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3 (Sem-6/CBCS) STA HE 2

2022

**STATISTICS**

(Honours Elective)

Paper : STA-HE-6026

**(Demography and Vital Statistics)**

Full Marks : 60

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

1. Answer the following questions as directed :

**(any seven)**

1×7=7

(a) If the last census population, migration births and deaths data for a region in a given time period are given, then the population at the time  $t$  can be estimated by the formula (with usual notation) as

(i)  $\hat{P}_t = P_0 + (B - D) + (I - E)$

(ii)  $\hat{P}_t = (B - D) + (I - E)$

Contd.



(iii)  $\hat{P}_t = P_0 \{(B - D) + (I - E)\}$

(iv) None of the above  
(Choose the correct option)

(b) Infant mortality rate is computed for children

(i) above the age of 1 year

(ii) under the age of 1 year

(iii) between the age of 1 to 3 years

(iv) None of the above  
(Choose the correct option)

(c) The relation between N.R.R. and G.R.R. is

(i) N.R.R. and G.R.R. are usually equal

(ii) N.R.R. can never exceed G.R.R.

(iii) N.R.R. is generally greater than G.R.R.

(iv) None of the above  
(Choose the correct option)

(d) Which of the following is not a vital event?

(i) Birth

(ii) Marriage

(iii) Education

(iv) Migration

(Choose the correct option)

(e) Census provides information for the \_\_\_\_\_ only. (Fill in the blank)

(f) The ratio between the number of males and the number of females in a given population is called \_\_\_\_\_. (Fill in the blank)

(g) Vital rates are customarily expressed as \_\_\_\_\_. (Fill in the blank)

(h) The probability of living reveals the \_\_\_\_\_ rate. (Fill in the blank)

(i) Female C.D.R. is generally less than male C.D.R. (State True or False)



(j) If vital index is greater than 100, then the population is regarded as having good medical care.

(State True or False)

2. Answer **any four** of the following :

2×4=8

(a) Define crude death rate. Is crude death rate an accurate measure of the mortality of population of a country?

(b) Distinguish stationary and stable population.

(c) What are the important sources of demographic data?

(d) Explicate the method of obtaining crude rate of natural increase.

(e) What is meant by Pearl's vital index of population and how can it be measured?

(f) In the usual notations, prove that

$$\frac{dLx}{dx} = -d_x.$$

(g) If  ${}_n P_x = \text{Prob (a man aged } x \text{ years survives } n \text{ years)}$ , then prove that

$${}_n P_x = P_x \cdot P_{x+1} \cdots P_{x+n-1}.$$

(h) Calculate G.R.R. from the following data :

Total fertility rate = 1070.75

Number of female live birth = 100

Total number of male live birth = 105

3. Answer **any three** questions from the following :

5×3=15

(a) Define and discuss specific death rate. Also mention its merits and demerits.

(b) What is expectation of life? Distinguish 'curtate expectation' and 'complete expectation' of life.

(c) Write the uses of life table.

(d) Explain infant mortality rate. Also state its advantages and drawbacks.



(e) The number of persons dying at age 75 is 476 and the complete expectation of life at 75 and 76 years are respectively 3.92 and 3.66 years. Find the numbers living at ages 75 and 76.

(f) Describe the uses of vital statistics.

(g) In the usual notations, prove that

$$(i) \frac{dT_x}{dx} = -l_x$$

$$(ii) \frac{d}{dx}(e_x^0) = (-1 + \mu_x e_x^0)$$

(h) Write a note on standardised birth rate.

4. Answer **any three** of the following questions :  $10 \times 3 = 30$

(a) What purpose is served by standardised death rates and how are they calculated?

(b) Define G.R.R. and N.R.R. in detail with their merits and demerits. Also derive the relationship between them.  $(4+4)+2=10$

(c) What is a complete life table? On what assumptions it is based? Describe in detail the construction of a complete life table.  $1+4+5=10$

(d) Discuss different fertility rates comparing their merits and demerits.

(e) Define central mortality rate and force of mortality in a life table. Show that with usual notations :  $(2+2)+(3+3)=10$

$$(i) \mu_x + \frac{1}{2} = m_x$$

$$(ii) T_x = \frac{1}{2} l_x + l_{x+1} + l_{x+2} + \dots$$

(f) Write notes on the following :  $3+3+4=10$

(i) Dependency ratio

(ii) Population composition and characteristic

(iii) Use of balancing equation



(g) (i) Write a brief note on shortcomings of vital statistics. 5

(ii) With usual notation prove that

$$q_x = \frac{1 - (e_x - e_{x+1})}{1 + e_{x+1}} \quad 5$$

(h) Given  $l_{91} = 871$  and

$x$	:	91	92	93	94	95	96	97	98	99	100
$d_x$	:	296	209	144	93	58	34	18	10	5	3

where  $l_x$  and  $d_x$  have their usual meaning as in a life table. Find the probability that

- (i) a person aged 93 will die in three years;
- (ii) a person aged 92 will survive up to age 96;
- (iii) three persons aged 92, 93 and 94 will survive 4 years.