Kunthavai Naachiyaar Govt Arts College (W)Autonomous, Thanjavur
M.Stat   18KP3SE1 S3
MAJOR BASED ELECTIVE - III
Population Studies

Hours : 6
Credits : 4

Unit – I
Definition of vital statistics and demography – concepts on population and measurement of population, uses of vital statistics, sources of collecting Vital Statistics, parts of demography.

Unit – II
Concepts and definitions of Sex Ratio, Rate of a Vital Event, Cohort, Generation, Marriage, Divorce, Separation, Stable Population, Stationary Population, Fertility and Mortality, Birth Rates – Crude Birth Rate, General Fertility Rate, Specific Fertility Rate and Total Fertility Rate (only concepts and formulae).

Unit – III
Measurement of Mortality – Crude Death Rate, Specific Death Rate, Infant Mortality Rate, Standardized Death Rates – Direct and Indirect method of standardization (No problems), Central Mortality Rate and Force of Mortality.

Unit – IV
Life Table – Assumptions, Descriptions, Construction and Uses of Life Table, Definitions of lx, dx, npx, px, qx, Lx and e0x. Expectation of life – Curate expectation and complete expectation of life. Basic theorems with proof.

Unit – V
Reproduction Rates – Gross Reproduction Rates and Net Reproduction Rates, Graduation of Mortality Rates – Makehem's Graduation Formula, Gompertz Makehem formula for Mortality, Method of four selected points and Method of partial sums

Text Books:
1. Gupta, S.P. & Kapoor, V.K., Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi (Unit I to Unit V)
2. Peter R Cox, Demography, Fifth edition, Vikas Publishing House, New Delhi. (Unit I and Unit II)

Book for Reference:
1. Ramraj, Fundamentals of Demography, Surjeet Publications, New Delhi

UNIT - I

VITAL STATISTICS :-

Vital statistics is defined as the branch of Biometry / with deals with data / and the law of human / mortality, morbidily and demography.

"The whole study of marked as affected by heredity or environment in so for / so the results of this study / can be arithmatically stated".

The basis sources of vital statistics :-

The PSA / maintained / an civil registration / documents / several books / for are needed / to records / vital events / from which vital statistics / where generated / these are.

Marriage certificate

certificate of live births

certificate of death

certificate of total death.

consus :-

The census almost in all the confires all over the would population census conducted at regular

interval of the time, usually ten years. Census consist of complete enumeration of the population of the particular area under study and collection information for individuals regarding age, sex, material status, occupation region and other ecomic and social characteristic.

Measurement of population :.

In order to determine the Population | of any time "t" | after the| census of between | two census|, a numbers of method | have been devised.|

Here we discuss a suitable method | with makes | use to the | births | death | and migration | statistics assumed that |

The census data| given us the total size of the population of region | of community | together the birth, death and migration statistics| during different periods | are obtained from register |, then the population |

$$P_t = P_0 + (B-D) + (I-E) \rightarrow (1)$$

where census B and D total
population / the last census B and
D / gives respectively / total number
of birth and death / informat / in
the intercent period t / and t is
the total no. of immigrants into
the region / E Num of emgrantly
from the region / during the period t. /

The sex wise / population of
India / for the years / 1951, 1961, 1971,
1981, 1991, 2001.

Population of India

Year	male	female	Total
1951	185, 528, 462	175, 559, 628	361, 008, 090
1961	226, 293, 201	212, 941, 570	439, 234, 771
1971	284, 049, 276	264, 110, 37	540, 159, 652
1981	355, 374, 460	329, 954, 637	633, 329, 097
1991	439, 230, 458	407, 072, 256	846, 302, 688
2001	531, 735, 169	495, 735, 169	1, 027, 015, 247

Territory :-

Definition :

The population figures have meaning unless they refer to a well defined territory.

The territory covered along with any changes in life area in successive Census should changes in the area successive censuses should be clearly and explicity.

universality :

Each person present and or residency with in its slope, without omission or deplic should be included in the census to ensure.

Completenes and accurancy of the census data simultansity :-

The total population enumeration should refer to one well defined point and or period of time. This is essential to an formility.

Example ﹀

Education by age, sex in different region current administration data system allow for other approches to enumeration with the same level of

detail but raise concern about and the probability of biasing estimates.

