Demography

Demography

- Demography is the scientific study of human population.
- It focuses its attention on three readily observable human phenomenon:
  - Changes in population size (growth & / or decline),
  - Composition of population,
  - The distribution of population in space,
  - *Causes of changes in these factors over time,*
  - *Consequences of these changes over time.*

- It deals with five ‘demographic processes’
  - Fertility
  - Mortality
  - Marriage
  - Migration
  - Social mobility
- These five processes are continuously at work within a population determining size, composition & distribution.

The knowledge in demography is helpful to public health administrators for various purposes :

- i) Mortality rates by age-sex and its geographical distribution with respect to various diseases are helpful in locating and identifying diseases of public health importance with respect to age-sex-location, for planning remedial measures to control these diseases, future planning for prevention of these diseases, for determining leading causes of mortality, for planning drugs/medicines/equipment/manpower/other medical facilities requirements etc.

- Percentage distribution of population by age-sex-location are helpful in understanding health and health care needs of various age groups by sex by location, for planning, designing, evaluation and effective implementation of various public health programs.
- For example : Vaccination and immunization program for children under 5 years of age, Mother and Child Health program for mother and new born, Family planning program, old age program, nutritional program etc.

- Determining the success or failure of health programs.
- To describe the level of community health.
- To determine the leading causes of mortality and morbidity.
- To determine the relative importance of different fatal diseases with respective to age and sex.
- To discover solution to health problems and find clues for public health administration.

DEMOGRAPHIC CYCLE

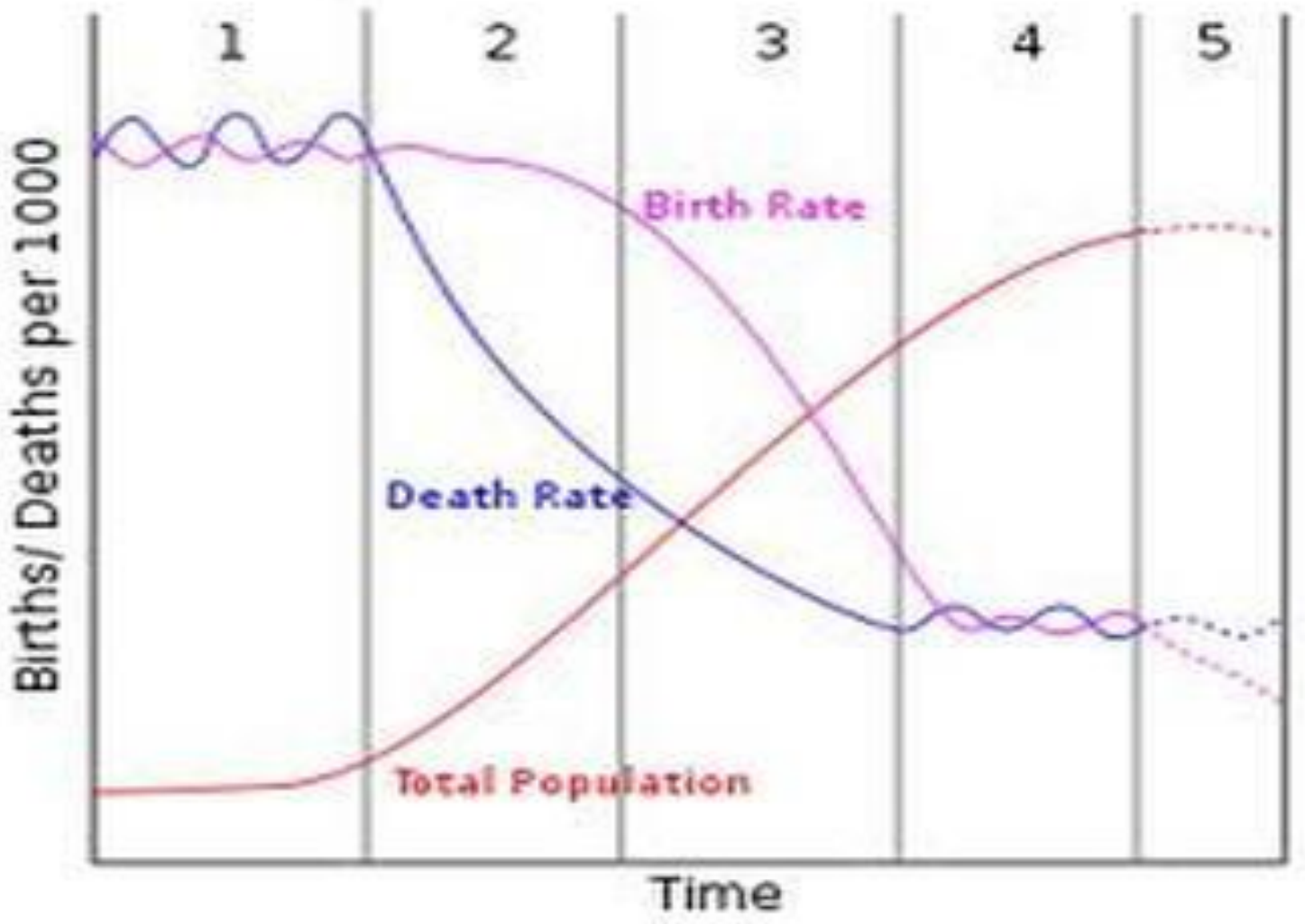
- Demographic cycle has 5 stages through which a nation has to pass
- **First stage (high stationary):**
  - ✓ This stage is characterized by a high death rate & a high birth rate which cancel each other & the population remains stationary (balance between them results in only very slow population growth that is referred to as the “High Stationary Stage” of population growth).
  - ✓ This situation was true of all human populations up until the late 18th century. India was in this stage till 1920.

- **Second stage (early expanding):**
  - ✓ The second stage is characterized by a rise in population caused by a decline in the death rate while the birth rate remains unchanged, or perhaps even rises slightly.
  - ✓ The decline in the death rate in Europe began in the late 18th century.
  - ✓ Many countries in South Asia and Africa are in this stage.

- **Third stage (late expanding) :**
  - ✓ The death rate decline still further, & the birth rate tends to fall.
  - ✓ The population continues to grow birth rate exceeds death rate. India has entered this phase.
- **Fourth stage (low stationary):**
  - ✓ This stage is characterized by a low birth & low death rate with the result that population becomes stationary.
  - ✓ Eg. Zero population growth has already been recorded in Austria during 1980 – 85.

- **Fifth stage (declining):**
  - ✓ The population begins to decline because birth rate is lower than the death rate.
  - ✓ Eg. East European countries like Germany and Hungary.

STAGE OF DEMOGRAPHIC TRANSITION



WORLD POPULATION TRENDS

- The **demographic features of the population of the world** include population density, ethnicity, education level, health measures, economic status, religious affiliations and other aspects of the population.

