



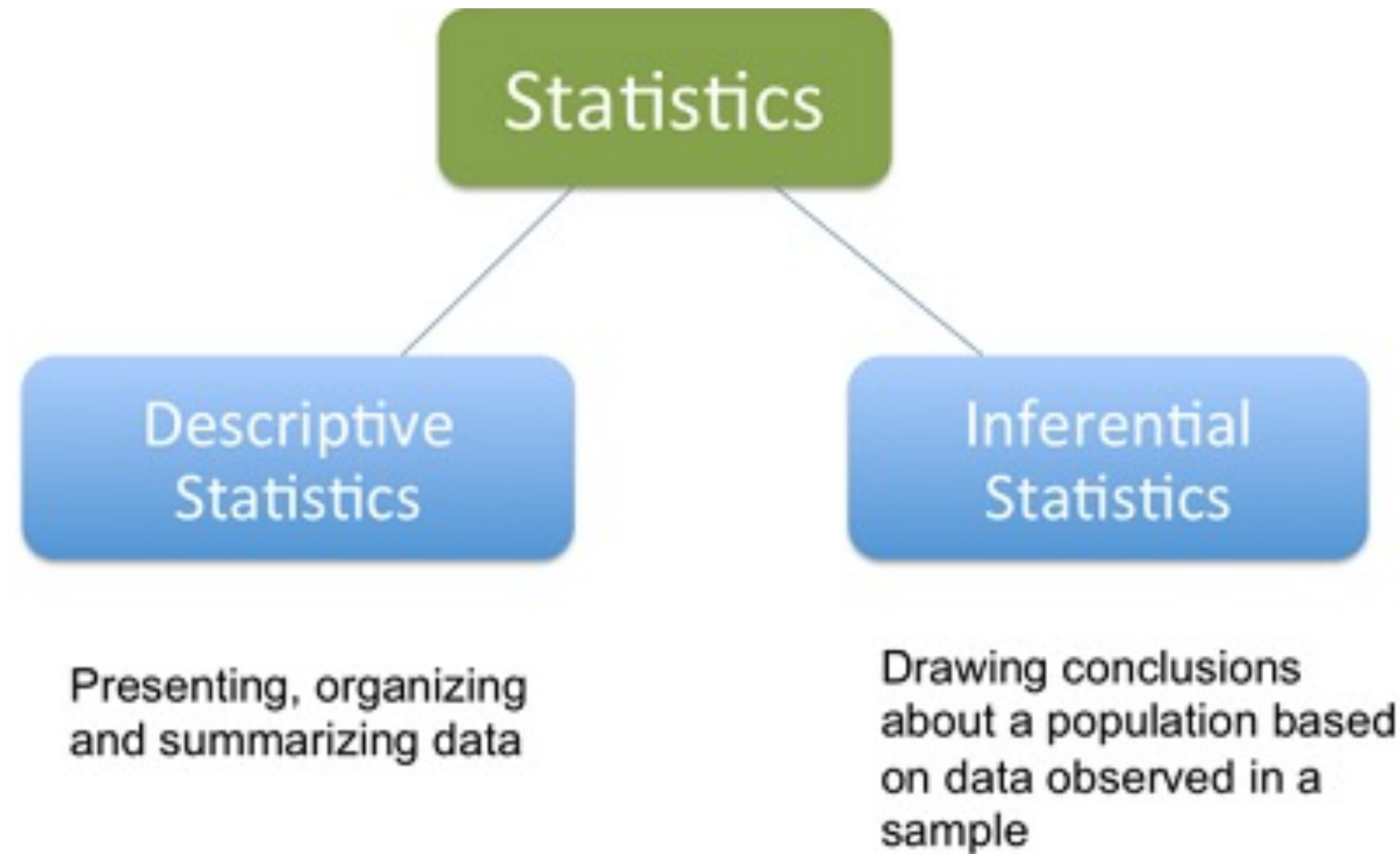
Basic Mathematics and Statistics

CHAPTER 10: DESCRIPTIVE STATISTICS: TABULAR AND GRAPHICAL

Dr. Khaing S. Htun

Recap (Descriptive Statistics)

9.6 Types of Statistics



Descriptive statistics do not generalize because they deal with the population itself.