In many cases, a carefuly choosen random sample can provides more occurate information that attempts to get a population census.

Essential features informations available from indian census :

The total process of collecting compliting and populashing demography economic and should social data fertivity at a specified time or times to all helson in a contry or deklimited fertility.

Some of the essential features of the census are as follows :

Spanshor spip :

To conduct a census last organisation and considerable resources are needed. The census organisation has to mobilise extension administrative machinery with a tequate. Occurate count of the total population and relationship of facts about the population to a specified period of time as a general rule a day fixed for the census and also a particular moment which is called census method.

Defined periodically :

Census should be taken at regular intervals so the comparable information is made available in a fixed sequency a series of census makes it possible to appraise the past accuratily desorible the present and estimate the future.

Individual units :-

Census data must be collected seperately for each individuals so the detailed classification may be provided in all the required combination a procedure of group enumeration" is not a census in the stride census sense of the from because the recording of aggregate or summarized information on the characteristics of a group of persons usually persludes the cross tabulations of data on several characteristics.

Computation and publication :

Do census is complete unless data collected are complied and published geographic area and by basic demography variable the unpublished data is of no use the potential uses of the census data. That why the census should be limited to very important items which can be tabulated published in time.

International Simultanerity :

The census of any currently is of greater value nationaly regionaly and internationaly if it can be compared with the census in most countries the some time.

census is most countries of the world are conducted in year ending in 0 or 1. In india the census are conducted in years ending in international comparationality in thus maintained.

Registration :

Registration methods refers to continuous permanant compulsariy recording of the occurance of vital events together with certain identifying or descriptive characters Analysis evaluating, presenting and disseniating these data. The population of vital statistics comparised of a system of operation in which the registration of vital events is an important component the system begins with the registration followed by the processing and controlling of vital records and events with the combination and analysis of vital statistics.

The uses of vital statistics :

Vital statistics are useful for local and national authorities specificaly for planning of human social and economic development.

Vital statistics :

Vital statistics are derived from information obtained at the time when the occurrence of vital events and their characteristic are describe in a civil register.

Vital acts and events are the births deaths total deaths marriages, and all such events that have sometimes to do with an individuals extreme and department, from life together with the change in civil status they may occur to a person during, his life time recording of these events in the civil registration and the resulting documents are called vital records.

Vital statistics Systems :-

A vital statistics system is defined as the total process of collecting by registration, enumeration or indirect estimation of information on the frequency

of occurance of certain vital events as well as relevent characteristics of the events themselves and of the persons They use the data in the following :

Input population estimation / projection future planning. As basic for forecasting requirement for fecel, having medical facilities educating and other the needs of the population.

The carry out policy making at local levels for planning health, education, services, housing etc...,

To address health inequalities from communicarale disease, chronic disease and injuries.

Generate "life table" and life expectation for many health planning purpose.

measure progress on the substrainable development goals and other International health goals.

prepare policing list for eligible for election purpose.

Calculate the number of parliment each state or pravine.

Allocate budgets for developments and for human resources.

Calculate the number of citizens year for administrative.

Scope of Demographic Studies :-

The scope of demographic is very wia.

Size of population
composition of population
Distribution of population
fertility mortality, and migration
labour force.
Social Demography
population policy.

b) Size of population :-

Ps is fundamentally study and the form of its size. The student of population. In this aspects / three important components / should bear mind.

Size
place
time

Size :-

May be affected / because of / higher or lower / birth and death rates and migration factors. These components affects the size of the population

place :-

The population studies / explain the population / phenomena நிகழ்வு, பிம்பம் / that take place, situations / and the changes in the contents of biological, social, economical settings.

Composition of population :-

Includes the measurable / characteristics of population / of communities / in a country / during the ~~population~~ particular period the characteristic of population / are / age, sex, material, status education level, region, caste rate / race and health etc... population study / ~~tries~~ to find out the / changes in the / characteristic of population / generally / changing factor / but also the responsible / for the changes. /

Distribution population :-

(The distribution population / general studied / according to geographical / area / it include percentage and density of population / the factor affecting and economic etc.) / It also studied. classification of residence includes rural an rural population locality of recidence unbabitance etc. (population study the density and the percentage cause / and factors affecting the) population.

