1.4 Shapes of Distributions

1. Modality

The modality of a distribution concerns how many peaks or high points there are.

Unimodal distribution: A unimodal distribution is a distribution with a single peak—that is, one value with a high frequency—is a unimodal distribution.

Multimodal distribution: A Multimodal distribution is a distribution with two or more peaks, and when there are exactly two peaks, the distribution is bimodal.

The following figure presents six distributions with different shapes. In Figure 1, the distributions labeled A, E, and F are unimodal, while B, C, and D are multimodal. Distributions B and D have two peaks, and thus can also be described as bimodal.

2. Symmetry and Skewness

Another aspect of a distribution's shape concerns symmetry. A distribution is symmetric if the distribution could be split down the middle to form two halves that are mirror images of one another. In Figure 1, distributions A through C are symmetric,while D through F are not.

Distributions of actual study data are rarely as perfectly symmetric as those shown in Figure 1. Minor departures from perfect symmetry are usually ignored when describing the shapes of data distributions.

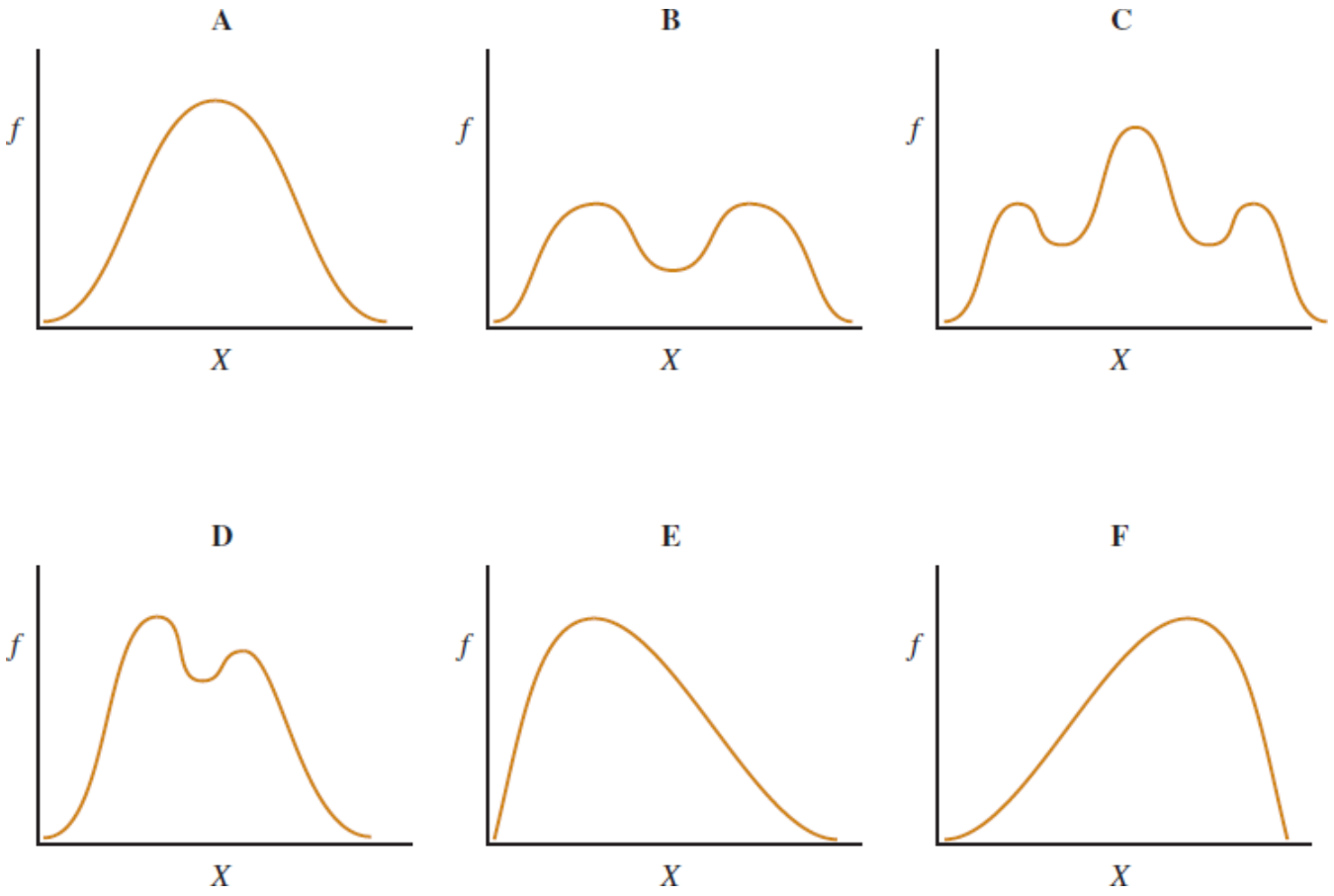


Figure 1: Examples of distributions with different shapes

Skewed distribution

In asymmetric distributions, the peaks are off-center, with a bulk of scores clustering atone end and a tail trailing off at the other end. Such distributions are described as skewed distribution and can be described in terms of the direction of the skew.

