



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE

ACTUARIAL

SPECIAL RESIT 2015/2016 ACADEMIC YEAR

MAIN REGULAR

COURSE CODE: SAC 102

COURSE TITLE: FUNDAMENTALS OF ACTUARIAL MATHEMATICS 1

EXAM VENUE: LAB 1

STREAM: (BSc. Actuarial)

DATE: 04/05/2016

EXAM SESSION: 9.00 – 11.00 AM

TIME: 2.00 HOURS

Instructions:

- 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 1 [30 marks]

a). Explain with examples, 3 distinct types of selection in the membership of a pension scheme. [6 marks]

b). Sketch the graph of a general human mortality pattern and explain the graph. [7 marks]

c). Suppose that the life table function is given by $l_x = 20,900 - 80x - x^2$

(i) compute the radix if $\alpha = 0$, and the limiting age for the life table [5 marks]

(ii) Compute ${}_{10}P_{20}$, q_x and u_x [6 marks]

d) Given the survival function

$$s(x) = \left(1 - \frac{x}{100}\right)^2 \quad \text{for } 0 \leq x \leq 100$$

Find : [6 marks]

(i) $\mu(x)$

(ii) $f(x)$

QUESTION 2 [20 marks]

a). Describe how selection can arise in pension schemes. [6 marks]

b). Describe how occupation affects mortality and morbidity [4 marks]

c). Describe the casual factors that explain the differences in mortality and morbidity. [6 marks]

d). Explain how an insurance company uses risk classification to control the profitability of its life insurance business [4 marks]

QUESTION 3 [20 marks]

a) Explain what is meant by the following terms and give an example of each [8 marks]

- i. Temporary initial selection
- ii. Time selection
- iii. Spurious selection
- iv. Class selection

b. Given ${}_t p_{30} = \frac{7800 - 70t - t^2}{7800}$ for $0 \leq t \leq 100 - x$

(i) Find ${}_{10} p_{30}$ and ${}_1 p_{30}$ and hence find ${}_9 p_{31}$ [4 marks]

(ii) Find μ_{30+t} and then μ_{30} and μ_{40} [4 marks]

(iii) Calculate ${}_{10} p_{31}$ assuming μ_{40} to be constant between ages 40 and 41 [4 marks]

QUESTION 4 [20 marks]

a) The abridged life table below data in the table below refers to the female population of England and Wales in 1980- 1982

x	l_x	T_x
0	100000	7700187
1	99016	7601014
10	98746	6711410
20	98497	5725004
30	98105	4741877
40	97346	3764073

Using these data calculate

(i) The probability that a woman aged exactly 20 will survive until her 40th birthday [3 marks]

(ii) The infant mortality rate, q_0 [2 marks]

(iii) The life expectation at birth and at exact age 1 year [3 marks]

(iv) The probability that a girl who survives until her first birthday will die between her 10th and 20th birthdays [3 marks]

(v) The expected age at death of those who die between their 20th and 30th birthdays: Use two alternative ways [3 marks]

(vi) The expected age at death of those who die when they are aged under 1 year: Use two alternative ways [3 marks]

b). In a certain population, μ_x is given by

Interval	μ_x
$60 \leq x \leq 70$	0.01
$70 \leq x \leq 80$	0.015
$x > 80$	0.025

Calculate the probability that a life aged exactly 65 will die between ages 80 and 83 [3 marks]

QUESTION 5 [20 marks]

You are given the following data from 2 populations

MADE UP TOWN				STANDARD POPULATION	
sex	occupation	population	deaths	Population	deaths
Male	Office worker	20000	100	10000	50
	Manual worker	60000	500	20000	300
	other	20000	250	20000	500
Female	Office worker	20000	50	10000	50
	Manual worker	30000	200	10000	100
	other	50000	900	30000	500

Calculate the directly standardized mortality of Made up town by standardizing by

- i. Occupation
- ii. Sex
- iii. Occupation and sex

[20 marks]