Fertility Mortality and migration :

(The important field of birth rate, birth order family size Stability and construception etc., population studies influences of biological limits Social forms upon fertility). Its also studies the reproductive spon in additc to that physiological, social and nonliral factors affecting fertility, the interval between the successive work reproductive wastage etc.

(Another important field of Studies is mortality.) (It includes of sex age pattern cause of death level and trends of mortality such as migration) It studies the general trends migration movements place of origin and is tination. migration intervals and steams. (It also studies differential migration as age.)

labour force :

Study in made a economically active both employed an an employed that is not economically such as homenokess. Student and Income replants The basis measure of economic activity or labour force analysis include the crude labour force.

The age sex specific labour force participation the standarization labour force participation rate etc, basidis national and International employement and unemployement etc.,

Social Demography :-

It include study of demography aspects of social infection particularly family and marriage. The study of marriage include material states, age / and marriages time / and trend marriage frequently) marriage by religious / group education level etc...,

Population Policies :-

The development of country total very much depend population policies, population policy includes pholosophy guiding principle organization structure and service and supplaced education motivation family planning and family planning progress and achievements etc..., population policies in different country are development according to total requirements.

The above discussion the nature and scope of demography include only major and established area. (The scope of demography has area been constrantly increasing.) Therefore, the new area of research and study are been explored thus the scope is constantly widered.

Difference between vital statistics and census :

Census

Census consists of the complete enumeration of the population of a country or a region under reference and collection information about the individual with regarded to age, sex, marital status, religion - occupation

This is live a still are to die. The population select the human inventory

population census is conducted at a define interval of time mostly ten year.

vital statistics

This is vital statistics collected information / about spend / even crude birth deaths marriage, health, divorce etc.,

vital statistics present a motion piture of the vital event of region. vital statistics provides that analysis of the population with regard to deaths births, failure growth to rate death rates etc.

The collecting of vital statistic is a continuous process.

UNIT - II

VITAL STATISTICS

Definition

Vital Statistics include and mean the statistics of births and deaths. Vital statistics deal mainly with the registration of births and deaths and also provide many other informations on the population growth. The births and deaths have an influence on the population. The population growth depends on births, deaths, marriage, divorce, separation, rate of multiplicity, fertility rate, fecundity of women, etc.

Uses of Vital Statistics

i) Vital statistics are important as a sound base for determination of administrative policies and economic and social policies.

ii) Future population projections can be forecast.

iii) Detailed information like fertility, maternity, mortality, density, etc. gives a way to development of civic amenities

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ii) Future population projections can be forecast.

iii) Detailed information like fertility, maternity, mortality, density, etc. gives a way to development of civic amenities

family planning, schemes of health, etc.

iv) Risk of life policies can be estimated.

v) vital statistics are a must in demographic research.

vi) To solve human problems of a particular area, one has to look to the vital statistics in order to draw proper conclusion.

Sources

The raw data on vital events are generally obtained from.

A. Registration of births and deaths is called vital statistics. It is legally required to register the occurrence of every birth and every death. It is a permanent record. Data on population can be acquired continuously through the birth and death registrations.

B. Enumeration of individuals under the state direction generally at regular intervals is called Census. It usually provides information on the distribution of the population by sex, age, marital status, economic

condition, etc. It provides data every tenth year and not continuously.

c) Adoc surveys by official agencies of a particular region are known as demographic surveys.

Rate of vital events

Census are taken every ten years, and if we want to determine the population between two census we have to make intercensual estimates of the total population, because the population is increased by (1) natural increases (births over deaths) and (2) net migration (immigration over emigration) symbolically.

$$Pt = P_0 (B - D) + (I - E)$$

Pt = Total population at a point of time.

P₀ = Total population at the last census.

B = Total Number of births during the given period.

D = Total Number of deaths during the given period.

I = Total Number of immigrants.

E = Total Number of emigrants.

Thus there are four factors which affect the size of population, viz. births, deaths, immigration and emigration. In these, births and deaths greatly affect the change in population and emphasise the study of fertility and mortality.