World Population[13][14]	
Year	Million
1500	458
1600	580
1700	682
1750	791
1800	978
1850	1,262
1900	1,650
1950	2,521
1999	5,978
2008	6,707
2013	7,096

Most Populated Countries in the World

Country	Capital City	Population	% of world population
China	Beijing	1,306,313,800	19.08%
India	New Delhi	1,080,264,400	17.14%
USA	Washington DC	295,734,100	4.46%
Indonesia	Jakarta	241,973,900	3.37%
Brazil	Brasilia	186,112,800	2.75%
Pakistan	Islamabad	162,419,900	2.57%
Bangladesh	Dhaka	144,319,600	2.16%
Russia	Moscow	143,420,300	2.31%
Nigeria	Abuja	128,772,000	2.36%
Japan	Tokyo	127,430,000	1.81%

Sources of Demographic Data

- **The following are the sources** of demographic data

DATA COLLECTION

- Health information is an integral part of the national health system. Data collection is important in terms of planning & evaluating various health activities.

DATA:

- Data consists of discrete observations of attributes or events that carry little meaning when considered alone; data as collected from operating health care systems or institutions are inadequate for planning.

- Data need to be transformed into Information by reducing them, summarizing them and adjusting them for variations, such as the age & sex composition of the population so that comparisons over time and placer are possible. It is the transformation of information through integration and processing with experience and perceptions based on social and political values that produces intelligence.

METHODS OF DATA COLLECTION

- Census
- Registration of Vital Events
- Sample Registration System (SRS)
- Notification of Diseases
- Hospital Records
- Disease Registers
- Record Linkage
- Epidemiological Surveillance
- Other Health Service Records
- Environmental Health Data
- Health Manpower Statistics
- Population Surveys

METHODS OF DATA COLLECTION

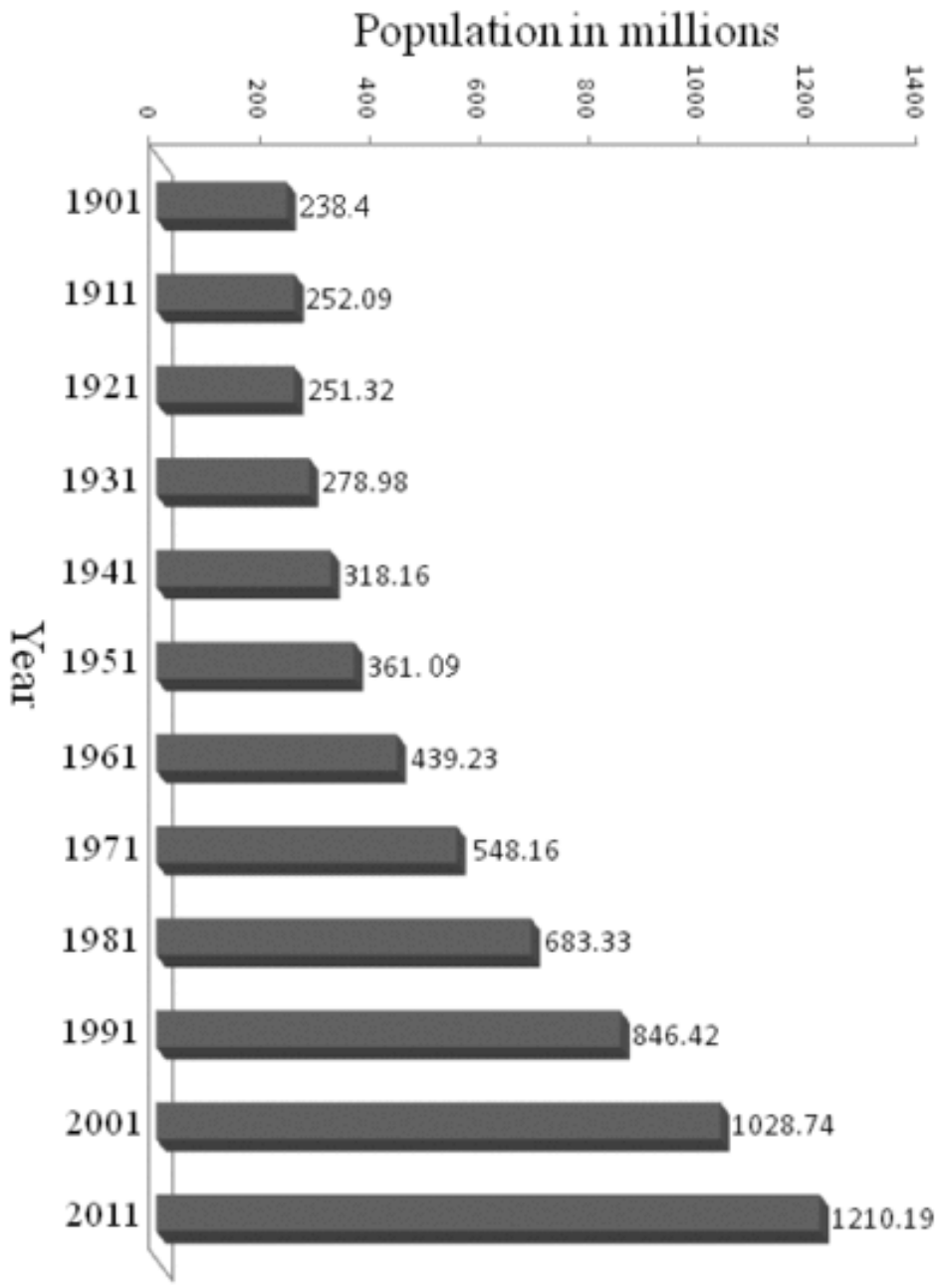
- **CENSUS:**
- A census is defined by the United Nations as “the total process of collecting, compiling and publishing demographic, economic and social data pertaining at a specified time or times, to all persons in a country or delimited territory ”
- Census means “to enumerate”. It consists of a sequence of activities concerned with collection, collation and factual presentation of data pertaining to social, demographic and health related factors, in respect of a nation (or large population group), undertaken periodically, and having some sort of statutory back - up for it to be undertaken.

- The periodicity of census is generally kept as once in 10 years, and it is generally undertaken during the first quarter of the first year of the decade.
- It was started in 1881.
- The amount of data collected may vary, from as little as population size and age / sex structure on one end to a large number of social, economic, demographic and health related variables on the other end; however, a fairly developed census mechanism would usually provide information regarding total population, density according to per square kilometers of land area, decadal growth rate, literacy rate, economic conditions, occupational characteristics, and selected indicators of mortality like overall death rate and infant mortality rate. A legal authority constituted by the government is generally made responsible for the collection, collation and publication of census data.

