

2-1

Chapter 2

Frequency Distributions and Graphs

Outline

- **2-1 Introduction**
- **2-2 Organizing Data**
- **2-3 Histograms, Frequency Polygons, and Ogives**
- **2-4 Other Types of Graphs**

Objectives

- **Organize data using frequency distributions.**
- **Represent data in frequency distributions graphically using histograms, frequency polygons, and ogives.**

Objectives

- **Represent data using Pareto charts, time series graphs, and pie graphs.**

2-2 Organizing Data

- When data are collected in original form, they are called **raw data**.
- When the raw data is organized into a **frequency distribution**, the frequency will be the number of values in a specific class of the distribution.

2-2 Organizing Data

- A **frequency distribution** is the organizing of raw data in table form, using classes and frequencies.
- The following slide shows an example of a frequency distribution.

2-2 Three Types of Frequency Distributions

- **Categorical frequency distributions** - can be used for data that can be placed in specific categories, such as nominal- or ordinal-level data.
- **Examples** - political affiliation, religious affiliation, blood type etc.

2-2 Blood Type Frequency Distribution - **Example**

Class	Frequency	Percent
A	5	20
B	7	28
O	9	36
AB	4	16

2-2 Ungrouped Frequency Distributions

- **Ungrouped frequency distributions** - can be used for data that can be enumerated and when the range of values in the data set is not large.
- **Examples** - number of miles your instructors have to travel from home to campus, number of girls in a 4-child family etc.

2-2 Number of Miles Traveled - Example

Class	Frequency
5	24
10	16
15	10

2-2 Grouped Frequency Distributions

- **Grouped frequency distributions** - can be used when the range of values in the data set is very large. The data must be grouped into classes that are more than one unit in width.
- **Examples** - the life of boat batteries in hours.

2-2 Lifetimes of Boat Batteries - Example

Class limits	Class Boundaries	Frequency	Cumulative frequency
24 - 30	23.5 - 37.5	4	4
38 - 51	37.5 - 51.5	14	18
52 - 65	51.5 - 65.5	7	25

2-2 Terms Associated with a Grouped Frequency Distribution

- Class limits represent the smallest and largest data values that can be included in a class.
- In the lifetimes of boat batteries example, the values 24 and 30 of the first class are the **class limits**.
- The **lower class** limit is 24 and the **upper class** limit is 30.

2-2 Terms Associated with a Grouped Frequency Distribution

- The **class boundaries** are used to separate the classes so that there are no gaps in the frequency distribution.

2-2 Terms Associated with a Grouped Frequency Distribution

- The **class width** for a class in a frequency distribution is found by subtracting the lower (or upper) class limit of one class minus the lower (or upper) class limit of the previous class.

2-2 Guidelines for Constructing a Frequency Distribution

- **There should be between 5 and 20 classes.**
- **The class width should be an odd number.**
- **The classes must be mutually exclusive.**

2-2 Guidelines for Constructing a Frequency Distribution

- **The classes must be continuous.**
- **The classes must be exhaustive.**
- **The class must be equal in width.**

2-2 Procedure for Constructing a Grouped Frequency Distribution

- **Find the highest and lowest value.**
- **Find the range.**
- **Select the number of classes desired.**
- **Find the width by dividing the range by the number of classes and rounding up.**

2-2 Procedure for Constructing a Grouped Frequency Distribution

- Select a starting point (usually the lowest value); add the width to get the lower limits.**
- Find the upper class limits.**
- Find the boundaries.**
- Tally the data, find the frequencies, and find the cumulative frequency.**

2-2 Grouped Frequency Distribution - **Example**

- **In a survey of 20 patients who smoked, the following data were obtained. Each value represents the number of cigarettes the patient smoked per day. Construct a frequency distribution using six classes. (The data is given on the next slide.)**

2-2 Grouped Frequency Distribution - Example

10	8	6	14
22	13	17	19
11	9	18	14
13	12	15	15
5	11	16	11

2-2 Grouped Frequency Distribution - Example

- **Step 1:** Find the highest and lowest values: $H = 22$ and $L = 5$.
- **Step 2:** Find the range:
$$R = H - L = 22 - 5 = 17.$$
- **Step 3:** Select the number of classes desired. In this case it is equal to 6.

2-2 Grouped Frequency Distribution - Example

- **Step 4:** Find the class width by dividing the range by the number of classes. $\text{Width} = 17/6 = 2.83$. This value is rounded up to 3.