Population of 10,000

10.1 Introduction

Tabular and graphical methods

- to summarize both qualitative and quantitative data
- in annual reports, newspaper articles, and research studies

10.2 Summarizing Qualitative Data or Categorical Data

Table

Table 10.1 Data from A Sample of 50 Soft Drink Purchases

Coke Classic	Coke Classic	Coke Classic	Sprite	Coke Classic
Diet Coke	Dr. Pepper	Diet Coke	Dr. Pepper	Diet Coke
Pepsi-Cola	Sprite	Coke Classic	Pepsi-Cola	Pepsi-Cola
Diet Coke	Coke Classic	Sprite	Diet Coke	Pepsi-Cola
Coke Classic	Diet Coke	Pepsi-Cola	Pepsi-Cola	Pepsi-Cola
Coke Classic	Coke Classic	Coke Classic	Coke Classic	Pepsi-Cola
Dr. Pepper	Coke Classic	Coke Classic	Coke Classic	Coke Classic
Diet Coke	Sprite	Coke Classic	Coke Classic	Dr. Pepper
Pepsi-Cola	Coke Classic	Pepsi-Cola	Pepsi-Cola	Pepsi-Cola
Pepsi-Cola	Diet Coke	Coke Classic	Dr. Pepper	Sprite

How can we organize these data?

frequency distribution table - lists all categories and the number of elements that belong to each of the categories

10.2 Summarizing Qualitative Data or Categorical Data

Frequency Distribution Table of Soft Drink Purchases

Soft Drink	Frequency (f)	Relative Frequency	Percent (%)
Coke Classic	19	$19/50 = 0.38$	38.0
Diet Coke	8	$8/50 = 0.16$	16.0
Dr. Pepper	5	$5/50 = 0.10$	10.0
Pepsi-Cola	13	$13/50 = 0.26$	26.0
Sprite	5	$5/50 = 0.10$	10.0
Total	50	1.00	100.0

$$\text{Relative frequency of a class} = \frac{\text{Frequency of the class}}{\text{Total number of observations}}$$

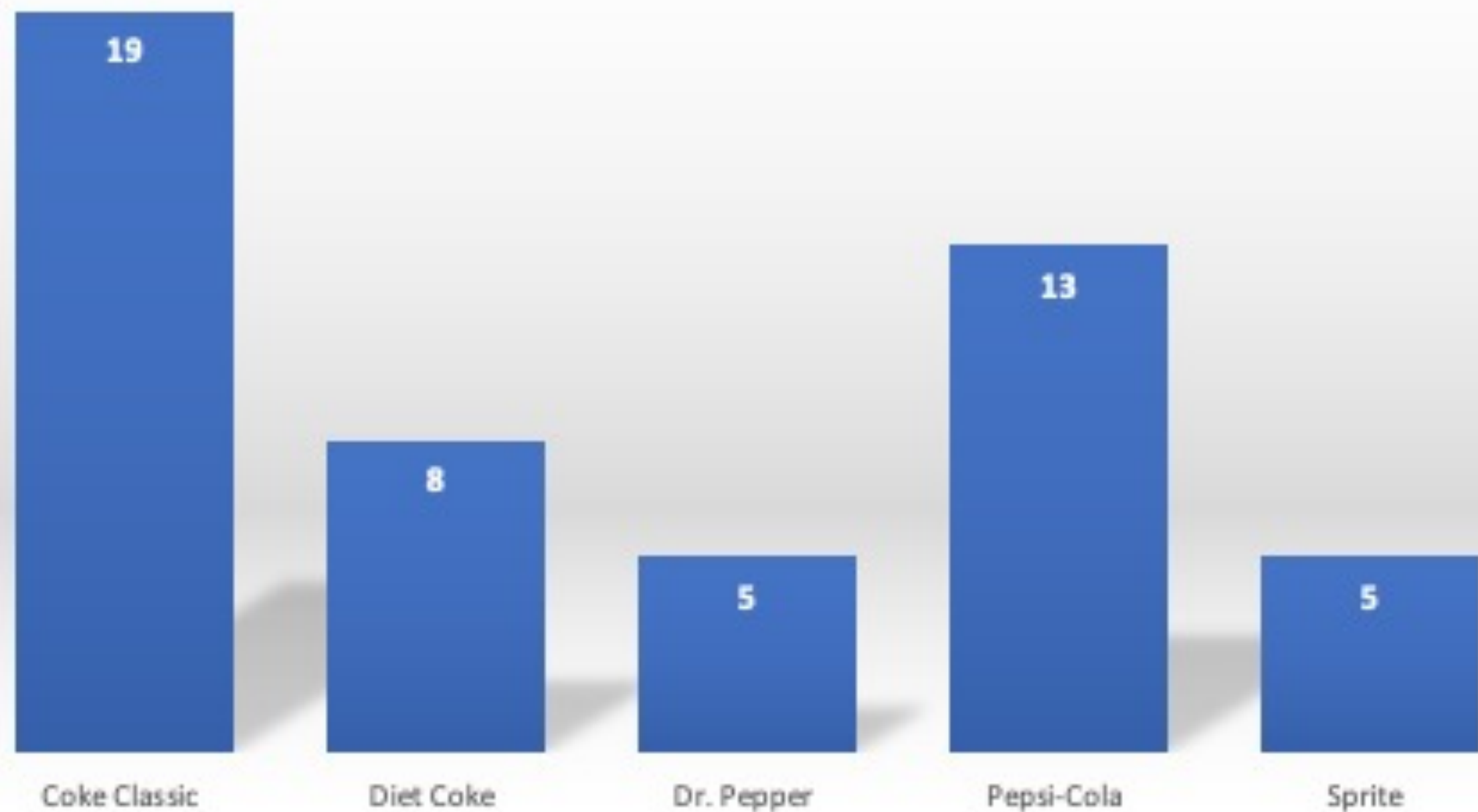
The **percent frequency** of a class is the relative frequency multiplied by 100.