- Methods of collection of data in a census :
- (a) de - facto method : Persons are enumerated according to their location at the time of enumeration. This method is used in developing countries like India.
- (b) de - jure method : This method is used in developed countries like U.S.A.
- The persons are assigned according to their “usual” place of residence and not according to their location at the time of census, as practiced in de - facto method.
- This method provides a better indication of permanent population and related socio - demographic factors of an area, though it is more expensive and needs much better level of training of census data collectors

2011 census of India

- The **15th Indian census** was conducted in two phases,
- house listing and
- population enumeration.
- House listing phase began on 1 April 2010 and involved collection of information about all buildings. Information for National Population Register was also collected in the first phase, which will be used to issue a 12-digit unique identification number to all registered Indians by Unique Identification Authority of India.
- The second population enumeration phase was conducted between 9 to 28 February 2011. Census has been conducted in India since 1872 and 2011 marks the first time biometric information was collected.


Population in millions
0
200
400
600
800
1000
1200
1400
Year
1901
238.4
1911
252.09
1921
251.32
1931
278.98
1941
318.16
1951
361. 09
1961
439.23
1971
548.16
1981
683.33
1991
846.42
2001
1028.74
2011
1210.19

POPULATION [1]	**Persons**	**1,21,01,93,422**	
	Males	62,37,24,248	
	Females	58,64,69,174	
DECADAL POPULATION GROWTH 2001-2011		**Absolute**	**Percentage**
	Persons	**18,14,55,986**	**17.64**
	Males	9,15,01,158	17.19
	Females	8,99,54,828	18.12
DENSITY OF POPULATION [2] (per sq. km.)		**382**	
SEX RATIO (females per 1000 males)		**940**	
POPULATION IN THE AGE GROUP 0-6 [1]		**Absolute**	**Percentage to total population**
	Persons	**15,87,89,287**	**13.12**
	Males	8,29,52,135	13.30
	Females	7,58,37,152	12.93
LITERATES [1]		**Absolute**	**Literacy rate**
	Persons	**77,84,54,120**	**74.04**
	Males	44,42,03,762	82.14
	Females	33,42,50,358	65.46

Literacy

S.No.	Census Year	Total (%)	Male (%)	Female (%)
1	1901	5.35	9.83	0.60
2	1911	5.92	10.56	1.05
3	1921	7.16	12.21	1.81
4	1931	9.50	15.59	2.93
5	1941	16.10	24.90	7.30
6	1951	16.67	24.95	9.45
7	1961	24.02	34.44	12.95
8	1971	29.45	39.45	18.69
9	1981	36.23	46.89	24.82
10	1991	42.84	52.74	32.17
11	2001	64.83	75.26	53.67
12	2011	74.04	82.14	65.46

- **REGISTRATION OF VITAL EVENTS:**

  Live births, deaths, fetal deaths, marriage, divorces, adoptions, legitimations, recognitions, annulments & legal separations

- **The Central Birth & Registration Act 1969:** It came in force on 1st April 1970.
- The act provides for compulsory registration of birth & deaths & other Vital events throughout the country.
- The time limit for registration of birth is 14 days & that of death is 7 days. In default a fine of Rs. 50/- can be imposed. But still there is lack of registration of birth (38-97%) & in death (3-83%). It is because of illiteracy, ignorance, lack of concern & motivation.

LAY REPORTING: It is the collection of information , its use, and its transmission to other levels of the health system by non-professional health workers.

SAMPLE REGISTRATION SYSTEM (SRS):

- SRS is based on a system of double recording method.
- The first part of record collection is done by a part time enumerator (usually the local school teachers) in his or her area.
- In the second part, once in six months, an official from the SRS department, who is a full time enumerator independently collects data on these aspects form all the households in the sample villages and urban blocks.
- The SRS is undertaken under the authority of the Registrar General of India.

- As of now, the SRS has more than 6670 sampling units, including 4435 in rural and 2235 in urban areas, covering a sample population of almost 6 million population.
- Each rural sampling unit has a complete village (subject to maximum population of 1500) while each urban sampling unit is equivalent to an urban census enumeration block with population of 750 to 1,000.

Notification of Diseases

- Usually diseases considered to be serious public menace are notified.
- As per International Health Regulation , Cholera, Plague, Yellow Fever are to be notified to WHO, Geneva.
- International Surveillance is required for Louse borne Typhus, relapsing Fever, Polio, Influenza, Malaria, Rabies, Salmonellosis.
- The primary purpose of notification is to effect prevention & control of disease.
- Mainly Health workers at grass-root level report the disease.

Hospital records

- The Drawbacks of hospital records
- They constitute the “ tip of the ICE-BERG.”
- Admission policy varies from hospital to hospital.
- There are no precise boundaries to the catchment area of the hospital.

Disease registers

- A register is a permanent record & here the cases can be followed-up.
- Morbidity registers exist only for Stroke, MI, TB, Leprosy, Congenital Rubella & congenital defects.
- If the reporting system is effective, & the coverage is on national basis, than register can provide useful data on disease specific morbidity & mortality.

Record linkage

- It is the process of bringing together records relating to one individual.
- “Medical Record Linkage” is the assembly & maintenance for each individual in a population , of a file of the more important records relating to his health.
- The main drawback is the volume of data it can accumulate.
- It is used only on limited scale e.g. in twin studies & genetic diseases.

Epidemiological surveillance

- Surveillance systems are often set-up in case where a disease is endemic e.g., Malaria.
- To report New cases
- To know the result of efforts to control the diseases.

OTHER HEALTH SERVICE RECORDS

- Records of hospitals OPD .
- Primary Health Centres.
- Private practitioners Maternal &
- Child Health Centres.

Environmental health data:

- It may be the data of air water & noise pollution
- Industrial intoxicants.

HEALTH MANPOWER STATISTICS:

- State Medical/ dental / Nursing Council can provide information of the respective health manpower.
- Ministry of Health & Family Welfare , Govt. of India publishes every year the statistics data as “Health Information of India.”

Population surveys:

- Health surveys can be broadly classified into 4 types on basis of method applied for data collection.
  - Health Interview (face to face) survey
  - Health examination survey here treatment is also provided to the people suffering from the disease.
  - Health records survey cheapest method.
  - Mailed questionnaire survey. Has a high rate of non-response.