Measurement of Fertility

a) Crude birth rate

Crude birth rate means number of persons. Symbolically,

$$\text{Crude birth rate} = \frac{\text{Annual births}}{\text{Total population at the mid-year}} \times 1000$$

Crude birth rates are not generally suitable for the purpose of comparison. The reason is that the percentage of population in each age group may be different. In order to make comparison of birth rates between two populations, allowances should be made for differences in age and sex distribution i.e. the birth rate have to be standardised

by a system of weighted arithmetic mean.

B) General fertility rate

The total live births primarily depends upon the proportion of women in the child bearing age. Therefore the general fertility refers to the proportion of the Number of children born per 1000 females (child bearing age). The formula is

$$GFR = \frac{No.\ of.\ live\ birth \times 1000}{No.\ of.\ female\ population\ of\ 15-49}$$

C) Specific fertility rate

The general fertility rate is an improvement over crude birth rate and it gives a general trend of the fertility rate of the child-bearing age group, 15-49 years, as a whole. To have a detailed and better study, we have to calculate specific fertility rate for different child bearing age groups. It is calculated as

follows

Age specific fertility rate.

$$\frac{\text{No. of births of females of a specified age group} \times 100}{\text{mid-year female population of a specific age group.}}$$

D) Total fertility rate

When we find out the sum of age specific fertility rates at each age group say 15-49 years of age, it will give us the total fertility rate. The formula is,

$$TFR = \frac{SFR \times i}{1000}$$

E) Gross reproduction rate

The general fertility rate indicates the number of children born per 1000 women who are in 15-49 age group. The specific fertility rate indicates the number of children born to women of a particular age group, say 15-19, per thousand, these fertility rates are unsuitable for the study

of the growth of population. The population increases mainly through female babies, who are future mothers. In order to have an idea of the reproduction of population, we have to take into account only the number of female babies which is an important factor.

General reproduction Rate indicates the average number of female children born to a woman of child bearing age. For e.g.

100 females give birth to 100 females G.R.R = 1

100 females give birth to 150 females G.R.R = 1.5

100 females give birth to 80 females G.R.R = 0.8

If the G.R.R is one, it indicates that the set under consideration is exactly replacing. If the rate is more than one, the population would increase

$$G.R.R = \frac{No. \; of. \; female \; births}{Total \; number \; of \; births} \times Total \; F.R$$

The G.R.R does not take into account the mortality factor, but shows rate at

which mothers would be replaced by daughters without considering death rate.

F) Net reproduction rate

G.R.R indicates the number of female children born to 1000 women of child bearing age. It means and indicates the average number of female children born per woman of child-bearing age. G.R.R. does not take into account the current mortality rate. N.R.R is nothing but G.R.R adjusted for the effects of mortality rate. N.R.R is nothing but G.R.R adjusted for the effects of mortality. It measures the extend to which generation of girl babies survive to reproduce babies of their sex, as they pass through the child bearing age group. The formula is:

$$N.R.R = \frac{\text{No. of female children born and survived to 1000 female}}{1000}$$

N.R.R is a good measure of population growth. It can never be greater than G.R.R. because

N.R.R takes into account the mortality factor.

Measurement of mortality

Mortality statistics are important. The number of deaths per thousand of population is known as deathrate or mortality rate. There are many rates used for measuring mortality.

A) General Death Rate (Crude death rate)

The general, death rate is widely used, because it is easy to calculate and to understand. It requires only the total population and the total number of deaths. It gives preliminary indication of the level of mortality. The crude death rate measures the decrease in population due to death.

Crude death rate is not suitable.

for comparing the mortality prevailing in different regions, because the composition of different age groups may differ widely. Therefore standard death rates are to be calculated for purposes of comparison.

B) Age Specific Death Rate

Crude death rates simply reveals the average number of deaths per 1000 persons, irrespective of age. It does not include specifications as to age or sex. In order to study the mortality conditions for a particular section of a population, say, infants, child bearing womens, old persons we have to study the deaths occuring among the particular section. Such specific study of death rate is known as age specific death rate.

$$\text{Specific Death rate (age)} = \frac{\text{No. of deaths which occurred among a specific age group of the population of a given geographic area during the given year}}{\text{Mid year population of the specified age}} \times 1000$$

The specific death rate is a popular measure of mortality. It provides an idea of the chance of dying in each of the age group selected for computation.

