MACHAKOS UNIVERSITY

University Examinations for 2022/2023 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (STATISTICS AND PROGRAMMING)

SST 400: MATHEMATICS FOR DEMOGRAPHY AND GRADUATION

DATE: **TIME:**

INSTRUCTIONS TO CANDIDATES:

Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Define demography and giving its two classes (3 marks)

b) Explain the meaning of population census and give any one feature of census (2 marks)

c) Explain the meaning of age heaping as used in demography (2 marks)

d) Explain the meaning of Crude Birth Rate (CBR) when it is given as 30% (2 marks)

e) Distinguish between migration and immigration (2 marks)

f) Identify and describe briefly two types of enumeration (2 marks)

g) Use the data below to answer the following questions,

1989	1999
20365450	27265371

i. Compute the exponential growth rate (2 marks)

ii. Estimate the population in the year 2019 (2 marks)

iii. How long will the 1989 population take to double (2 marks)

h) Given the following data;

Age-group	Female population	Female births	Total births
15-19	79865	4293	8813
20-24	63315	8582	17620
25-29	51860	7104	14585
30-34	44440	4986	10235
35-39	38795	3686	7569
40-44	32250	1344	2760
45-49	26720	186	381

i. Determine the gross fertility rate (2 marks)
ii. Age specific fertility rate (4 marks)
iii. Total fertility rate (3 marks)
iv. Gross reproductive rate (2 marks)

QUESTION TWO (20 MARKS)

a) Distinguish between Gross Reproductive Rate and Total Fertility Rate (4 marks)
b) Consider the following table on data from a West African country, assume that the total population is 7000

Age group	Number of women	Number of births	ASFR	Number of female births	Female ASFR	$\frac{l_x}{l_0}$
15-19	250	30	0.10	10	0.045	0.90
20-24	300	70	0.27	35	0.117	0.87
25-29	350	90	0.33	45	0.150	0.85
30-34	400	80	0.20	35	0.088	0.83
35-39	500	40	0.05	11	0.023	0.80
Total	1800	310	0.95	136	0.423	

Calculate;
i) Crude birth rate (3 marks)
ii) General fertility rate (3 marks)
iii)Gross reproductive rate (3 marks)
iv)Total fertility rate (3 marks)
v) Net reproductive rate (4 marks)

QUESTION THREE (20 Marks)

a) Define a life table (2 marks)
b) give one disadvantage of exponential projection in demography (1 mark)
c**)** Given the following functions of a life table;

age	l_x	nd_x	nq_x	nP_x	nL_x	T_x	e_x
0	10,000	1632					
1		1557					
5		316					
10		179					
15		199					
20		207					
25		192					
30		241					
35		260					
40		390					
45		542					
50		525					
55		543					
60		686					
65		690					
70		732					
75+		1109					

Fill the plank spaces in the table above. (9 marks)

c) Assume that in 1990 and 2009, the world population was 3.9 and 7.8 billion respectively.

i) Obtain the exponential model (4 marks)

ii) Forecast the future population in 2060 (2 marks)

iii) Determine the year in which the population would be 12 billion (2 marks)

QUESTION FOUR (20 MARKS)

a) Identify and briefly describe two sources of demographic data (4 marks)
b) Differentiate between a bridged life table and a complete life table (4 marks)
c) Given the following life table on Australian males

Age x	l_x	d_x
30	96726	
31	96567	
32	96412	
33	96251	
34	96083	
35	95910	182

Calculate ;

i. Probability of males aged 32 who will survive to age 35 (4 marks)
ii. Probability of males aged 32 who will die by age 35 (4 marks)
iii. Out 6000 of males aged 31, how many will die after age 35? (4 marks)

QUESTION FIVE (20 MARKS)

a) Use the data shown in the table below to answer the following questions

Age group	Female population	Male population
0-4	2350	2376
5-9	1972	1983
10-14	1614	1628
15-19	1265	1277
20-24	986	997
25-29	779	807
30-34	644	661
35-39	533	551
40-44	378	394
45-49	278	267
50-54	228	194
55-59	200	161

60-64	163	136
65-69	123	103
70-74	79	75
75+	59	62

i. Find the average sex ratio score (2 marks)
ii. The average male age ratio score (3 marks)
iii. The average female age ratio score (3 marks)
iv. Find the UNAI (2 marks)

Given the following data for 3 counties and their causes of death. Determine the cause specific death rates w.r.t each county. (6 marks)

County	TB	MALARIA	DIABETES
Kisumu	91.19	82.66	61.67
Nakuru	80.54	80.54	72.96
Mombasa	46.35	43.23	54.75

c) The following is across tabulation table relating to 2 counties from 2019 census,

	Nairobi	Mombasa
Nairobi	1460526	1829290
Mombasa	1365260	202350

Obtain;

i. The crude immigration rate (1 mark)
ii. Crude outmigration rate (1 mark)
iii. Crude gross migration rate (1 mark)
iv. Crude net migration rate (1 mark)