10.2 Summarizing Qualitative Data or Categorical Data

Graph

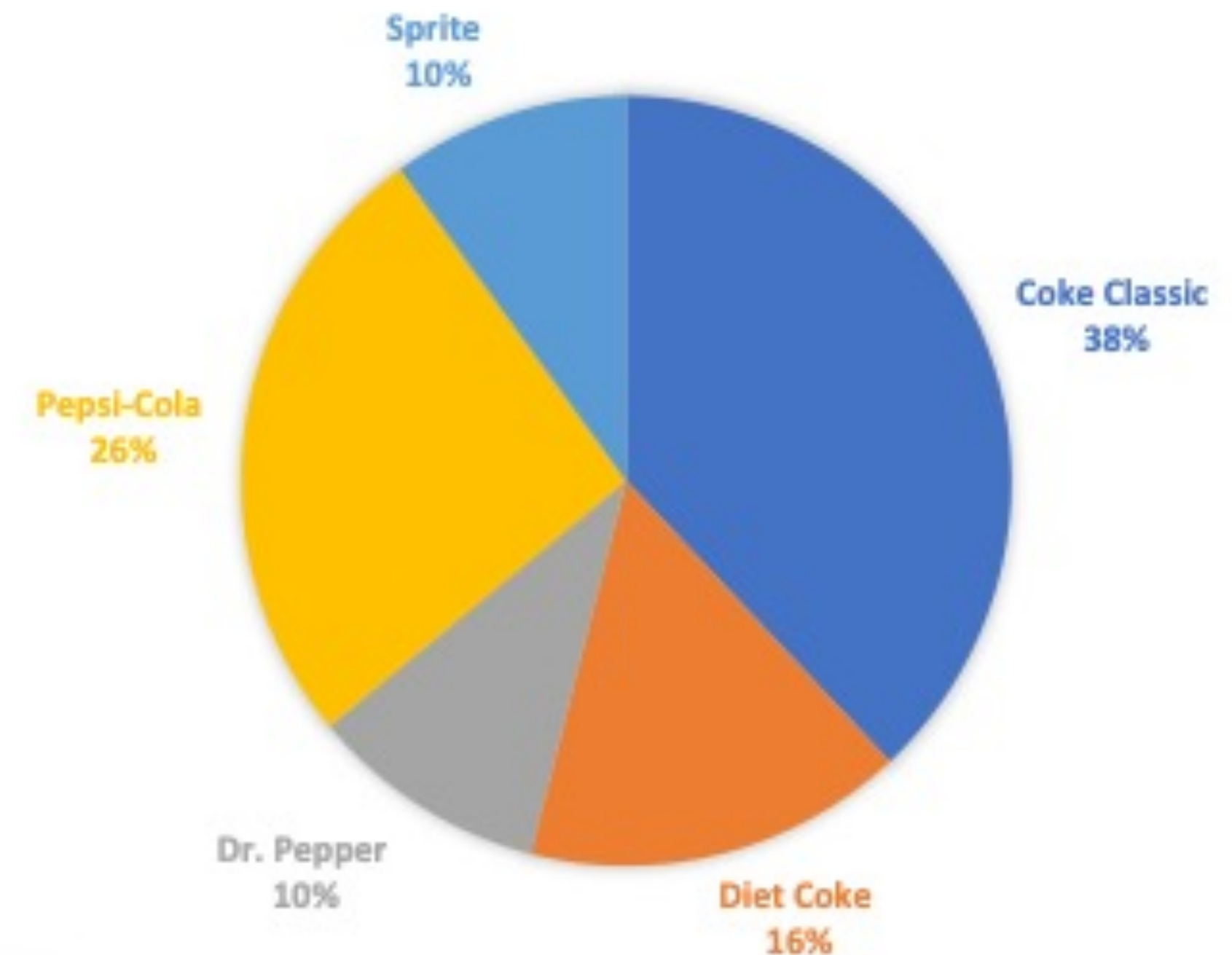
Bar Chart

Bar Chart of Soft Drink Purchases



Pie Chart

PIE CHART OF SOFT DRINK PURCHASES



10.3 Summarizing Quantitative Data or Numerical Data

Table

12	14	19	18	15	15	18	17	20	27	n=20
22	23	22	21	33	28	14	18	16	13	

frequency distribution table - group the data into categories showing the number of observations in each mutually exclusive category

- 1. Find the **range** = the largest data value minus the smallest data value. $33-12 = 21$
- 2. Decide on a suitable **number of the classes** (between 5 and 20). *To estimate the number of classes, we can select the smallest integer such that $2^k \geq n$, where n is the total number of observations.*

Class	
A	1
B	2
C	3
D	4
E	5

10.3 Summarizing Quantitative Data or Numerical Data

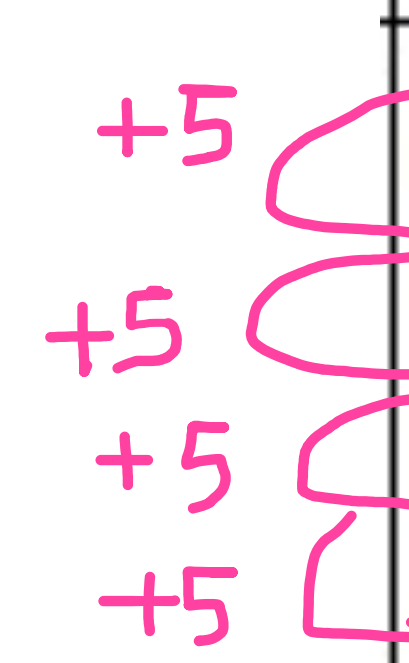
Table

3. Find **class width (i)** by use the following formula

$$\text{Class Width (i)} = \frac{\text{Largest Data Value} - \text{Smallest Data Value}}{\text{Number of Classes}}$$

or
$$\text{Class Width (i)} = \frac{\text{Range}}{\text{Number of Classes}} = \frac{21}{5} = 4.2 \approx 5$$

or
$$\text{Class width (i)} = \text{upper class boundary} - \text{lower class boundary}$$



The diagram shows a series of pink arrows pointing from the upper limit of one class to the lower limit of the next class, with a '+5' written next to each arrow. The first arrow points from 16 to 21, the second from 21 to 26, the third from 26 to 31, and the fourth from 31 to 36. The first class limit '12-16' is circled in pink.

Class Limit	Tally
12-16	 //
17-21	 //
22-26	
27-31	//
32-36	/

4. Find **class limit** which consist of the **lower and the upper class limit**. Any convenient number, which is equal to or less than the smallest value in the data set, can be used as the lower limit of the first class.

Note that *the smallest data value is included in the first class and the largest data value is included in the last class.*

5. **Tally** each observation into each class limit. (one observation will fall into only one class).

10.3 Summarizing Quantitative Data or Numerical Data

Table

- 6. Count the frequency and calculate the relative frequency of each class
- 7. Compute class boundary and midpoint.

• The class boundary is given by the midpoint of the upper limit of one class and the lower limit of the next class.