D) STANDARD DEATH RATE

Crude death rate is not generally suitable for the purpose of comparison, because the distribution of population among various age groups will be generally different. The proportion of deaths in two populations depends upon the number of children and old aged people whose death

rate is high. To be clear, the age specific death rate will be higher among infants, old people, etc. Thus the comparison of health conditions in two populations through crude death rates will give fallacious conclusions. In order to remove the defects, the death rate is to be standardised for direct comparison of figures. This can be done by assuming the total population of a town as standard for comparison. and the number of local deaths in each age group is applied to the standard population, instead of local population. The process adopted is known as standardisation - standard rates or adjusted rates. The procedure is explained below.

Problem - 1

Compute the specific fertility rate, general fertility rate, total fertility rate and the cross reproduction rate from the data given below:

age group (years)	No. Of Womens (1000)	No. of live birth
15 - 19	25	800
20 - 24	20	2400
25 - 29	18	2000
50 - 34	15	1500
35 - 39	12	500
40 - 44	6	120
45 - 49	4	10
	100	7330

It is given that out of 7550 the number of female birth was 4000.

Solution

Compitation specific fertility rate

Specific Fertility Rate (S.F.R)
[for age 15-19 years]

$$\text{SFR} (15-19) = \frac{800}{25000} \times 1000 = 32$$

$$\text{SFR} (20-24) = \frac{2400}{20000} \times 1000 = 120$$

$$\text{SFR} (25-29) = \frac{2000}{18000} \times 1000 = 111.1\ldots$$

$$\text{SFR} (30-34) = \frac{1500}{15000} \times 1000 = 100$$

$$\text{SFR} (35-39) = \frac{500}{12000} \times 1000 = 41.67$$

$$\text{SFR} (40-44) = \frac{120}{6000} \times 1000 = 20$$

$$\text{SFR} (45-49) = \frac{10}{4000} \times 1000 = 2.5$$

G.F.R.

$$\text{GFR} = \frac{\text{No. of live birth}}{\text{No. of women's age (15-49) (years)}} \times 1000$$

$$= \frac{7550}{1000000} \times 1000 \quad 7.33$$

It is clear from above that (15-19) age group SFR is 32. Accordingly 1000 females exactly age 15, would by the time, they reach 20. have born $32 \times 5 = 160$. children. It is necessarily

to multiply by 5. Since the specific fertility rate is a rate per annum and by the time the females reach the age of 20. They will have spend 5 years in the age group 15-19.

In the table below show the no. of. births which 1000 female will have born by the time they reach certain age.

Exact age (years)	SFR × 5	Total birth per 1000 female age 15/Started age
15	0	0
20	32 × 5 = 160	160
25	120 × 5 = 600	7.60
30	111.1 × 5 = 555.5	1315.5
35	100 × 5 = 500	1815.5
40	41.67 × 5 = 208.35	2023.85
45	20 × 5 = 100	2123.85
50	2.5 × 5 = 12.5	2136.35

Total Fertility Rate

$$T.F.R = \frac{\Sigma(S.F.R)}{1000}$$

$$= \frac{2136.35}{1000}$$

$$= 2.13635$$

$$T.F.R = 2.14$$

Gross Reproduction Rate

$$C.R.R = \frac{No. \text{ of. female birth}}{Total \text{ birth}} \times T.F.R$$

$$= \frac{\frac{4000}{100000}}{7530} \times 2.14 \Rightarrow \frac{13.642 \times 2.14}{}$$

$$= 29.195$$

$$G.R.R = 1.167$$

2. Calculate the Gross and Net Reproduction rate from the data given below.

No. of. womens in age groups and No. of children born in one year.

Age groups	Female Population (1000)	Female borns	Survival rate
15-19	1600	190000	0.921
20-24	1000	70200	0.901
25-29	1685	90600	0.885
30-34	1750	62400	0.862
35-39	1725	32500	0.850
40-44	1620	11000	0.832
45-49	1510	800	0.812

Solution

$$\text{S.F.R Per Women} = \frac{\text{No. of. female } \overset{\text{birth}}{\cancel{\text{Population}}}}{\text{Female Population}} \times \cancel{1000}$$

Age group	Female Population	Female borns	S.F.R Per Women
15-19	1600000	190000	0.011875
20-24	1000000	70200	0.0702
25-29	1685000	90600	0.05438
30-34	1730000	62400	0.0361
35-39	1725000	32500	0.019
40-44	1620000	11000	0.0068
45-49	1510000	800	0.00053

$$= 0.1981$$

Cross reproduction rate = $\Sigma SFR \times 5$

$= 0.1981 \times 5$

$= 0.9905$

Cross reproduction
rate $= 0.9905$

Net reproduction rate is the no. of. female children survive in dill the reproduction born to on women as she passage through children bearing age. This it is ΣSFR per women for all age $\times$ survival rate for expressed in 5 yearly age group it is the ΣSFR per women for group $\times$ survival rate $\times 5$ the calculation are show below.