Other routine statistics related to health

- Demographic
- Economic
- Social security schemes

METHODS OF DATA Interpretation

- **Presentation of statistical data**
- There are several methods of data presentation, which includes
- Tables
- Charts
- Diagrams
- Graphs
- Pictures
- Special curves

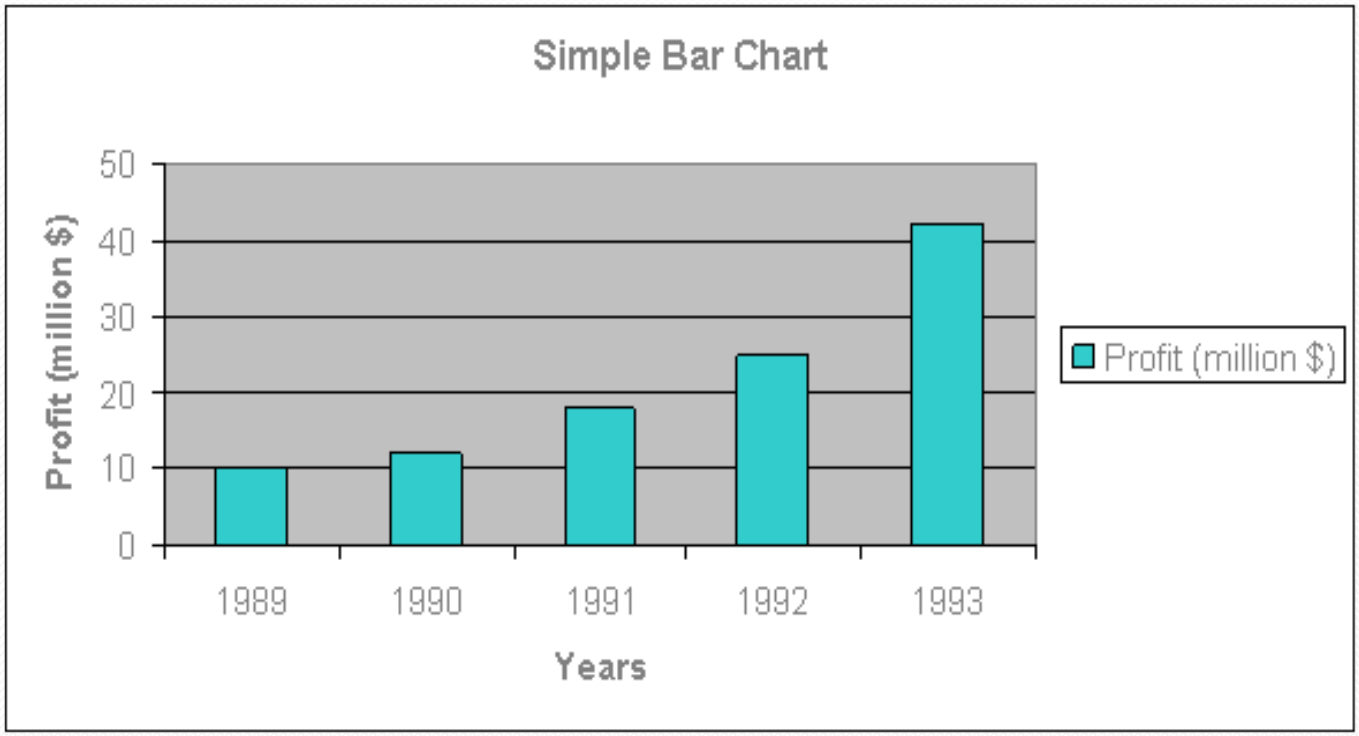
- **TABLES**
- Tables are devices for presenting data simply from masses of statistical data. Tabulation is the first step before the data is used for analysis or interpretation.
- Tables can be simple or complex, depending upon the number or measurement of a single set or multiple sets of items.
- Types:
- Simple tables
- Frequency distribution tables

Adult Arrests for Aggravated Assault - Sussex County Source: Uniform Crime Report	
Year	Number of Arrests
2003	47
2004	55
2005	71
2006	46
2007	60
2008	63
2009	51

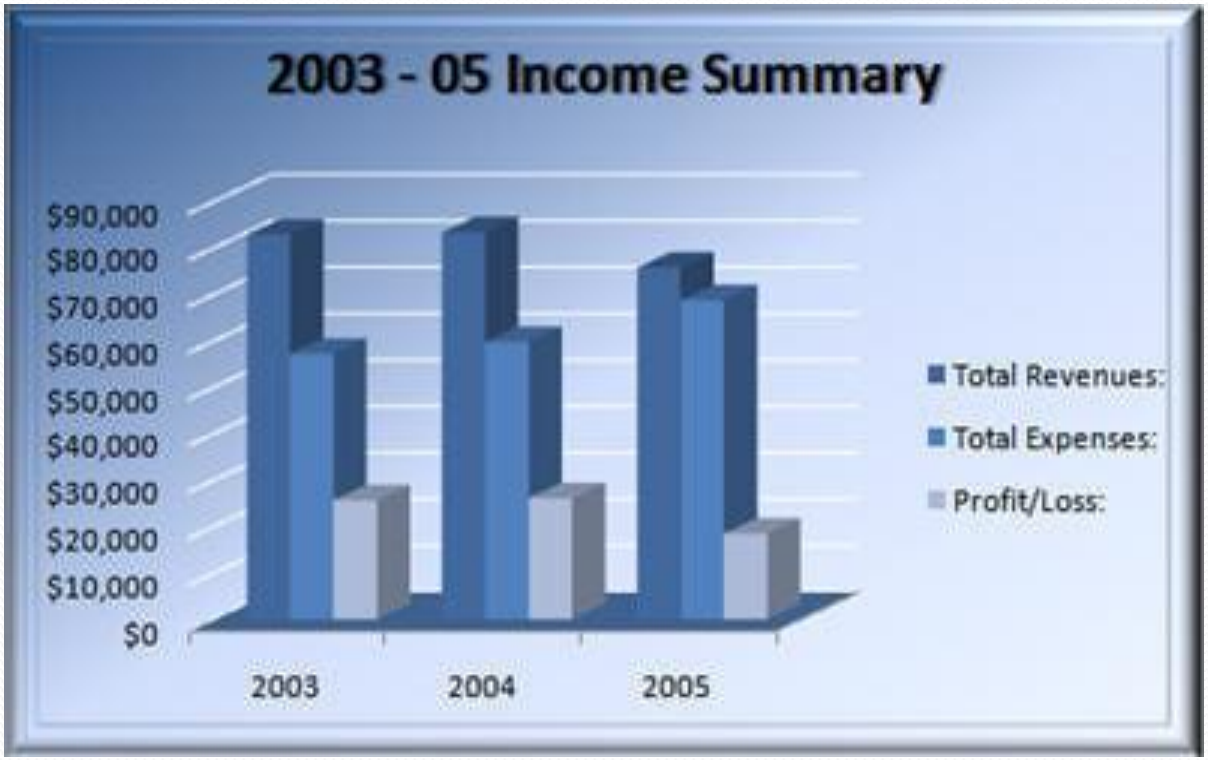
Class (Rs.)	Tally Marks	Frequency Students
20 - 30	𝍸	5
30 - 40	𝍸 |||	8
40 - 50	𝍸 ||||	9
50 - 60	𝍸 𝍸	10
60 - 70	𝍸 |	6
70 - 80	||	2
Total		**40**

- **CHARTS AND DIAGRAMS**
- 1. **Bar Charts:**
- Bar charts are merely (just)a way of presenting a set of numbers by the length of a bar the length of the bar is directly proportional to the magnitude(size) to be represented.
- Simple bar charts
- Multiple bar charts
- Component bar charts