±0.5

•
$$\text{Class midpoint} = \frac{\text{Lower limit} + \text{Upper limit}}{2}$$

Frequency Distribution Table

Class	Class Limit	Tally	Class Boundary	Midpoint	Frequency (f)	Relative Frequency (%)
1	12 – 16	 //	11.5 – 16.5	14	7	35.0
2	17 – 21	 //	16.5 – 21.5	19	7	35.0
3	22 – 26		21.5 – 26.5	24	3	15.0
4	27 – 31	//	26.5 – 31.5	29	2	10.0
5	32 – 36	/	31.5 – 36.5	34	1	5.0
					20	100.0

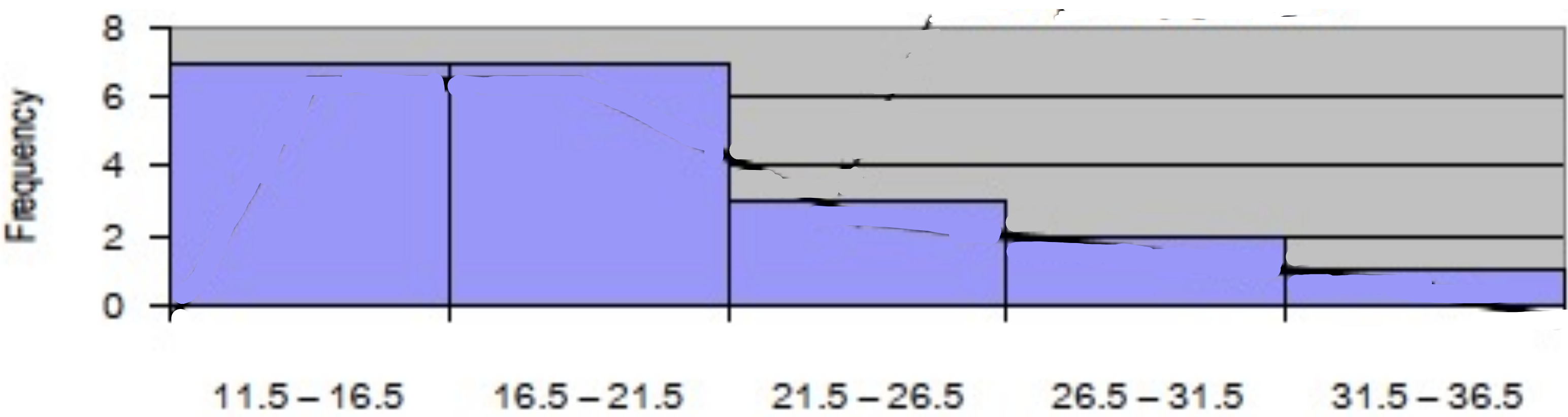
Note that when we present the data in the form of a frequency distribution table, we lose the information on individual observations.

