Chapters 5 – Past Test and Quiz Problems

Whole Life and Temporary Life Annuities Payable Continuously or every 1/m

(4 points) Calculate the annual rate of payment for a 20-year temporary life annuity continuous sold to (70) for 305,164.94. Mortality follows the Standard Ultimate Life Table, interest is 5%, and deaths are uniformly distributed between integral ages.

Solution:

$$305{,}164.94 = P\bar{a}_{70:\overline{20}|}$$

$$305{,}164.94 = P\left(\frac{1-\left[\left(\frac{i}{\delta}\right)(A_{70:\overline{20}|} - {}_{20}E_{70}) + {}_{20}E_{70}\right]}{\delta}\right)$$

$$= P\left(\frac{1-\left[(1.0248)(0.47091-0.17313)+0.17313\right]}{0.04879}\right)$$

$$305{,}164.94 = P(10.69286854)$$
$$P = 28{,}539.11$$

*Try calculating variance.

(5 points) Jeff is (72). He has 800,000 and wants to buy a 12-year temporary life annuity due with monthly payments to fund his retirement.

Assume that mortality follows the Standard Ultimate Life Table with interest equal to 5%. Further, assume that deaths are uniformly distributed between integral ages.

Calculate the monthly payment.

Solution:

$$800,000 = 12P\ddot{a}^{(12)}_{72:\overline{12|}} \implies P = \frac{800,000}{12\ddot{a}^{(12)}_{72:\overline{12|}}}$$

$$\text{where } \ddot{a}^{(12)}_{72:\overline{12|}} = \frac{1-A^{(12)}_{72:\overline{12|}}}{d^{(12)}} = \frac{1-\left[\left(\frac{i}{i^{(m)}}\right)\left(A_{72}-\left({}_{12}E_{72}\right)A_{84}\right)+{}_{12}E_{72}\right]}{0.04869}$$

$$\text{and } {}_{12}E_{72} = (1.05)^{-12}\left(\frac{64,506.5}{89,082.1}\right) = 0.403219422$$

$$\ddot{a}^{(12)}_{72:\overline{12|}} = \frac{1-A^{(12)}_{72:\overline{12|}}}{d^{(12)}} = \frac{1-\left[(1.02271)\left(0.45968-\left({}_{12}E_{72}\right)0.6599\right)+{}_{12}E_{72}\right]}{0.04869} = 8.190357788$$

$$P = \frac{800,000}{12(8.190357788)} = 8,139.65$$