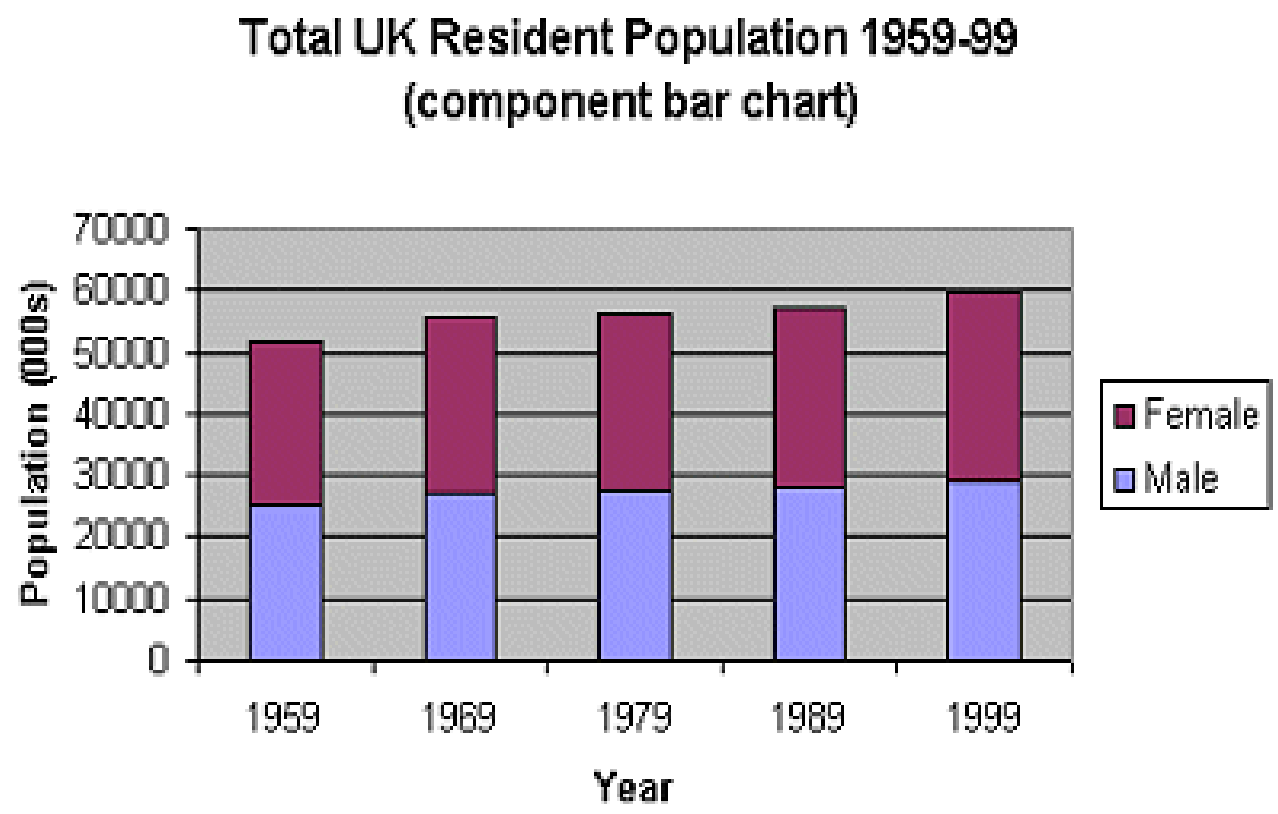
Simple bar charts



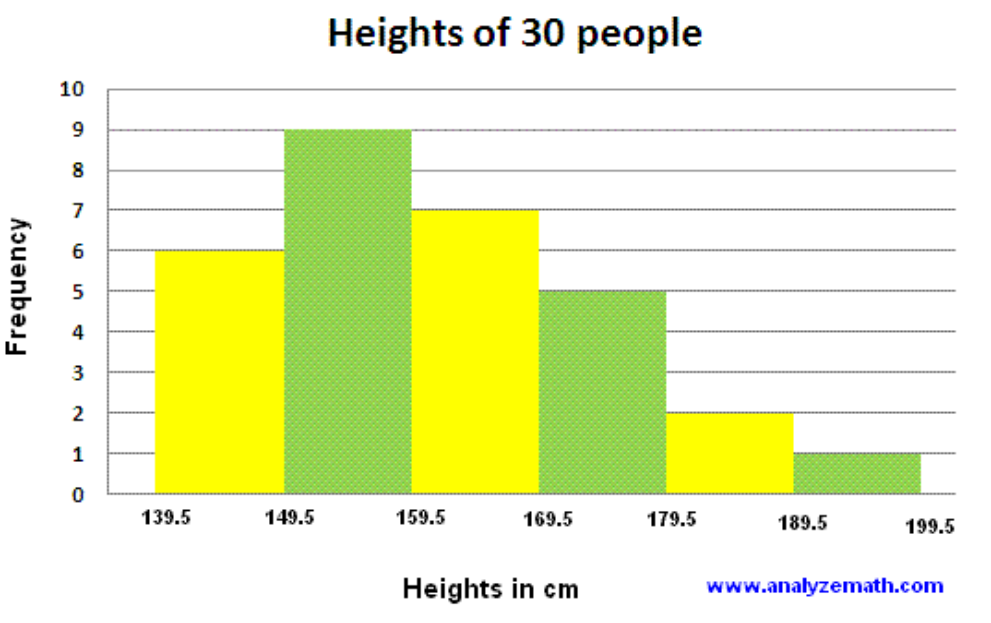
Multiple bar charts



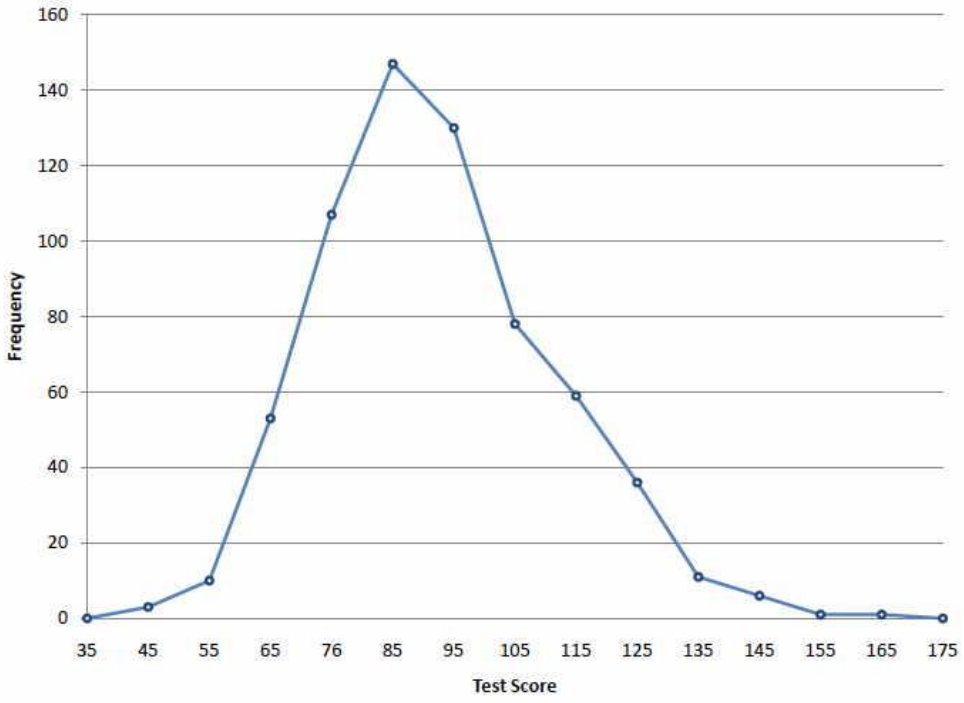
Component bar charts

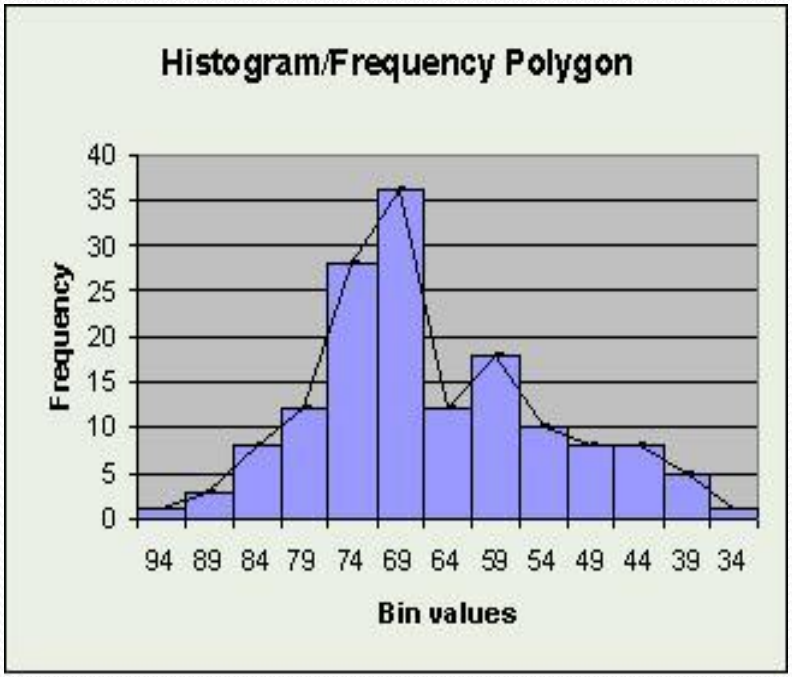


- **Histogram:**
- It is a pictorial diagram of frequency (repeated)distribution.
- It consists of series of blocks.
