Total No. of Pages: 2

7593

Register Number:

Name of the Candidate:

P.G.DIPLOMA EXAMINATION, May 2015

(ACTURIAL STATISTICS)

130: ADVANCED TOPICS IN ACTUARIAL STATISTICS

Time: Three hours Maximum : 100 marks

SECTION – A

Answer any FIVE Questions (5 × 8 = 40)

1. Explain the three principles generally used for premium calculations.
2. Derive a relation between ${}_hP^{(m)}_{x\overline{n}|}$ and ${}_hP_{x\overline{n}|}$
3. Discuss the reserve for a semi-continuous policy.
4. Determine an expression in actuarial present values and benefit premiums for the $Var[{}_kL \mid K(x)\geq]$ for a fully discrete n-year endowment insurance with a unit benefit.
5. If $b_{h+1}={}_{h+1}V$, ${}_0V=0$, $\pi_k=\pi$, *for* $h=0,1....k-1$, prove that ${}_kV=\pi_{SK}$
6. Develop a retrospective formula for the benefit reserve for the general fully continuous insurance.
7. Suppose each life follows Makeham's mortality law with the force of mortality $\mu_x(s)=A+BC^{x+n}$ and $\mu_y(s)=A+BC^{y+n}$. Show that there exist a ω such that $({}_1P_w)^2={}_1P_{xy}$
8. Define lexis diagram. Explain its features.

SECTION – B

Answer ALL Questions (5 × 12 = 60)

9. a) Prove that the variance of loss associated with a single premium whole life insurance is less that the variance of the loss associated with an annual premium whole life insurance. Assume immediate payment of claims on death and continuous payment of benefit premiums.

(OR)

b) i) Show that ${}_{20}P^1_{x3\overline{0}|}-P^1_{x2\overline{0}|}={}_{20}P({}_{20|}A^1_{x1\overline{0}|})$

ii) If ${}_{15}P_{45}=0.038, P_{45:1\overline{5}|}=0.056$ and $A_{60}=0.625$, calculate $P^1_{45:1\overline{5}|}$

10. a) For a fully continuous whole life insurance of 1000 issued to (25) with premiums payable as whole life annuity, it is given that δ=0.05 and mortality follows Gompertz's law with B=0.0001151 and C=1.096. Calculate prospective reserve for t=5,10 and 15.

(OR)

b) ${}_kL$ is the prospective loss random variable for a fully discrete whole life insurance 1000 issued to *(x)*. It is given that A_x =0.125, A_{x+k}=0.4, ${}^2A_{x+k}$ =0.02, δ=0.05. Assume that premiums are calculated on the basis of the equivalence principle. Calculate $E({}_kL)$, $Var({}_kL)$ and the aggregate reserve at time k for 100 policies of this type.

11. a) Obtain the recurrence relations for fully discrete benefit reserves.

(OR)

b) The annual benefit premiums for a fully discrete whole life insurance with a unit benefit issued to (x) are $\pi_j = \pi\omega_j$, where $\omega_j = (1+r)^1$. The rate r might be selected to estimate the expected growth rate in the insured's income. Obtain the expressions for (i) π (ii) ${}_hV$ and (iii) ${}_hV$ when r=i.

12. a) It is given that ${}_tP_x = 1-t^2q_x$, $0\le t\le 1$, ${}_tP_y = 1-t^2q_y$, q_x=0.08, q_y=0.004 and T(x) and T(y) are independent. Derive an expression for ${}_tP_{xy}\mu_{xy}(t)$ in terms of t

(OR)

b) Assuming Gompertz's law for the forces of mortality calculate (i) the actuarial present value for an n-year term contingent insurance paying a unit amount at the moment of death of (x) only if (x) dies before (y) and (ii) the probability that (x) dies within n years and predeceases(y).

13. a) Assume a stationary population with survival function s(x) and that this same survival function is used in the evaluation of actuarial functions. Verify and interpret the equation, $l_r\bar{a}_r + \delta\int_r^\infty l_x\bar{a}_x dx = T_r$

(OR)

b) Give the net maternity function, $\phi(x)=x^{\alpha-1}e^{-\beta x}$, $\alpha>0, \beta>0$, (i) compute R(ii) is the population stable or stationary if α=2 and β=1.

$$$$$$$