KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

FOURTH YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN SCIENCE IN ACTUARIAL SCIENCE
SECOND SEMESTER 2022/2023
[JANUARY-APRIL, 2023]

BACS 403: CONTEMPORARY ISSUES ACTUARIAL SCIENCES

STREAM: Y4S2 **TIME: 2 HOURS**

DAY: TUESDAY, 12:00 – 2:00 PM **DATE: 04/04/2023**

INSTRUCTIONS
1. **Do not write anything on this question paper.**
2. ***Answer question ONE and any other TWO questions.***
3. ***Tables for actuarial examinations and approved electronic calculators may be used.***

QUESTION ONE (30 Marks). (Compulsory)

1. A mortality study lasts from January 1, 2007 until December 31, 2009, i.e, for three years. The following is the experience of two lives in the study:

   - Life A comes under observation on 2007 +0.4 at exact age x - 1.2 and remains under observation until the end of the study.
   - Life B comes under observation at the study at exact age x – 0.2 and remains under observation until he dies at age x + 2.1.

   a) Calculate the contribution to the exposed to risk of these lives under the age label ‘age last birthday’. (2 Marks)

   b) Repeat (a) but with the age label ‘age nearest birthday’. (2 Marks)

2. A census type investigation into the mortality of a certain class of policyholders is conducted, where age of death is defined by: age x last birthday. Census data are available on 1 January where age is defined by: ‘age x nearest birthday’.
   There were 55 deaths aged 50 in 2004 and 49 deaths aged 50 in 2005. The census data are as follows.

Census data	Number of Lives		
	Age 49	50	51
1 January 2004	16678	18231	19345
1 January 2005	16976	16845	17823
1 January 2006	16995	17534	17982

Use these data to estimate the force of mortality μ_{50} (6 Marks)
At what exact age does your estimate apply? (1 Marks)

3. The annual aggregate claims, S, from a risk have a *CP* $(100, F_X)$distribution, where individual claim amounts, X, have a lognormal distribution with parameters μ = 0.34657 and σ^2 =0.69315. The insurer calculates the premium for this this using the premium loading factor θ_I = 0.3.

   (a) Explain briefly why it is reasonable to approximate the distribution of S by normal distribution. (3 marks)

   (b) Calculate E[X] and V[S]. (5 marks]
   (c) Using a normal approximation, calculate the probability that S is less than the insurer's premium

   (d) Now suppose that the insurer arranges proportional reinsurance with retained proportion α and that the reinsurer calculates premium using a premium loading factor θ_R = 0.4. Let S_I and $S_R$denote the aggregate claims paid by the insurer, net of reinsurance, and reinsurer, respectively.

   (i) Show that α = 0.5 minimises (V [S_I] + [S_R]. (4 marks)

4. Discuss the legal and ethical issues in the practice of actuarial Profession.
(20 Marks)