2-2 Grouped Frequency Distribution - Example

- **Step 5:** Select a starting point for the lowest class limit. For convenience, this value is chosen to be 5, the smallest data value. The lower class limits will be 5, 8, 11, 14, 17, and 20.

2-2 Grouped Frequency Distribution - Example

- **Step 6:** The upper class limits will be 7, 10, 13, 16, 19, and 22. For example, the upper limit for the first class is computed as $8 - 1$, etc.

2-2 Grouped Frequency Distribution - Example

- **Step 7:** Find the class boundaries by subtracting 0.5 from each lower class limit and adding 0.5 to the upper class limit.

2-2 Grouped Frequency Distribution - Example

- **Step 8:** Tally the data, write the numerical values for the tallies in the frequency column, and find the cumulative frequencies.
- The grouped frequency distribution is shown on the next slide.

Note: The dash “-” represents “to”.

<i>Class Limits</i>	<i>Class Boundaries</i>	<i>Frequency</i>	<i>Cumulative Frequency</i>
05 to 07	4.5 - 7.5	2	2
08 to 10	7.5 - 10.5	3	5
11 to 13	10.5 - 13.5	6	11
14 to 16	13.5 - 16.5	5	16
17 to 19	16.5 - 19.5	3	19
20 to 22	19.5 - 22.5	1	20

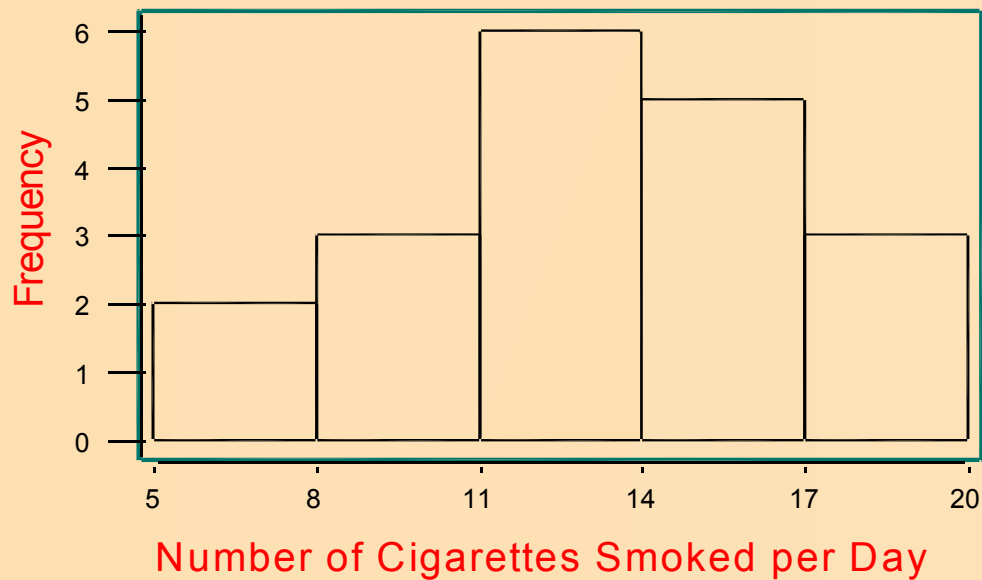
2-3 Histograms, Frequency Polygons, and Ogives

- The three most commonly used graphs in research are:
- The histogram.
- The frequency polygon.
- The cumulative frequency graph, or ogive (pronounced o-jive).

2-3 Histograms, Frequency Polygons, and Ogives

- The **histogram** is a graph that displays the data by using vertical bars of various heights to represent the frequencies.

