CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATIONS

FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN ACTUARIAL SCIENCE

ACTM 102: FUNDAMENTALS OF ACTUARIAL MATHEMATICS I

STREAMS: BSC (ACTR SCI)   **TIME: 2 HOURS**

DAY/DATE: MONDAY 10/12/2018   **2.30 PM – 4.30 PM**

INSTRUCTIONS:

- Answer question **ONE** and **TWO** other questions
- Sketch maps and diagrams may be used whenever they help to illustrate your answer
- Do not write anything on the question paper
- This is a **closed book exam**, No reference materials are allowed in the examination room
- There will be **No** use of mobile phones or any other unauthorized materials
- Write your answers legibly and use your time wisely

QUESTION ONE (30 MARKS)

a.) Find the survivorship function of l_x if force of mortality is given by

$$\mu x = \frac{1}{100 - x} \quad \text{for} \quad x < 100 \qquad \text{[4 marks]}$$

b.) At a certain company, the probability of each employee leaving during any given year is 5%, independent of the other employees. Those who remain with the company for 25 years are given Ksh1, 000,000. What is the expected present value of this payment to a new starter, assuming an interest rate of 7% *pa* and ignoring the possibility of death? [3 marks]

c.) A population with limiting age 100 has the following survival function:

$$t P_0 = \left(1 - \frac{t}{100}\right)^{0.5} \text{ for } 0 \leq t \leq 100$$

Calculate the complete expectation of life at age 50.   [6 marks]

d.) Explain why we study fundamentals of actuarial mathematics.   [4 marks]

e.) Calculate: 5|10 $q[52]$
            Basis:
            Mortality: AM92 Select   [4 marks]

f.) Define the force of mortality and give its mathematical formula   [3 marks]

g.) (i.)What is annuity?   [2 marks]
     (ii.) Explain two types of annuities you know   [4 marks]

QUESTION TWO (20 MARKS)

a.)   A population is subject to a constant force of mortality of 0.015.
Calculate:
        (i.) The probability that a life aged 20 exact will die before age 21.25 exact. [5 marks]

        (ii.) The curtate expectation of a life aged 20 exact.   [5 marks]

b.) You are provided with the following extract from a life table:

x	lx
50	99,813
51	97,702
52	95,046

Calculate 0.75p50.5 using two different methods.   [5 marks]

QUESTION THREE (20 MARKS)

a.)   In a special mortality table with a select period of one year, the following relationships are true for all ages:

$$0.5 q_{[x]} = (0.33) q_x$$

$$0.5 q_{[x]+0.5} = (0.5) q_x$$

Express $p[x]$ in terms of px .   [10 marks]

b.) (i.) Define and calculate the value of $_{5|10}q_{[40]+1}$.
Basis: AM92 Select   [7 marks]

(ii.) Explain the meaning of differed probabilities   [3 marks]

QUESTION FOUR (20 MARKS)

a.) In a certain non-select mortality table that follows a uniform distribution of deaths (U.D.D.), find the values of the following in terms of l_x ;

(i.) $_{1.5}P_{30.5}$ [5 marks]

(ii.) $\mu_{30.5}$ [5 marks]

b.) State and explain the common laws of mortality   [10 marks]

QUESTION FIVE (20 MARKS)

(a) Fill in the table below   (5 marks)

Age x	l_x	d_x	p_x	q_x
30	94726			
31			0.99839	
32	94425			0.00167
33		164		
34			0.99817	
35		182		

Using the table;

(i.) What is the proportion aged 31 expected to live to age 35   [4 marks]

(ii) What is the average number of persons who might be expected to die between age 31 and 35 out of 3000 persons aged 30 now   [4 marks]

(b) Using the actuarial life tables, what is the chance that a male child born to a mother aged 31 and a father aged 33 will live be alive 2 years but orphaned by both parents   [7 marks]

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