- The class intervals are given along the horizontal axis & the frequencies along the vertical axis.
- The area of each blo
  the frequency.

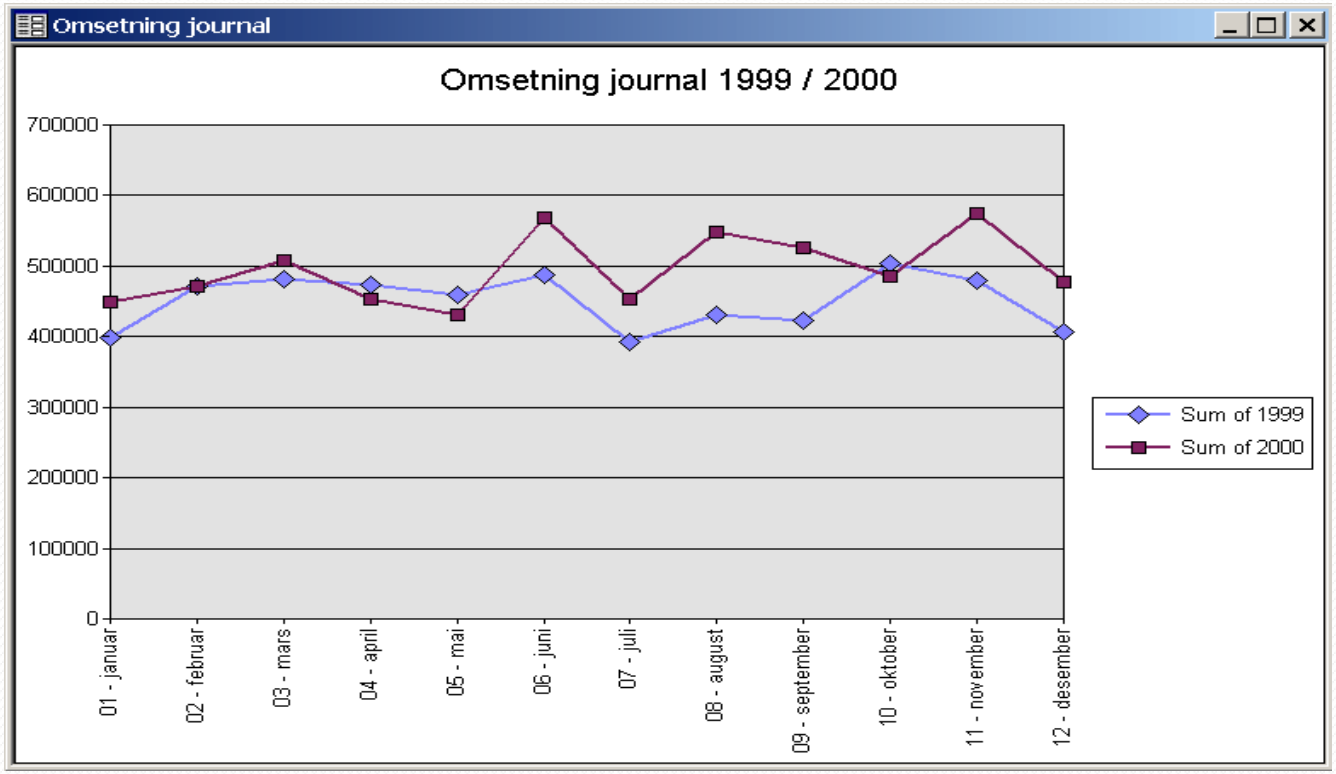


- **Frequency polygon:**
- A frequency distribution may also be represented diagrammatically by the frequency polygon.
- It is obtained by joining the mid points of the histogram blocks.