Positively skewed distribution: When a skewed distribution has a long tail pointing to the right, as in D and E of Figure 1, this is a positively skewed distribution. An example of an attribute that is positively skewed is annual income. In most countries, most people have low or moderate incomes and would cluster to the left, and the relatively small numbers in upper-income brackets would be distributed in the tail.

Negatively skewed distribution: When a skewed distribution has a long tail pointing to the left, as in F of Figure 1, this is a negatively skewed distribution. An example ofan attribute that is negatively skewed distribution is the age at death. we would have a negatively skewed distribution: Most people would be at the far-right side of the distribution, with relatively few people dying at a young age.

3. Kurtosis

The third aspect of a distribution's shape concerns how pointed or flat its peak is—thatis, the distribution's kurtosis. Two distributions with different peakedness are superimposed on one another in Figure 2. Distribution A in this figure is more peaked and would be described as a **leptokurtic** (from the Greek word lepto, which means thin) distribution. Distribution B is flatter and is a **platykurtic** (from the Greek word platy, which means flat) distribution.

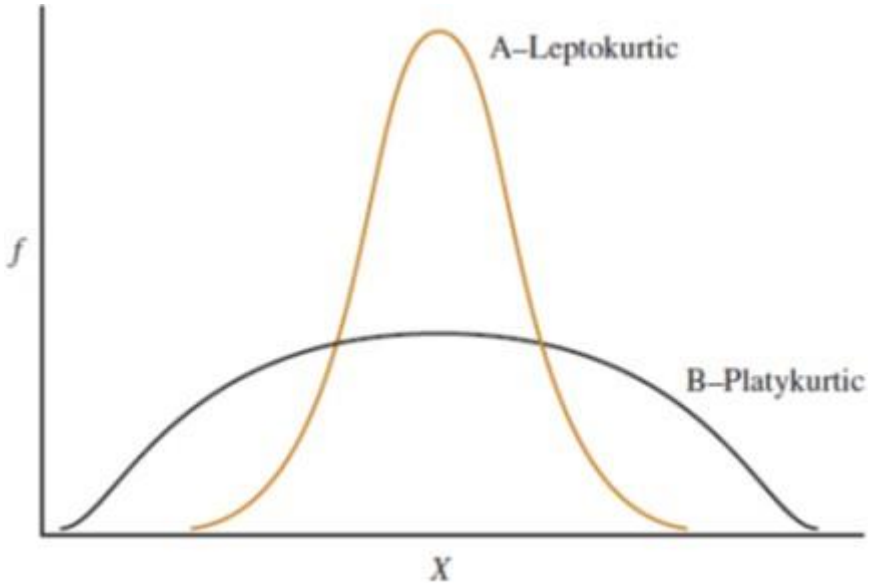


Figure 2: Example of distributions with different kurtoses

Kurtosis index:

There is a statistical index of kurtosis that can be computed when computer programs are instructed to produce a frequency distribution. For the kurtosis index, a value of 0 indicates a shape that is neither flat nor pointed (e.g., distribution A in Figure 1). Positive values on the kurtosis statistic indicate greater peakedness, and negative values indicate greater flatness.

Example 12

Calculate the kurtosis index of the distribution of the heart rate data.

Statistics
heartrate

N	Valid	100
	Missing	0
Kurtosis		-.550
Std. Error of Kurtosis		.478

The kurtosis index = -.550

The standard error of kurtosis = .478

For the heart rate data displayed in Figure 8, the kurtosis index is -.550 (with a standard error of .478), indicating that the distribution is only slightly more platykurtic than leptokurtic

The Normal Distribution

A distribution that has special importance in statistical analysis is the normal distribution (also known as the bell-shaped curve, normal curve, or Gaussian distribution). A normal distribution is one that is unimodal, symmetric, and not too peaked or flat. The normal distribution was given its name because many human attributes—such as height, weight, intelligence, and so on—appeared to be distributed according to this shape.