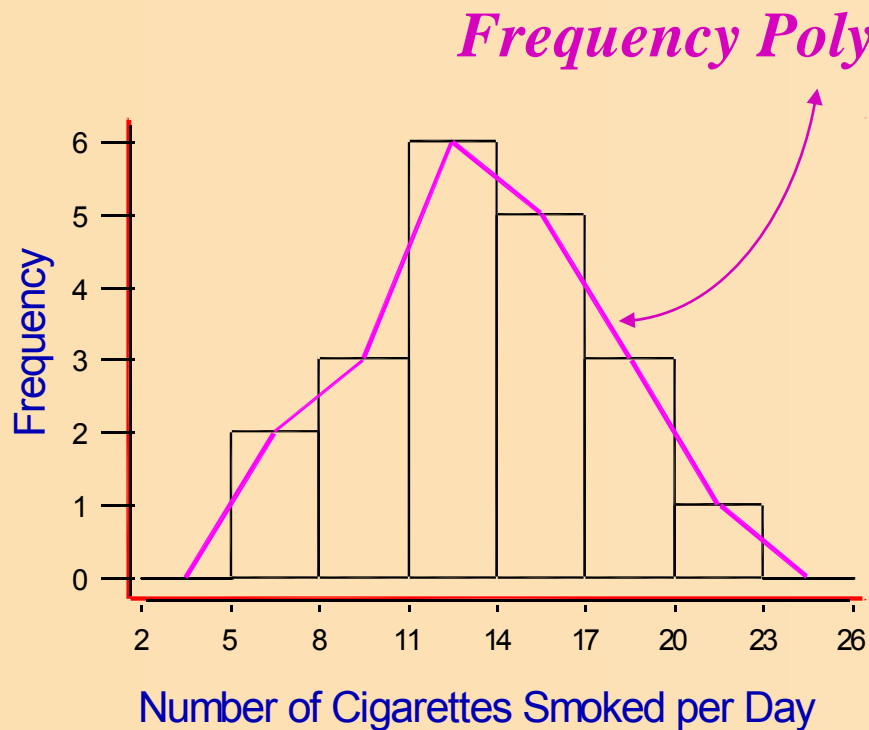
Example of a Histogram



2-3 Histograms, Frequency Polygons, and Ogives

- A **frequency polygon** is a graph that displays the data by using lines that connect points plotted for frequencies at the midpoint of classes. The frequencies represent the heights of the midpoints.

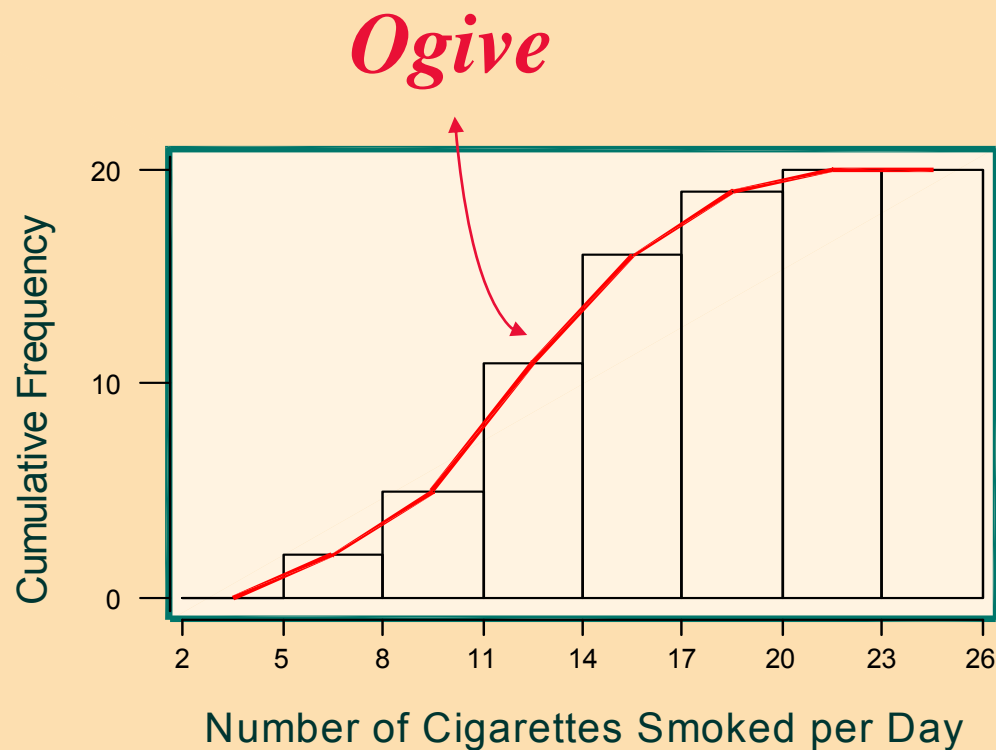
Example of a Frequency Polygon



2-3 Histograms, Frequency Polygons, and Ogives

- A **cumulative frequency graph** or **ogive** is a graph that represents the cumulative frequencies for the classes in a frequency distribution.