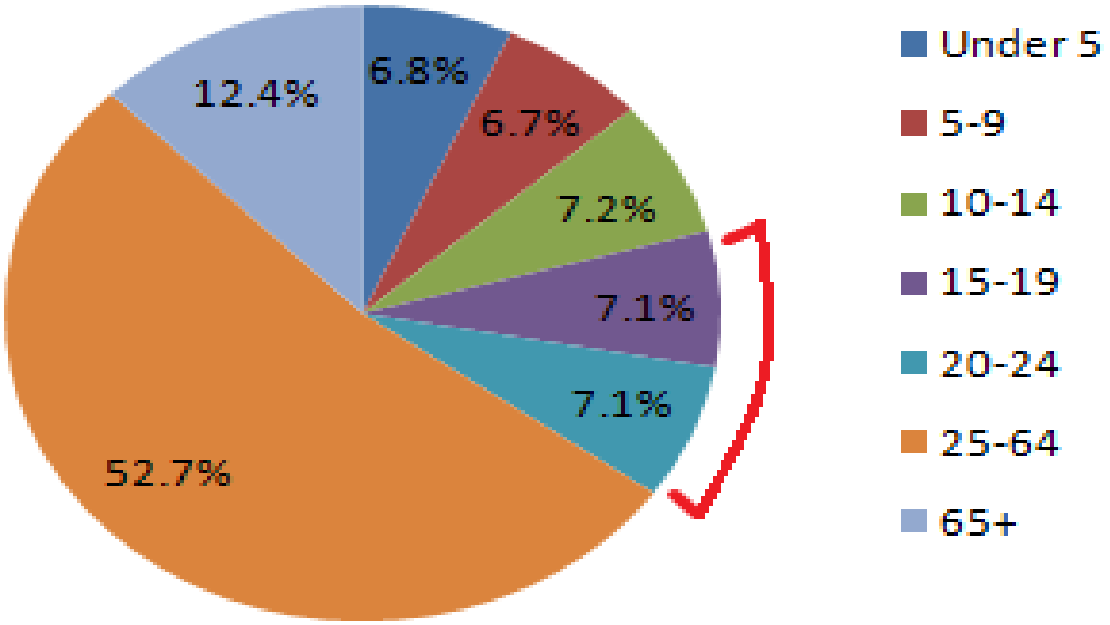
- **Line diagram:**
- Line diagrams are used to show the trend of events with the passage of time.



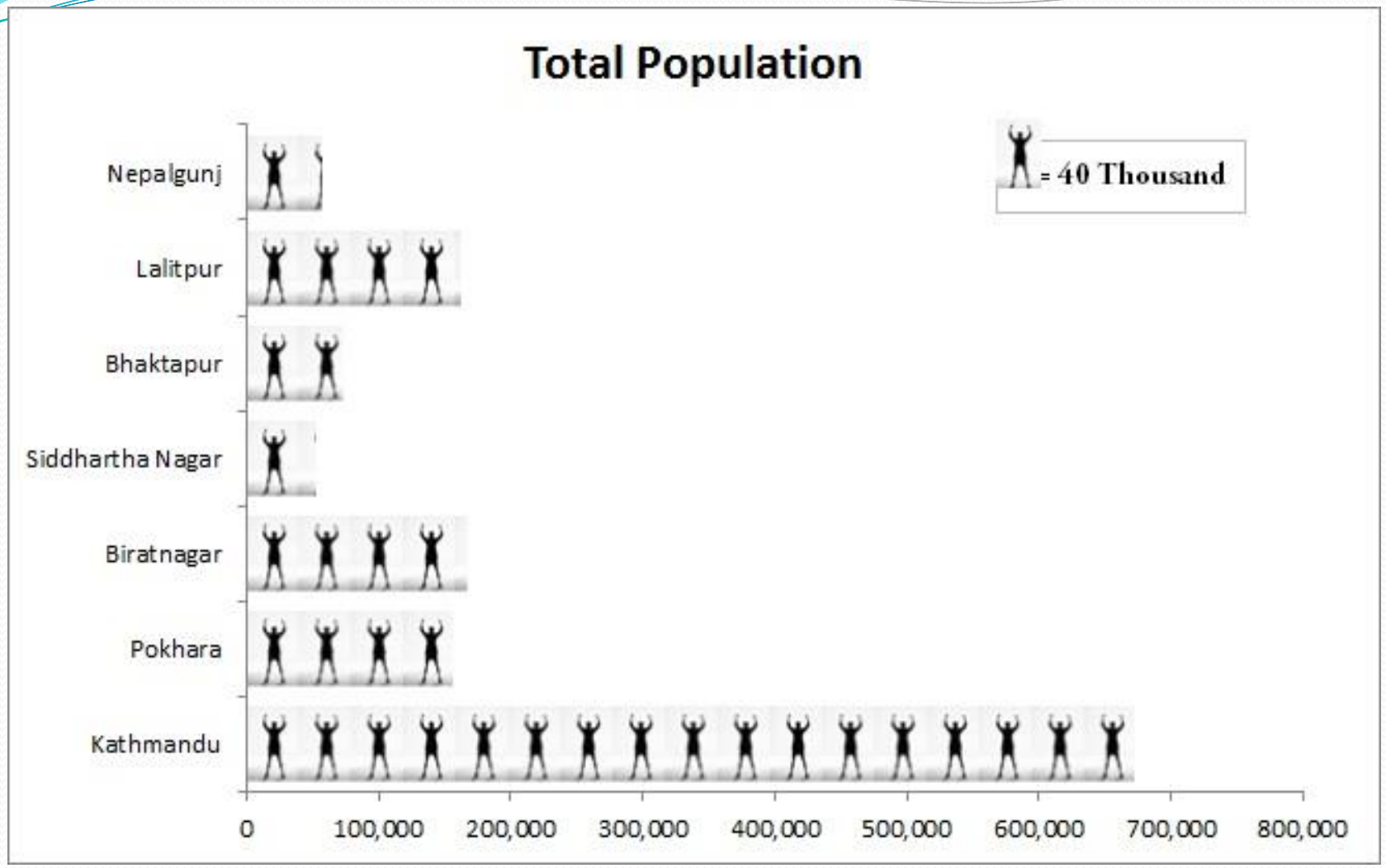
- **Pie charts:**
- Instead of comparing the length of a bar, the areas of segment of a circle are compared. The area of each segment depends upon the angle.
- Pie charts are extremely popular with the laity, but not with the statisticians who consider them inferior to bar charts. It is often necessary to indicate the percentages in the segments, as it may not be sometimes very easy, virtually to compare the areas of segments.
- Formula for calculating angle of segment is as follows:

$$\text{Degree to be presented} = \frac{\text{Frequency of data}}{\text{total frequency}} \times 360^{o}$$

