JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF MATHEMATICAL & ACTUARIAL SCIENCE

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (ACTUARIAL) WITH IT

2ND YEAR 1ST   SEMESTER 2013/2014 ACADEMIC YEAR

CENTRE: MAIN

COURSE CODE: SAC 203

COURSE TITLE: FUNDAMENTALS OF ACTURIAL MATHEMATICS II

EXAM VENUE: LR 3   STREAM: (BSc. Actuarial)

DATE: 23/12/2013   EXAM SESSION: 9.00 – 11.00 AM

TIME: 2 HOURS
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QUESTION ONE [30 MARKS]

1a). At a certain company, the probability of each employee leaving during any given year is 5 %, independent of other employees. Those who remain with the company for 25 years are given kshs.10 million, What is the expected present value of this payment to a new starter assuming an interest rate of 7% and ignoring the possibility of death [3 marks]

b).Calculate the standard deviation of the present value [2 marks]

2.Calculate the expected present value and variance of the present value of a term assurance of 1 payable immediately on death for a life aged exact 40 if death occurs within 30 years.

Basis:4% per annum,A1967-10 ultimate mortality [5 marks]

3. Define:

   i.   surrender value [2 marks]
   ii.   paid up policy value [2 marks]
   iii. Reserve [2 marks]

4. A life aged exactly 30 buys a 15 year endowment assurance policy with a sum assured of kshs.100,000 payable on maturity or at the end of year of earlier death. Level of premiums are payable monthly in advance .Calculating the monthly premium, assuming A1967-70 mortality at 4 % interest. Ignore the expenses.
[6 marks]

5. Given that t $p_{30} = \frac{7800 - 70t - t^2}{7800}$, $0 \le t \le 60$

[5marks]

   Calculate the exact value of $q_{50} - u_{50}$

6. Calculate $_{10/}a_{30}$ and $\ddot{a}_{50}$, $a^{(2)}_{20:10}$ based on A1967-70 ultimate mortality at 6% [3 marks]

QUESTION 2: [20 MARKS]

a).i) State the conditions under which the prospective and the retrospective reserves will be equal

[2 marks]

ii. A whole life annuity is issued to a life aged x. The annuity is purchased by a single premium and the benefit of 1 is payable at the beginning of every year throughout life. Show that net prospective and retrospective reserves are equal [10 marks]

b)Ten years ago a life office issued a 20 year endowment assurance without profits to a person aged 35.The sum assured is $10,000 payable at the end of year of death or on survival for 20 years, and premiums are payable annually in advance. Using A1967-70 ultimate 6 % and ignoring expenses, Calculate

   i.   The annual premium [4 marks]
   ii.   The reserve ,assuming that premium now due has been paid [4 marks]

QUESTION 3:[20 MARKS]

A)Find the single premium for a 10 year term assurance with the sum assured for $ 500 for a life aged 30 on the basis of the !967-70 select table at 4 %.The premium is paid to be returned with the sum insured in the event of a claim. Expenses are 3% of the sum assured with continuing administrative costs of $ 1 each year. [5 marks]

b) Calculate on the basis of A1967-70 ultimate tables the annual premium for a 25 year endowment assurance on a life aged 40 allowing for the initial expenses of 4 % of the sum assured, renewal expenses of including renewal commission of 5% of each premium including 25% each year for $100 sum assured and the initial commission of 40% of the first year gross premium. [6 marks]

c)i. Find the annual premium, halving after 15 years for a whole life assurance for a select life aged 35 on the basis of the A1967-70 table of mortality at 4 % [4 marks]

ii. To what value does the above premium reduce to after 15 years [1 mark]

d .Calculate the premium values using the commutation functions of A1967-70 table at 4 % interest

i. $P_{[30]:\overline{10}|}$ [2 marks]

ii. $_5P_{40}$ [2 marks]

QUESTION FOUR [20 MARKS]

a). Describe the three varieties of life annuity contracts [5 marks]

b). (i) Given that $a_x = 20$, $a_{x:n} = 18$ and $a_{x+n} = 8$, Find the value of $_nE_x$ and $\ddot{a}_{x:n}$ [5 marks]

c).Calculate the values of the following using commutation functions of A1967-70 table at 4% interest [5 marks]

(i) $\ddot{a}_{[40]}$

(ii) $_{5/}a_{45}$

(iii) $_{10/15}\ddot{a}_{30}$

(iv) $\ddot{a}_{[39]+1:10}$

(v) $_{5/}\ddot{a}_{[40]:25}$

d).A life office issued a certain policy to a life aged 40.The benefits under this contract are as follows:

On death before age 60: an immediate annuity lump sum of $ 1,000

On survival to age 60: An annuity of $ 500 p.a payable continuously for the remaining lifetime of the policy holder.

Level annual premiums are payable continuously until age 60 or earlier death. Premiums are calculated according to the following basis:

Mortality: English Life tables No.12 males

Interest: 4% pa

Expenses: Nil

Calculate the annual premium   [5 marks]

QUESTION FIVE [20 MARKS]

a. Show that

$$q_x = \frac{m_x}{1 + \frac{1}{2} m_x} \quad,$$ [5 marks]

b. For many years a company has recruited, uniformly over each year, 200 employees on their 20th birthdays and a fixed number of additional employees on their 25th birthdays. Mortality follows English Life table no.-12 males. Employees may retire on their 60th or 65th birthdays, and one third of employees reaching their 60th birthdays retire on that date. Employees leave the company only through death or retirement and the total number of employees is 10,000.Find the total number of new recruits each year
[5 marks]

c. For a certain population $l_x = 10,000(121 - x)^{\frac{1}{2}}$ [6 marks]

   Find u_x, q_x and the probability that a life aged 0 will die between ages 21 and 40

D.Using English life table no.12 –male calculate

i. $\overset{0}{e}_{2:10}$ [2 marks]

ii. T_{15} [2 marks]