MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2018/2019 ACADEMIC YEAR
FOURTH YEAR FIRST SEMESTER

SCHOOL OF SCIENCE
BACHELOR OF SCIENCE IN APPLIED STATISTICS WITH COMPUTING

COURSE CODE: STA 420
COURSE TITLE: STATISTICAL DEMOGRAPHY

DATE: 4TH DECEMBER 2018 **TIME: 08.30 – 10.30 HOURS**

INSTRUCTIONS TO CANDIDATES

1. Attempt Question **ONE** and any other **TWO** questions.
2. Show all your Workings.

QUESTION 1

a). In a stable population, the growth rate is 2 % per annum, the death rate is 14.2 per a thousand and the value of

$$\frac{{}_1l_{15}}{l_0} = 0.7931$$

i). What is the birth rate? **[2 Marks]**

ii). What is the proportion of population aged 15 (that is aged between 15 and 16) years. **[3 Marks]**

b). A part of a life table is provided below with some entries missing. On the basis of available information, complete the life table.

Age	l_x	d_x	q_x	L_x	T_x	e_x
10	93102		0.0062			
11			0.0066			
12			0.0072			
13			0.0080			
14			0.0090			
15			0.0100			
16			0.0112			
17			0.0123		5027336	

[5 Marks]

c). What is the Differentiate between

i). Fertility and Fecundity. **[2 Marks]**

ii). Complete life table and Abridge life table. **[2 Marks]**

iii). Gross Reproductive Rate (GRR) and Net Reproductive Rate (NRR). **[2 Marks]**

d). In a certain life table

$\mu_x = 0.15 - 0.10x$ for $0 \leq x \leq \frac{1}{2}$ and

$\mu_x = 0.10^x$ for $\frac{1}{2} \leq x \leq 1$. Find l_1 if $l_0 = 100,000$.

[4 Marks]

e). On the life table with, $l_x = \frac{100-x}{190}$.

Determine;

i). The chance that a child who has reached age 5 will live to 60.

[1 Mark]

ii). The chance that a man of 30 lives to age 80. **[1 Mark]**

iii). The probability of dying within five years for a man aged 40. **[1 Mark]**

iv). The average age of at death for those dying between ages 40and 45. **[2 Marks]**

v). The instantaneous death rate at age 40. **[1 Mark]**

vi). The expectation of life at age 40. **[2 Marks]**

vii). The chance that three men aged 30 at least one survives to age 80. **[2 Marks]**

QUESTION 2

a). Find l_x if $\mu_x = \frac{1}{100-x}$. **[4 Marks]**

b). A group of lives experience special mortality between the ages 50 and 60 which can be represented by addition to the force of mortality according to the A 1967-70 mortality table ultimate of 0.01 at age 50 decreasing continuously in arithmetic progression to zero at age 60. Calculate the probability that a life aged 50 will live for 10 years. **[6 Marks]**

c). The data provided below relates to an observed population

Age Group	Female Population in '000's	Births in 1000's
15-19	4459	19
20-24	4383	427
25-29	3974	674
30-34	3540	318
35-39	2949	185
40-44	2663	22
45-49	2418	1

A demographer also ascertains that the population is 91, 088, 000 and the sex ratio of births is

$$\frac{105\ Males}{100\ Females}$$

Determine,

i). i). CBR. **[6 Marks]**

ii). ii). TFR. **[2 Marks]**

iii). iii). GRR. **[2 Marks]**

QUESTION 3

a). (i). A population satisfies the logistic law $\frac{dN}{dt} = rN - \lambda N^2$
Where $r > 0$ and $\lambda > 0$ are constants. At time t_0 it has N_0 members. Solve the differential equations by expressing the population as a fraction of time. **[8 Marks]**

(ii). List the four fundamental laws of a stable population **[4 Marks]**

(iii). Show that in a stationary population $b = \frac{1}{e_0}$ where b is the Birthrate and e_0 is the life expectancy at birth. **[4 Marks]**

b). The following is the population characteristic of Lower Narok;

Population 1st January 2017	10554
Births	456
Deaths	215
Immigration	40
Emigration	145
Population 1st January 2018	10690

Determine

i). The rate of growth during year 2017. **[2 Marks]**

ii). The rate of Natural increase during the year 2017. **[2 Marks]**

QUESTION 4

a). The population of Mau Settlement Scheme satisfies the logistic law as provided in question 3 above where $\frac{dN}{dt} = rN - \lambda N^2$ with parameters $r = 0.03$ and $\lambda = 3 \times 1\ 0^{-8}$ And the time t is measured in years. If the population in 2010 was 200,000

i). What was the population in the year 2030? **[7 Marks]**

ii). What is the limiting value of the population **[2 Marks]**

b). Two lives now aged x and y respectively are subjected to Gompertz Mortality from the same table where $\mu_x = BC^x$ and $\mu_y = BC^y$.

i). What is the probability that a life aged x dies before the life aged ? **[10 Marks]**

ii). Generalize the results in (i) for a case of three lives **[1 Mark]**