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**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**SCHOOL OF MATHEMATICS AND ACTURIAL SCIENCE**

**UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE ACTURIAL**

**4th YEAR 1st SEMESTER 2016/2017ACADEMIC YEAR**

**MAIN REGULAR**

**COURSE CODE: SAS 417**

**COURSE TITLE: STATISTICAL DEMOGRAPHY II**

**EXAM VENUE: STREAM: (Bsc. Actuarial Science)**

DATE: EXAM SESSION: SEP-DEC 2016

TIME: 2.00 HOURS

**Instructions:**

1. **Answer questions one and any other two.**
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) What is a demographic transition and what is a demographic trap?

(b)How do you obtain the doubling time for a geometric growth model and for an exponential growth model?

(c) Using 1979 and 1989 Kenya’s censuses, the population was 15.3 million and 21.4 million respectively. Find the growth rates and the doubling times using geometric and experimental growth models.

(d)i) Define crude death rate and standardized death rate

ii) Given below is the data regarding deaths in two districts. Calculate the standardized death rates. Give your comments.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Age range | District A | | District B | | Age distribution of standardized population per 1000 |
| Population | Deaths | Population | Death |
| 0-10 | 2000 | 50 | 1000 | 20 | 206 |
| 10-55 | 7000 | 75 | 3000 | 30 | 583 |
| 55 and above | 1000 | 25 | 2000 | 40 | 211 |

(e) How are the following fertility measures related?

1. CBR and ASFR
2. TFR and GRR
3. GFR and ASFR

**QUESTION TWO(20 Marks)**

1. i) Write down the four fundamental laws of a stable population

ii) Show that for a stationary population, the birth rate is the reciprocal of life expectancy at birth.

1. The number of births occurring in a country in a particular year is shown, classified according to age of mother, together with the female population in each age-group of the reproductive period.

|  |  |  |
| --- | --- | --- |
| Age-group | Female population | Number of births to mothers |
| 15-19  20-24  25-29  30-34  35-39  40-44  45-49 | 84796  70018  72660  75924  75109  71625  66660 | 2349  14547  16746  10229  5257  1432  93 |

The total population of the country during the year was 2285800. With the above data, determine CBR, GFR, ASFR and TFR. Assuming that the sex-ratio at birth was 104.6 male births to 100 female births determine GRR.

**QUESTION THREE(20 Marks)**

1. Give four ways of expressing person years lived between age and
2. i) From , construct a probability density function.

ii) Show that the mean-time denoted by is given by

=

1. i) From , construct another pdf.

ii) Find its mean denoted by

iii) Hence or otherwise express in terms of .

1. Using one of the formulae in (a), express in terms of , , and .

**QUESTION FOUR(20 Marks)**

1. Describe the reproductive life cycle of a woman
2. How would you use this framework to study factors influencing
3. Child survival
4. Prevention of mother to child transmission (pmtct) of HIV.

**QUESTION FIVE(20 Marks)**

Let P(t) denote the estimated population of a certain country at time t years from the present. A demographer believes that P(t) will satisfy the logistic deferential equation:

, where and λ are known positive constants. The present population is known.

1. By making the substitution find a first-order linear differential equation for .
2. Solve this equation for and hence find a formula for in terms of , and (in addition to time t).
3. What is the limit as , of the estimated population?