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UNIVERSITY EXAMINATIONS 2021/2022

FOURTH YEAR, FIRST SEMESTER SPECIAL SUPPLEMENTARY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE IN STATISTICS AND BACHELOR OF ACTUARIAL SCIENCE

SMS 3451: DEMOGRAPHIC TECHNIQUES

DATE: JANUARY 2023 **TIME: 2 HOURS**

INSTRUCTIONS: Answer Question ONE and any other TWO questions.

QUESTION ONE (30 MARKS)

a) Explain three advantages of demographic surveys over population houses. (3 Marks)

b) Briefly explain three major factors of data used in demographic study. (3 Marks)

c) Describe two uses of population projections. (2 Marks)

d) In 1960, the population of a counting was recorded as $6.73x12^6$ and in 1970 it was recorded as $8.54\ x10^6$. Determine

i. Rate of growth of the population (3 Marks)

ii. How long it will take for the population to double. (Use geometric model) (4 Marks)

e) The annual rate of growth for a counting was estimated between 1960 and 1970 to by at 2.4% pa. what will be the country's population size in 1980 assuming that the rate at 2.4% p.a will continue to that year. Take the population of 1970 as $8.54x10^6$. (5 Marks)

f) State three assumptions made in the analysis of a stable population. (3 Marks)

g) Use the data in the table below to

i. Calculate the out – migration rates for each region. (3 Marks)

ii. Calculate the in – migration rates for each region. (4 Marks)

Region of recording/Enumeration

Region of birth	A	B	C	Total
A	74609	526	21	75156
B	4899	32688	825	38412
C	191	1180	22612	23983
Total	79699	34354	23458	

QUESTION TWO (20 MARKS)

a) Given the table below of a number of births in different female age, determine

i. The mean age of child beany (3 Marks)

ii. Standard, deviation age of child bearing. (5 Marks)

iii. Modern and median age of child bearing. (5 Marks)

b) A population P, t years after find observation is given by its function

$P = 1000\ (2^{1.01t})$

Determine the:

i. Initial population (2 Marks)

ii. The population 100 years later (2 Marks)

iii. Rate of growth of the population at each of these times. (3 Marks)

QUESTION THREE (20 MARKS)

a) A population is given by the expression $u_t = a + bc^t$. Use three points corresponding to u_1, u_2 and u_3 to fit an exponential current to this population. (10 Marks)

b) A population model is given as $P = 50{,}000(4 - e^{-0.002t})$ when P is the population after one year. Determine

i. The initial population size (3 Marks)

ii. Ultimate population size (3 Marks)

iii. The rate of population growth 200 years after initial observation. (4 Marks)

QUESTION FOUR (20 MARKS)

a) A population of 100 is restricted to dead end university by end of year 1,40 have left. By end of year 2 another 35 have left. By end of year 3 another 15 have left. The rest will leave at same time in fourth year.

i. Determine the life table quantities $lol, d_x, p_x, q_x, T_x, L_x$ for this population. (8 Marks)

ii. Sketch a graph for this population. (2 Marks)

iii. Determine the life table quantity lol. (2 Marks)

b) Briefly explain two major uses of life tables. (8 Marks)

QUESTION FIVE (20 MARKS)

a) The table below describe women of different age groups and their number of child they gave birth to.

Age group	All women	Children born	Female	$n^S a$
15 – 19	39419	18670	9015	0.9742
20 – 24	335924	75651	36956	0.9713
25 – 29	313611	69048	33785	0.9683
30 – 34	351825	46193	22383	0.9644
35 – 39	372637	23509	11377	0.9587
40 – 44	334594	6409	3131	0.9500
45 – 49	321900	456	226	0.9364

i. Estimate and interpretation the General facility rate. (3 Marks)

ii. Estimate and interprete the total facility rate. (3 Marks)

iii. Estimate and interprete net reproductive rate. (3 Marks)

iv. Sketch a graph of the ASFR's. (3 Marks)

v. What is the different between net reproductive rate and gross reproductive rate. (3 Marks)

b) Describe how fertility, mortality and migration process affect the age-sea comprising of a population. (5 Marks)