Example of an Ogive



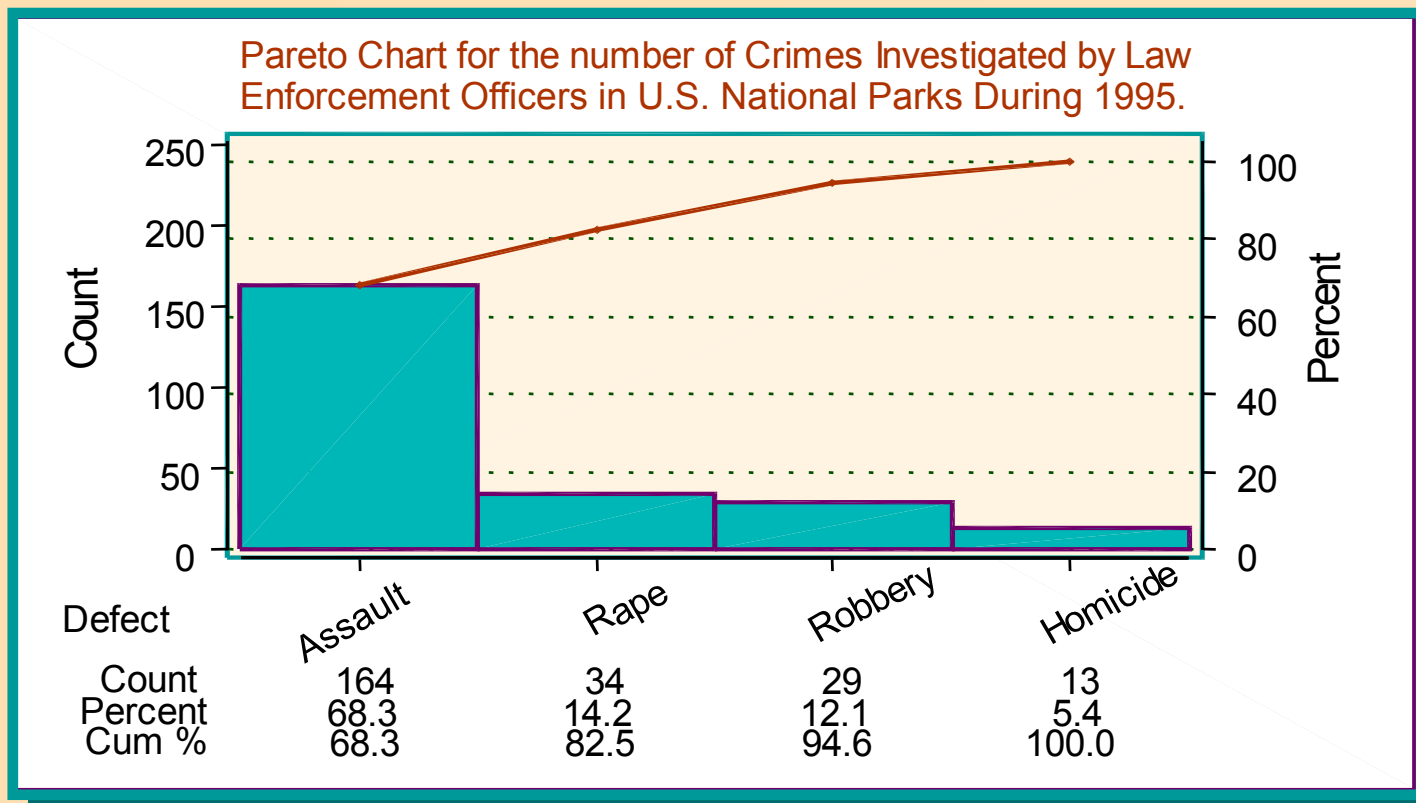
2-4 Other Types of Graphs

- **Pareto charts** - a Pareto chart is used to represent a frequency distribution for a categorical variable.

2-4 Other Types of Graphs-Pareto Chart

- **When constructing a Pareto chart -**
- **Make the bars the same width.**
- **Arrange the data from largest to smallest according to frequencies.**
- **Make the units that are used for the frequency equal in size.**