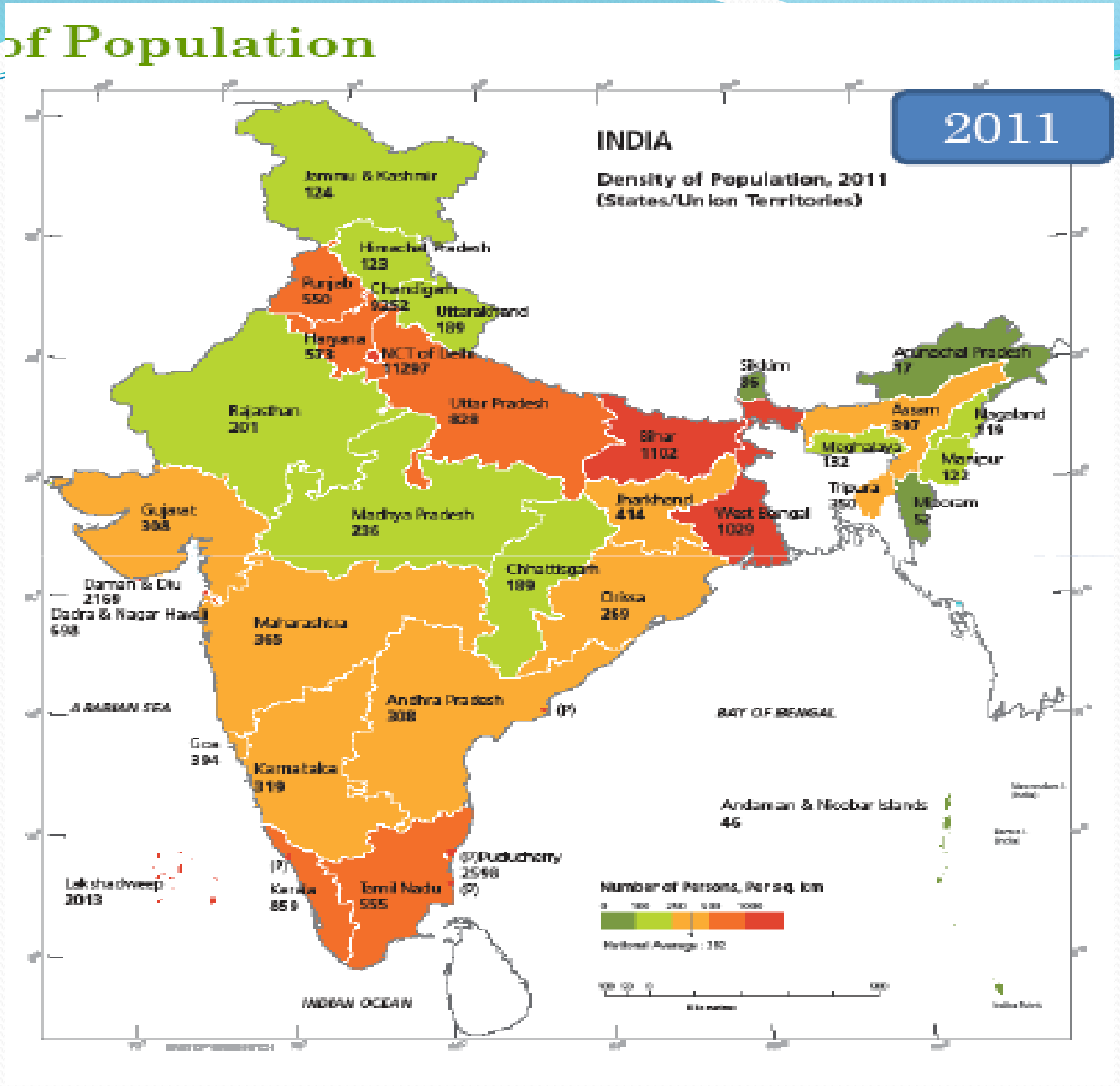
Population by Age Group



- **Pictogram:**
- In pictogram small pictures or symbols are used to present the data.
-
- **Statistical map:**
- These are used to present the data of different sizes & are presented in form of shaded maps or dot maps.
- In order to indicate relationship of two variables, scattered diagrams are used. A linear relationship is evident if the dots are near or around a straight line.


Total Population
= 40 Thousand
Nepalgunj
Lalitpur
Bhaktapur
Siddhartha Nagar
Biratnagar
Pokhara
Kathmandu
0
100,000
200,000
300,000
400,000
500,000
600,000
700,000
800,000

# of Population



- **Normal distribution curve:**
- Normal distribution curve is used to present the values for a very large number of people after creating narrow class interval with frequency distribution.
- The shape of curve is based on mean and standard deviation. There is a mean value & the limits on either side of mean are the confidence limits, from which the probability of a subject falling outside the confidence limit can be identified.

DEMOGRAPHIC RATES & RATIOS

- **Birth Rate:**
- Birth rate is defined as 'the number of live births per 1000 estimated mid – year population, in a given year'.
-
- Birth rate = Number of live births during the year X 1000
- Estimated midyear population

- **General Fertility Rate (GFR):**
- It is the ‘number of live births per 1000 women in the reproductive age group (15 – 44 yrs) in a given year.
-
- General Fertility Rate = Number of live births in an area during the year X 1000
  Mid year female population (15 – 44 yrs) in the same area in the same year

- **General Marital Fertility Rate (GMFR):**
- It is the ‘number of live births per 1000 married women in the reproductive age group (15 – 44 yrs) in a given year.
-
- **Age Specific Fertility Rate:**
- Number of live births in a year to 1000 women in any specified age group.

- **Age Specific Marital Fertility Rate:**
- Number of live births in a year to 1000 married women in any specified age group.
- **Total Fertility Rate (TFR):**
- TFR represents the average number of children a woman would have if she were to pass through her reproductive years bearing children at the same rates as the women now in each age group.

- **Total Marital Fertility Rate (TMFR):**
- Average number of children that would be born to a married woman if she experiences the current fertility pattern throughout her reproductive span.
-
- **Gross Reproduction Rate (GRR):**
- Average number of girls that would be born to a woman if she experiences the current fertility pattern throughout her reproductive span (15 – 44 yrs), assuming no mortality.

- **Net Reproduction Rate (NRR):**
- NRR is defined as the number of daughters a newborn girl will bear during her lifetime assuming fixed age – specific fertility & mortality rates.
-
- . **Child – woman ratio:**
- It is the number of children (0 – 4 years) of age per 1000 women of child bearing age.
-

- **Pregnancy rate:**
- It is the ratio of number of pregnancies in a year to married women in ages 15 – 44 years. The number of pregnancies includes all pregnancies, whether these had terminated as live births, still births or abortions or had not yet terminated.

- **Abortion ratio:**
- This is calculated by dividing the number of abortions performed during a particular time period by the number of live births over the same period.

- **Abortion Rate:**
- The number of all types of abortions usually per 1000 women of childbearing age.

- **Marriage Rate:**
- It is the number of marriages in the year per 1000 population.

- Crude Marriage Rate = $\frac{\text{Number of marriages in the year}}{\text{Mid Year Population}} \times 1000$

- Demographers consider this a very unsatisfactory rate, because the denominator consists of the population that is not eligible to marry.
-
- GMR is more sensitive.
-
- General Marital Rate = Number of marriages within 1 year X 1000
- Number of unmarried persons in the age group 15 – 44 yrs