Net reproduction = $\Sigma SfR \times 5$
rate

$= 0.117 \times 5$

$= 0.585$

Net Reproduction Rate = 0.585 13.08.5.75

Age group	Female population (1000)	Female borns	SFR Per woman	Survival Rate	S.F.R x 5
15-19	1900	19000	0.0110	0.921	0.0109 0.0505
20-24	1000	70200	0.00702	0.901	0.0063 0.351
25-29	1985	90600	0.054	0.885	0.0477 0.27
30-34	1730	92400	0.0570	0.862	0.0311 1.32
35-39	1725	32500	0.019	0.850	0.016
40-44	1920	11000	0.0068	0.832	0.0043 0.034
45-49	1510	800	0.00053	0.812	0.00043 0.005
				Total	0.41773 = 2.6177/5

A# Calculate the total Fertility rate and
2. cross reproduction rate.

Age group	No. of. womens	G.F.R Per 1000.
15-20	100	15
20-25	120	100
25-30	110	120
30-35	105	140
35-40	100	80
40-45	80	50
45-50	70	10

Solution

Age group	No. of. womens	S.F.R Per (1000)	No. of. childrens born [N. of W × S.F.R / 1000]
15-20	100	15	1.500
20-25	120	100	12
25-30	110	120	13.2
30-35	105	140	14.7
35-40	100	80	8
40-45	80	50	4
45-50	70	10	0.7
Total	=685	=515	=54.1

Cross Reproduction Rate = $\dfrac{\text{Total No. Of. Children born}}{\text{Total No. Of. Women}} \times 1000$

$= \dfrac{54.1}{685} \times 1000$

$= 78.98 \,(\text{Per } 1000)$

Total Fertility Rate = $\text{F.R} \times 5$

$= 515 \times 5$

$= 2575 \,(\text{Per } 1000)$

48. From the following figures calculate the female cross reproduction rate if the ratio of the rate and female children born.

48 : 52

Age group	No. Of. Children born In 1000 Women
15-19	50
20-24	180
25-29	200
50-54	150
55-59	80
40-44	40
45-49	10

Soln

Age group	No. of. Children born in 1000 women	No. of. female children born
15-19	50	26
20-24	180	93.6
25-29	200	104
30-34	150	78
35-39	80	41.6
40-44	40	20.8
45-49	10	5.2
Total	= 710	= 369.2

Gross Reproduction Rate = $\dfrac{\text{Total birth of 1000 women}}{1000}$

$$= \dfrac{\text{Total No. of. female children born}}{\text{Total No. of. Womens}}$$

$$= \dfrac{369.2}{1000}$$

$$= 0.3692 \ (\text{Per } 1000)$$

5 Calculate the Net reproduction from the following data

Age group of Child bearing female	No. of female children born 1000 women causing through age/age group	No. of. Survival rate out of each 1000 female children.
15-20	50	850
20-25	180	800
25-30	450	750
30-35	500	700
35-40	800	650
40-45	100	600
45-50	40	500

No. of. Survival rate which replaced Present women $= \dfrac{\text{No. of. f. ch. born} \times \text{No. of. Survival f.}}{1000}$

A.g of C. b.women	No. of. female children born 1000 women causing thru—	No. of. Survival	No. of. S. rate which replaced Present women
15-20	50	850	42.5
20-25	180	800	144
25-30	450	750	337.5
30-35	500	700	350
35-40	300	650	195
40-45	100	600	60
45-50	40	500	20