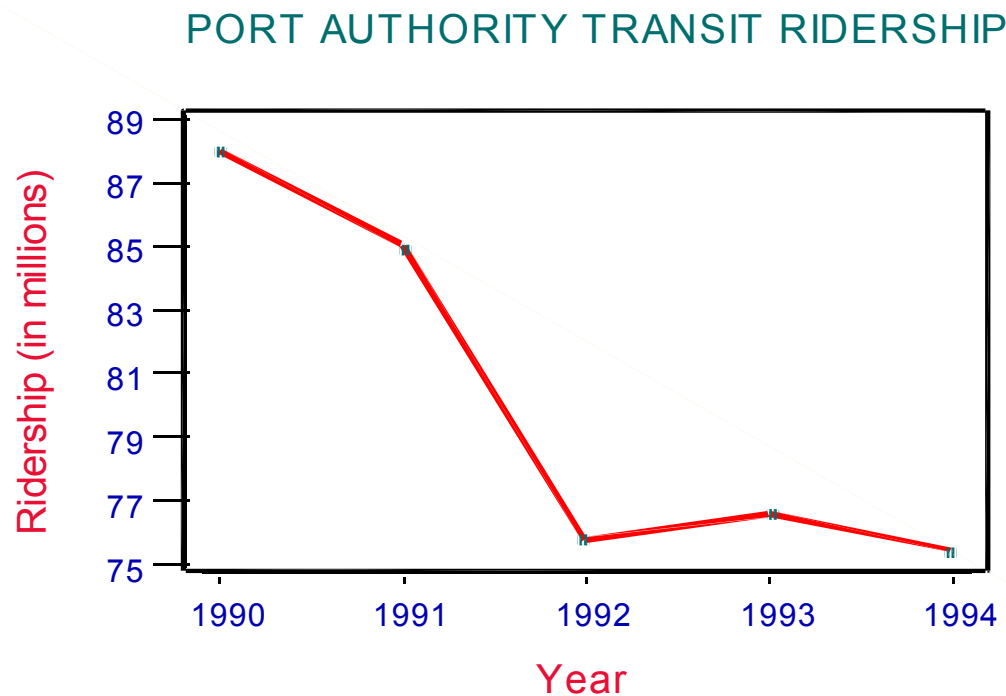
Example of a Pareto Chart



2-4 Other Types of Graphs

- **Time series graph** - A time series graph represents data that occur over a specific period of time.

2-4 Other Types of Graphs - Time Series Graph

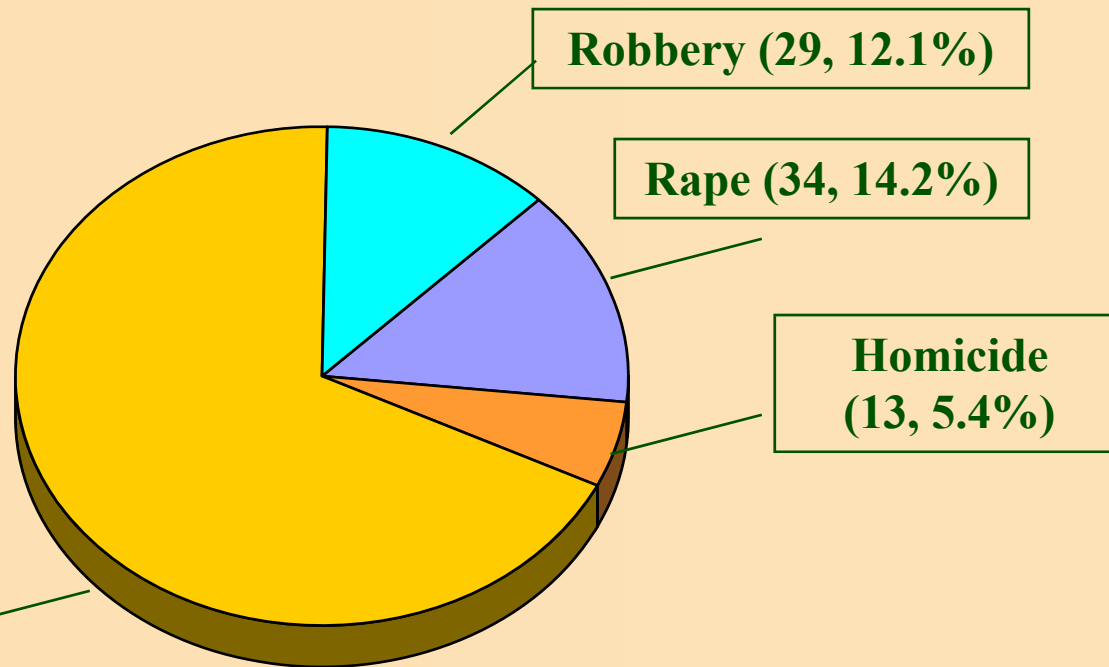


2-4 Other Types of Graphs

- **Pie graph** - A pie graph is a circle that is divided into sections or wedges according to the percentage of frequencies in each category of the distribution.

2-4 Other Types of Graphs - Pie Graph

**Pie Chart of the
Number of Crimes
Investigated by
Law Enforcement
Officers In U.S.
National Parks
During 1995**



**Assaults
(164, 68.3%)**