10.3 Summarizing Quantitative Data or Numerical Data

Graph

Histogram

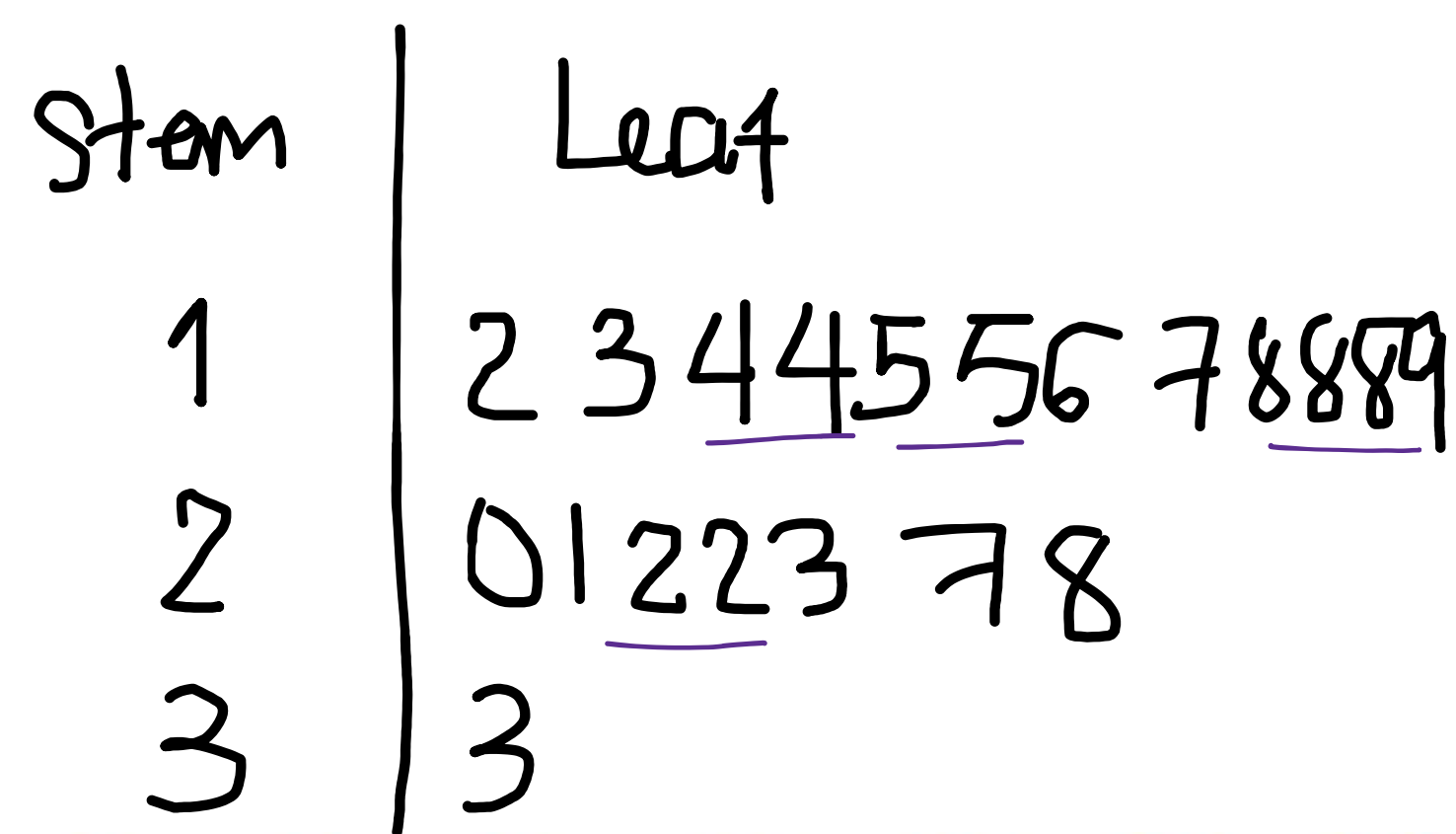
- is a vertical rectangle at each value (or mark classes), and the height of the rectangle equal to relative frequency.



Class Boundary	Frequency (f)
11.5 – 16.5	7
16.5 – 21.5	7
21.5 – 26.5	3
26.5 – 31.5	2
31.5 – 36.5	1
	20

Stem-and-Leaf Display

- is a statistical technique for displaying a set of data. Each value is divided into two parts: the leading digits become the stem and the trailing digits become the leaf.

