JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE
UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF   SCIENCE ACTUARIAL
1ST   YEAR 2ND SEMESTER 2018/2019 ACADEMIC YEAR
REGULAR (MAIN)

COURSE CODE: SAC 102

COURSE TITLE: FUNDAMENTALS OF ACTUARIAL MATHEMATICS II

EXAM VENUE: **STREAM: (BSc. Actuarial)**

DATE: **EXAM SESSION:**

TIME: 2.00 HOURS

<u>**Instructions:**</u>

1. **Answer question 1 (Compulsory) and ANY other 2 questions**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE

(a) Define the following terms as used in actuarial mathematics

    i. Morbidity.

    ii. Homogeneous population.

    iii. Area Comparability Factor. [3 marks]

(b) Explain how education influences morbidity. [6 marks]

(c) Define in words the following single figure indices.

    i. Crude death rate. [1 mark]

    ii. Indirectly standardised mortality rate. [2 marks]

    iii. Standardised mortality ratio. [2 marks]

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(d) You are given the following statistics in respect of a certain country.

	Males		Females	
Age	E_x^c	Mortality rates	E_x^c	Mortality rates
20-29	125000	0.00356	100000	0.00125
30-39	200000	0.00689	250000	0.00265
40-49	100000	0.00989	200000	0.00465
50-59	90000	0.01233	150000	0.00685

Calculate

    i. Directly standardised mortality rate. [4 marks]

    ii. Indirectly standardised mortality rates for the female lives using the combined population as the standard population.

[6 marks]

(e) Explain how a change in the stringency of underwriting may give rise to spurious selection.

[3 marks]

(f) Explain why it must be necessary to subdivide policies by method of selling in order to obtain homogeneous lapse rates. [3 marks]

QUESTION TWO

(a) Discuss each of the following terms and give an example of each.

    i. Class selection.

    ii. Selective decrement.

    iii. Spurious selection.

    iv. Adverse selection.

    v. Temporary initial selection [10 marks]

(b) Discuss the causal factors that explain observed differences in mortality and morbidity.

[6 marks]

(c) Explain why lives are subdivided into separate groups for the analysis of mortality.

[4 marks]

QUESTION THREE

(a) Explain how an insurance company uses risk classification to control the profitability of its life insurance business. [3 marks]

(b) Define the following terms giving formulae and defining all notation used
   i. Crude death rate. [2 marks]
   ii. Indirectly standardised mortality rate. [2 marks]

(c) The following data is extracted from a population census

Age band	All professions Population	Deaths	Proffesion A Population	Deaths
20-29	120000	256	12500	30
30-39	178000	458	15000	40
40-49	156000	502	16000	50
50-61	123000	600	14000	60

   i. Calculate the ACF for profession A using the data for All Professions as the standard population.
   ii. Hence or otherwise calculate the indirectly standardised mortality rate and the directly standardised mortality rate.

[8 marks]

(d) Explain how nutrition affects mortality and morbidity. [5 marks]

QUESTION FOUR

(a) Discuss the factors that affect the stated rate of mortality for different occupations. You should consider the factors that affect both the real and apparent levels of mortality.

[15 marks]

(b) Describe how selection can arise in pension schemes. [5 marks]

QUESTION FIVE

(a) Explain how geographical location can affect mortality. [5 marks]

(b) The following data has been extracted from the census for the whole of a country with a developed economy and for two of its administrative regions.

Age-group	Region X		Region Y		Country	
	E_x^c	θ_x	E_x^c	θ_x	E_x^c in 000s	θ_x
0-14	590000	136	408000	108	102000	2550
15-39	980000	820	510000	441	16800	13950
40-59	1050000	5690	520000	2816	12900	70950
60-79	870000	42630	260000	11980	8900	418300
80+	11000	18920	36000	6077	1200	204000

(c) The following table gives a summary of mortality for a particular occupational group compared to the whole population. Calculate

    i. Crude mortality rate for each region and the whole country.   [2 marks]

   ii. Standardised mortality rate and

  iii. Standardised mortality ratio for each region by reference to the country as a whole.

                                                  [8 marks]

  iv. Comment on your results.   [2 marks]

(d) Give three different forms of selection that would be expected in a group of lives purchasing immediate annuities with an example of each.

                                                  [3 marks]