_x = E\left(v^{K_x+1}\right) = \sum_{k=0}^{\infty} v^{k+1} \ {}_{k|}q_x$$

Pure endowment: ${}_nE_x = v^n \ {}_np_x = v^n \ \frac{l_{x+n}}{l_x}$

Term insurance: $A^1_{x:\overline{n}|} = A_x - \ {}_nE_x A_{x+n}$

Endowment insurance$A_{x:\overline{n}|} = A^1_{x:\overline{n}|} + \ {}_nE_x$

Endowment insurance: $A_{x:\overline{n}|} = A_x -_n E_x A_{x+n} +_n E_x$

Endowment insurance (continuos case: benefit paid immediately on death:

$$\bar{A}_{x:\overline{n}|} = \frac{i}{\delta}\left(A_x -_n E_x A_{x+n}\right) +_n E_x$$

Life annuity due:

$$\ddot{a}_x = \sum_{k=0}^{\infty} v^k \ {}_k p_x = \sum_{k=0}^{\infty} \ddot{a}_{\overline{k+1}|} \ {}_{k|}q_x$$

Term annuity (due/in arrears):

$$\ddot{a}_{x:\overline{n}|} = \ddot{a}_x - \ v^n \ {}_n p_x \ddot{a}_{x+n}$$

$$a_{x:\overline{n}|} = a_x - \ v^n \ {}_n p_x a_{x+n}$$

$$a_x = \ddot{a}_x - 1$$

$$
\begin{aligned}
A_x &= 1 - d\ddot{a}_x \text{ and } \bar{A}_x = 1 - \delta\ddot{a}_x \\
A_{x:\overline{n}|} &= 1 - d\ddot{a}_{x:\overline{n}|} \\
\bar{A}_{x:\overline{n}|} &= 1 - \delta\ddot{a}_{x:\overline{n}|}
\end{aligned}
$$

$$
\ddot{a}_{x:\overline{n}|} = \frac{1 - A_{x:\overline{n}|}}{d}
$$