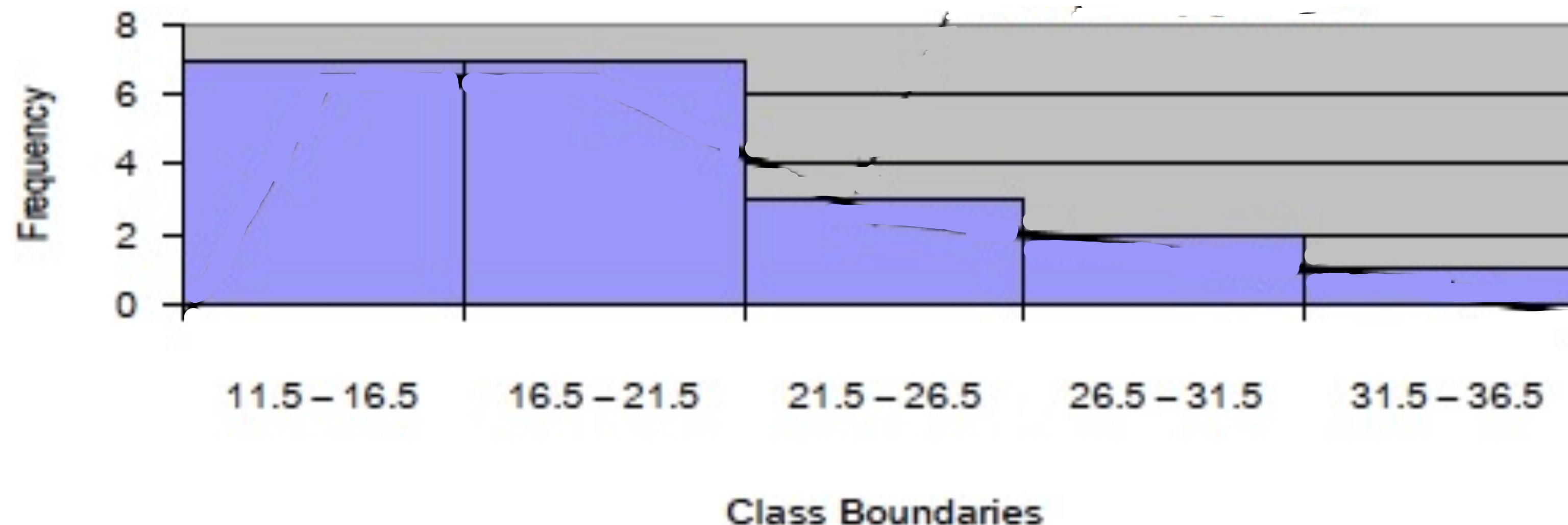


12 14 19 18 15 15 18 17 20 27
22 23 22 21 33 28 14 18 16 13

10.4 Graphic Presentation of a Frequency Distribution

Histogram

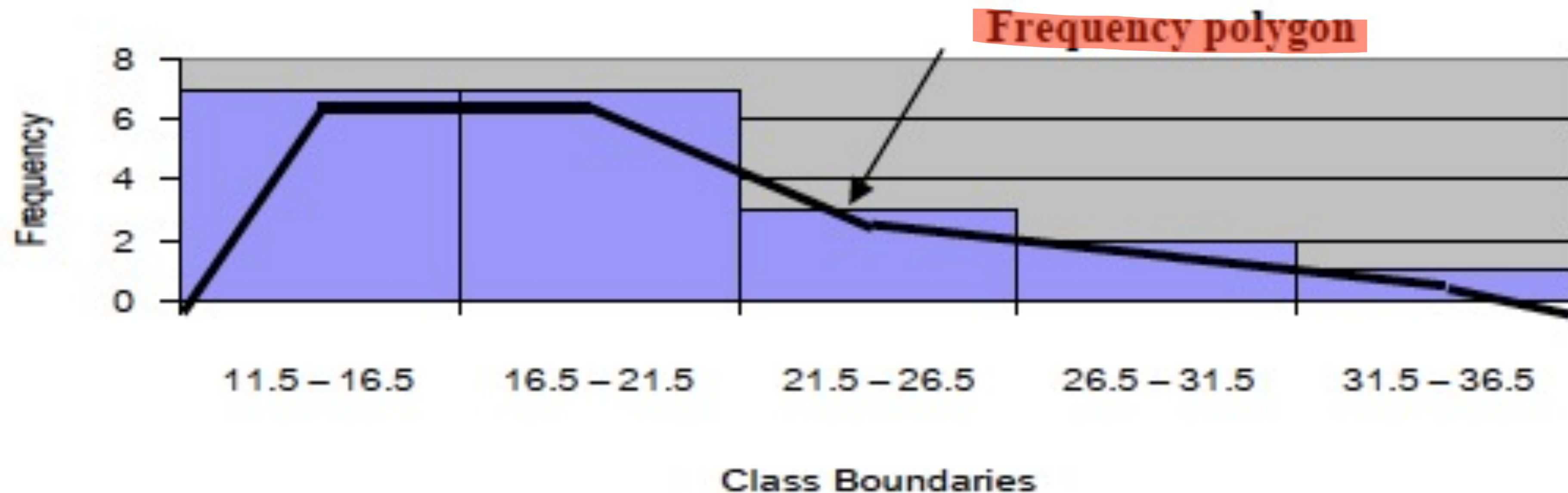
Histogram: A graph in which the classes are marked on the horizontal axis and the class frequencies on the vertical axis. The class frequencies are represented by the heights of the bars and the bars are drawn adjacent to each other.