Net Reproduction

$$\text{Rate} = \frac{\sum\left(\substack{\text{No. of. female} \\ \text{children born}} \times \substack{\text{No. of.} \\ \text{survival} \\ \text{rate}}\right)}{1000}$$

$$= \frac{1149}{1000}$$

$$= 1.149$$

b| From the data given below calculate the Gross and Net reproduction rate

Age group	No. of. Children born to 1000 Women Passing through the age group	mortality rate
16-20	150	120
21-25	1500	180
26-30	2000	150
31-35	800	200
36-40	500	220
41-45	200	230
46-50	100	250

Sexs ratio being male and female

42:58 52:48

Age group	No. of children born to 1000 women passing through the age group	No. of female children 48%	Survival rate [1000-m] 1000 mortality rate	No. of female children Survival
16-20	150	72	1000-120 = 880	63.36
21-25	1600	720	820	590.4
26-30	2000	960	850	816
31-35	800	384	800	307.2
36-40	500	240	780	187.2
41-45	200	96	770	73.92
46-50	100	48	750	36
Total		2520	5450	2074.08

Gross Reproduction Rate

$$G.R.R = \frac{\text{Total No. of. female born}}{1000}$$

$$= \frac{2520}{1000}$$

$$G.R.R = 2.52$$

Net Reproduction Rate

$$N.R.R = \frac{\text{No. of. female borns}}{\underset{\text{Survival to 1000 women}}{\text{and}}}$$
$$\frac{}{1000}$$

$$= \frac{2074.08}{1000}$$

$$N.R.R = 2.07408. \text{(Per 1000 Womens)}$$

7. Compute the Crude and Standardised death rate of the two population A and B from the following data.

Age group (years)	A		B	
	Population	Death	Population	Death
below 5	15000	360	40000	1000
5 - 30	20000	400	52000	1040
above 30	10000	280	8000	240
	45000	1040	100000	2280

Solution

$$\text{Crude death rate} = \frac{\text{No. of deaths}}{\text{Population}} \times 1000$$

$$\text{Crude death rate } A = \frac{1040}{45000} \times 1000$$

$$= 23.11$$

$$\text{Crude death rate } B = \frac{2280}{100000} \times 1000$$

$$= 22.8$$

Standardised death rate taking population of town as standard population.

Age group	A			B		
	Population	Death	Death rate per 1000	Population	Death	Death per 1000
Below 5	15000	360	24	40,000	1000	25
5-30	20,000	400	20	52000	1040	20
above	10000	280	28	8000	240	30
Total	45000	1040		100000	2280	

Standardised death rate (town A)

$$= \frac{\left[(15000 \times 24) + (20000 \times 20) + (10000 \times 28)\right]}{15000 + 20000 + 10000}$$

$$= \frac{360000 + 400000 + 280000}{45000}$$

$$= \frac{1040000}{45000} = 23.11$$

Standardised death rate (town B)

$$= \frac{\left[(40000 \times 25) + (52000 \times 20) + (8000 \times 30)\right]}{40000 + 52000 + 8000}$$

$$= \frac{1000000 + 1040000 + 240000}{100000}$$

$$= \frac{2280000}{100000} = 22.8$$

We can say that the death rate in town B is higher than in town A.

8. From the following table compare the death rate in towns A and B

Age group	Town A		Town B				Standard town C Population	
	Population	No. of deaths	Populati-on		No. of deaths		Population	No. of deaths
0-10	4000	36	9	3000	30	10	2000	60	30
10-25	12000	48	4	20000	100	5	8000	8	1
25-60	6000	60	10	4000	48	12	6000	4	26
60 above	8000	152	19	3000	60	20	4000	50	12-5
Total	30,000	296		30000	238		20000	122	

Solution.

Standardised death rate Town A

Town A

$$= \frac{\left[2000(9) + 8000(4) + 6000(10) + 4000(19)\right]}{2000 + 8000 + 6000 + 4000}$$

$$= \frac{18000 + 82000 + 6000 + 76000}{20,000} = \frac{186000}{20000}$$

$$= 9.3$$

standardised death rate town B

$$= \frac{[2000\,(10) + 8000\,(5) + 6000\,(12) + 4000\,(20)]}{2000 + 8000 + 6000 + 4000}$$

$$= \frac{20000 + 40000 + 72000 + 80000}{20000}$$

$$= 10.6$$

Death rate is lower in town A compared to Town B. Hence Town A is more healthy.