



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**SCHOOL OF BIOLOGICAL PHYSICAL MATHEMATICS AND ACTUARIAL**  
**SCIENCE**  
**UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE**  
**ACTUARIAL**  
**2<sup>ND</sup> YEAR 2<sup>ND</sup> SEMESTER 2022/2023 ACADEMIC YEAR**  
**REGULAR (MAIN)**

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**COURSE CODE: WAB 2212**

**COURSE TITLE: DEMOGRAPHY AND SOCIAL STATISTICS**

**EXAM VENUE:** **STREAM: (B.s.c ACTUARIAL SCIENCE)**

**DATE:** **EXAM SESSION:**

**TIME: 2.00 HOURS**

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**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 ONE (30 MARKS)**

- a) Outline SIX features of census (6 Marks)  
b) Using the table below

Age	$l_x$	$d_x$	$1000q_x$
0	1,000,000	1,580	
1	998,420	680	
2	997,740	485	
3	997,255	435	

- i. Complete the table above. (4 Marks)  
ii. Find the probability that a newborn will live to age 3. (2 Marks)  
iii. Find the probability that a newborn will die between age 1 and age 3 (3 Marks)
- c) Outline FIVE contents of demography (4 Marks)  
d) 30% of those who die between ages 25 and 75 die before age 50. The probability that a person aged 25 dying before age 50 is 20%. Find  ${}_{25}p_{50}$  (6 Marks)  
e) Outline FIVE components of crude death rate (5 Marks)

**QUESTION TWO (20 MARKS)**

- a) Identify and explain FIVE different sources of demographic data (10 Marks)  
b) Doubling time is given by  $\frac{\ln 2}{\ln(1+r)} = \frac{0.693}{\ln(1+r)}$ , if  $r$  is the rate of increase compounded annually, show  
i. that  $\frac{0.70}{r}$  is on the whole a better approximation than  $\frac{0.693}{r}$  for values  $r = 0.01, 0.02, 0.03, 0.04$   
ii. that for those  $r$  values the error in  $\frac{0.70}{r}$  is never in the excess of 1%. (10 Marks)

**QUESTION THREE (20 MARKS)**

Given that  $l_x = 1000\left(1 - \frac{x}{105}\right)$  determine each of the following

- a)  $l_0$  (2 Marks)  
b)  $l_{35}$  (2 Marks)  
c)  $q_{20}$  (3 Marks)  
d)  ${}_{15}p_{35}$  (3 Marks)  
e)  ${}_{15}q_{25}$  (3 Marks)  
f) The probability that a 30 year old dies between ages 55 and 60. (4 Marks)  
g) The probability that a 30 year old dies after 70 years. (3 Marks)

**QUESTION FOUR (20 MARKS)**

- a) Explain FIVE cohort measures of mortality. (10 Marks)
- b) For the following small cohort life – table, find  $d_x$ , the probabilities for all values of  $T$ , both unconditionally and conditionally for lives age 2. (10 Marks)

$x$	0	1	2	3	4	5
$l_x$	100	80	65	55	40	0

**QUESTION FIVE (20 MARKS)**

The following table is from part of a population

AGE	${}_n^f P_x$	${}_n B_x$	${}_n i_x$
15-19		2,208,361	298
20-24	398,732		269.6
25-29	462,800	55,628.4	
30-34	445,362	25,770.87	
35-39	428,109		298.6
40-44	406,211		242.8
45-49		4,466.13	36.9
TOTAL			

- a) Complete the table above (10 Marks)
- b) Use the information to calculate the General Fertility Rate and Total Fertility Rate (7 Marks)
- c) Given that Gross Reproduction Rate is approximated as  $\frac{300}{306}$  of Total Fertility Rate. What will be its value (3 Marks)