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SAC 305: ACTUARIAL LIFE CONTINGENCIES 1

Question 1 (30 marks)

(a). Define the following terms:

(i). Prospective net reserves

(ii). Retrospective net reserves

When are the two above reserves equal? (6 marks)

(b). A parent wishes to purchase a single premium an annuity for his child now aged 10 years. The annuity payments will begin at the child's 21st birthday and continue so long as the child lives. Assume the child experiences the A1967 select mortality and that each payment if Ksh.100,000 per annum. Determine the single premium to be paid by the parent. (4 marks)

(c). Show that

$A_x = q_x V + P_x V A_{x+1}$ (8 marks)

(d). Given that $a_{\overline{30:9|}}$ = 5.6 and ${}_{10}^{10}V P_{30}$ = 0.35 Calculate (6 marks)

$1000 \times P_{\overset{1}{30:\overline{10|}}}$

(e). Define the following actuarial functions:

(i). $r|(\overline{IA})_{x:\overline{n|}}$

(ii). $r|(I\ddot{a})_{[x]:\overline{n|}}$ (6 marks)

Question 2 (20 Marks)

(a). Show that

(i). $\bar{A}_x = 1 - \delta\bar{a}_x$

(ii). $\ddot{a}_{X:\overline{n|}}$ = 1 + $a_{x:\overline{n-1|}}$

(iii). $A_{X:\overline{n|}}$ = $A^{1}_{X:\overline{n|}}$ + $A_{\frac{1}{\overline{n|}}}$ (9 marks)

(b). Let the force of mortality and interest rate be μ and δ respectively. (11 marks)

(i). Determine Var (v^T) in terms of μ and δ where T is the future life-time of

say (x) and V is the annual constant discounting factor.

(ii). If E(v^{2T}) = ¼ , Calculate E(v^T). (11 marks)

Question 3 (20 marks)

(a). Write the following terms of the appropriate commutation functions.

(i). $P_{[x]}$

(ii). $P_{[x]:\overline{n|}}$ (6 marks)

(b). Consider a whole life assurance of (x) and suppose that premiums are payable continuously at rate P per annum until death, show that

P = $\frac{1}{\bar{a}_x}$ - δ

where δ is the constant force of interest. (6 marks)

(c). Given that $\delta = 0.055$, μ_{x+t} = 0.045, t ≥ 0 and $\bar{A}^{1}_{X:\overline{n|}}$ = 0.4275

Calculate 1000*$\bar{P}(\bar{A}_{X:\overline{n|}})$ (8 marks

Question Four (20 marks)

(a). (i). Define ${}_{10}\bar{P}(\bar{A}_{X:\overline{n}|})$, $10 \leq n$

(ii). Express ${}_{10}\bar{P}(\bar{A}_{X:\overline{n}|})$ in terms of force of interest δ and some annuity functions. (6 marks)

(b). Show that

(i). ${}_tV_{X:\overline{n}|} = 1 - \frac{\ddot{a}_{x+t:\overline{n-t}|}}{\ddot{a}_{x:\overline{n}|}}$

(ii). If the gross reserve at time t, ${}_tV^z$ for a policy where for sum assured of amount 1, the renewal expenses is e (including the first premium and initial expense is I, ${}_tV^z = (I + 1){}_tV_{x:\overline{n}|} - I$ (14 marks)

Question 5 (20 marks)

A 4 year car loan issued to 25 is t_o be paid with equal annual payments at the end of each year. A 4 year term insurance has a death benefit which will pay off the loan at the end of year of death, including the payment then due. Given: i = 0.06 for both the actuarial calculations and the loan;

$\ddot{a}_{25:\overline{4}|} = 3.667$ and ${}_4q_{25} = 0.005$ (4 marks)

(a). Express the insurer's loss random variable in terms of k, the curtate future lifetime (25), for a loan of 1000 assuming that the insurance for a loan is purchased with a single premium of amount G. (5 marks)

(b). Calculate G, the net single premium rate per 1000 of loan value for this insurance. (5 marks)

(c). The car loan is 10,000. The buyer borrows an additional amount to pay for the term assurance. Calculate the total annual payment for the loan.

(6 marks)