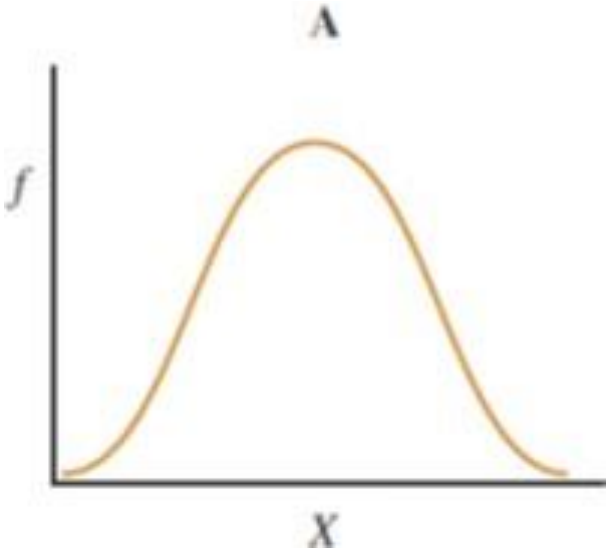


Figure 3: Example of the normal distributions

The Presentation of Frequency Information in Research Reports

Tables with frequency information often are used to summarize the background characteristics of study participants. For example, Liu and co-researchers (2008) studiedthe effects of age and sex on health-related quality of life among patients with kidney transplantation.

Table 5, shows frequency distributions for three background variables. Two variables, sex, and race are nominal-level variables. Age is a ratio-level variable, shown here in a grouped frequency distribution with five class intervals. This method of presentation is efficient because it provides readers with a quick summary of important sample characteristics.

TABLE 5 Example of Table with Frequency Distribution Information for Sample Description

Participants' Characteristics	Number	%
Sex		
Male	72	52.2
Female	66	47.8
Age		
25–34	20	14.5
35–44	31	22.5
45–54	44	31.9
55–64	30	21.7
≥65	13	9.4
Race		
White/Caucasian	106	76.8
Other	32	23.2
Total Number	138	

Reference: Statistics and Data Analysis for Nursing Research, Second Edition, 2014,by Denise F. Polit

Researchers are most likely to present substantive frequency information in tables or graphs when several variables have the same codes or score.

Table 6 shows the frequency with which the nurse practitioners in their sample prescribed 29 medications deemed inappropriate for people aged 65 and older. Such a matrix, with multiple medications and three response categories, presents a wealth of descriptive frequency information in a compact format.

TABLE 6 Example of Frequency Distributions for Multiple Variables

Medications Prescribed Inappropriately by Gerontological Nurse Practitioners (N = 234)

Medication[a]	Never %	Occasionally %	Frequently %
Diphenhydramine (Benadryl)	44	48	8
Cyclobenzaprine (Flexeril)	55	39	6
Amitriptyline (Elavil)	60	35	5
Ticlopidine (Ticlia)	74	23	3
Diazepam (Valium)	80	18	2
Chlorzoxazone (Parafon Forte)	90	9	1
Propantheline	98	2	0

Reference: Statistics and Data Analysis for Nursing Research, Second Edition, 2014,by Denise F. Polit

L8

Solve the following questions:

1. If a distribution has a kurtosis index $= 1$, then

a. the distribution is positively skewed.

b. the distribution is negatively skewed.

c. the distribution is symmetric.

d. the distribution is leptokurtic.

e. the distribution is platykurtic.

f. None of the answers.

2. If a distribution has a kurtosis index $= -1$, then

a. the distribution is positively skewed.

b. the distribution is negatively skewed.

c. the distribution is symmetric.

d. the distribution is leptokurtic.

e. the distribution is platykurtic.

f. None of the answers.

3. The type of the data that represent the number of accidents is

a. Nominal b. Ordinal c. Scale (Continuous) d. Scale (discrete)

4. The type of the data that represent the length of patients is

a. Nominal b. Ordinal c. Scale (Continuous) d. Scale (discrete)

5. The type of the data that represent the blood pressure is

a. Nominal b. Ordinal c. Scale (Continuous) d. Scale (discrete)

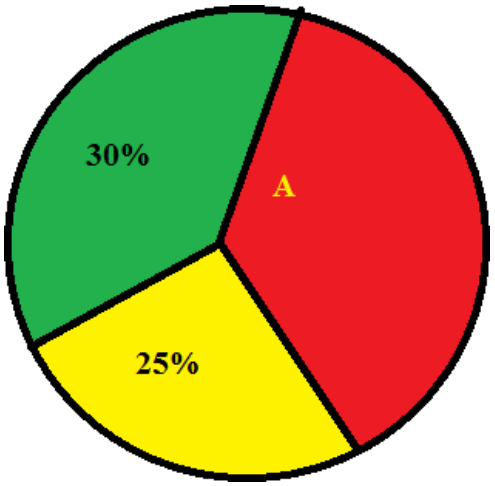
6. The type of the data that represent the place of residence is

a. Nominal b. Ordinal c. Scale (Continuous) d. Scale (discrete)

7. The type of the data that represent the degree of injuries is

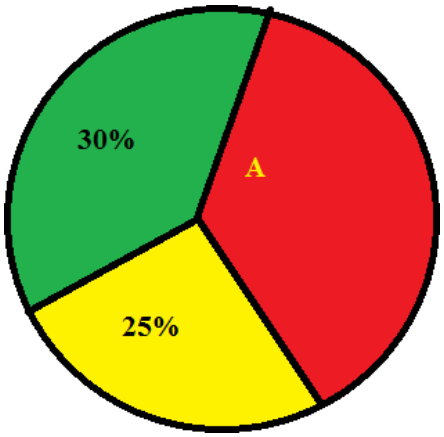
a. Nominal b. Ordinal c. Scale (Continuous) d. Scale (discrete)

8. In the following Pie chart



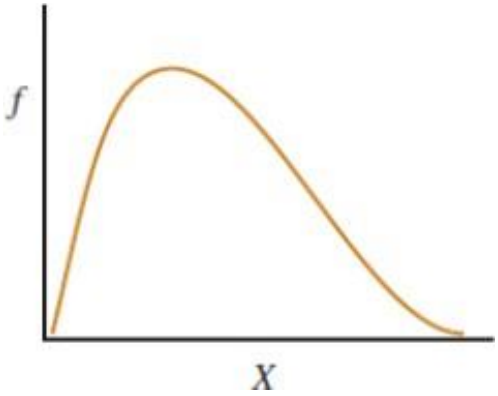
a. $\mathbf{A = 40\%}$ b. $\mathbf{A = 45\%}$ c. $\mathbf{A = 35\%}$ d. **None of the answers**

9. In the following Pie chart if the sample size equals 200, then the frequency of A equals



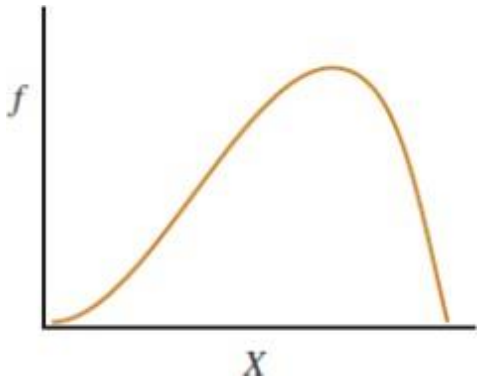
a. 45 **b. 90** **c. 100** **d. None of the answers**

10. The following distribution is



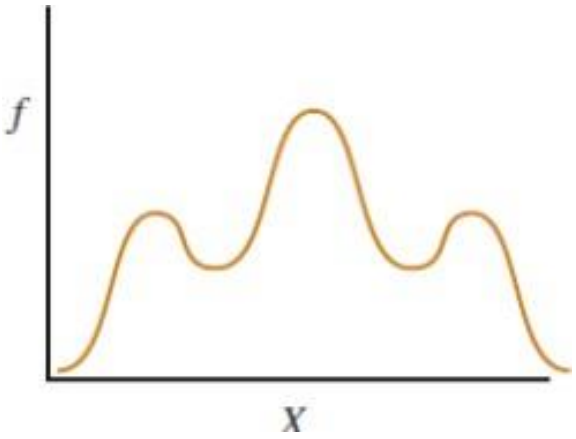
a. Unimodal and symmetric.
b. Unimodal and positively skewed.
c. Unimodal and negatively skewed.
d. Bimodal.
e. None of the answers.

11.The following distribution is



a. Unimodal and symmetric.
b. Unimodal and positively skewed.
c. Unimodal and negatively skewed.
d. Bimodal.
e. None of the answers.

12. The following distribution is



a. Unimodal and symmetric.
b. Multimodal and symmetric.
c. Unimodal and asymmetric.
d. Bimodal.
e. None of the answers.