10.4 Graphic Presentation of a Frequency Distribution

A frequency polygon

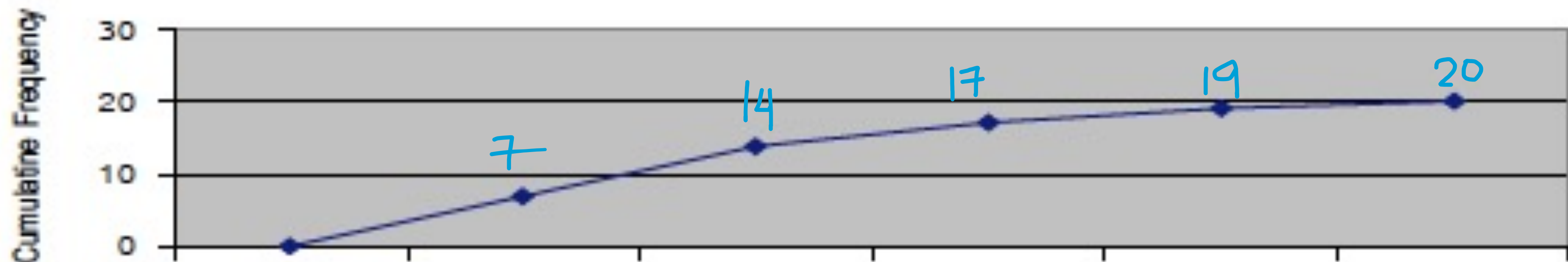
A **frequency polygon** consists of line segments **connecting** the points formed by the class **midpoint** and the **class frequency**.



10.4 Graphic Presentation of a Frequency Distribution

A cumulative frequency distribution (Ogive)

A cumulative frequency distribution (Ogive) is used to determine how many or what proportion of the data values are below or above a certain value.



Class	Class Limit	Frequency (f)	CF
1	12 – 16	7	7
2	17 – 21	7	14
3	22 – 26	3	17
4	27 – 31	2	19
5	32 – 36	1	20
		20	20

10.5 Shapes of Histograms

The most common shapes

- symmetric

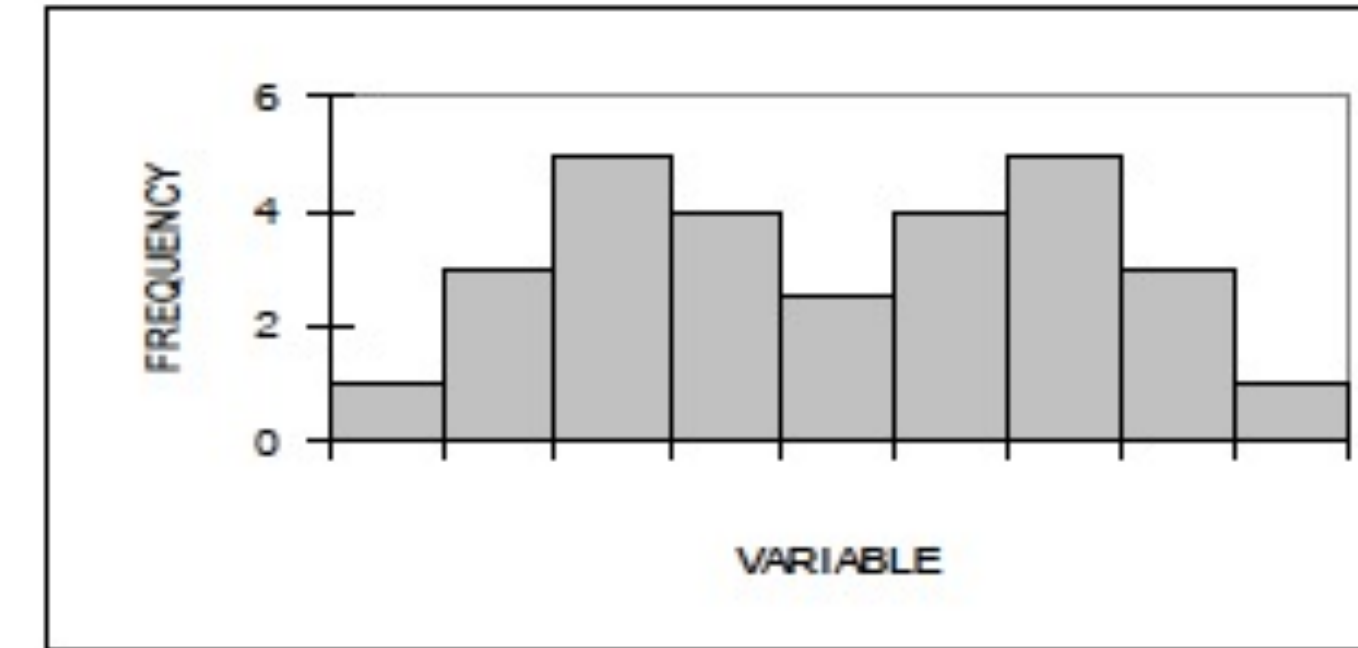
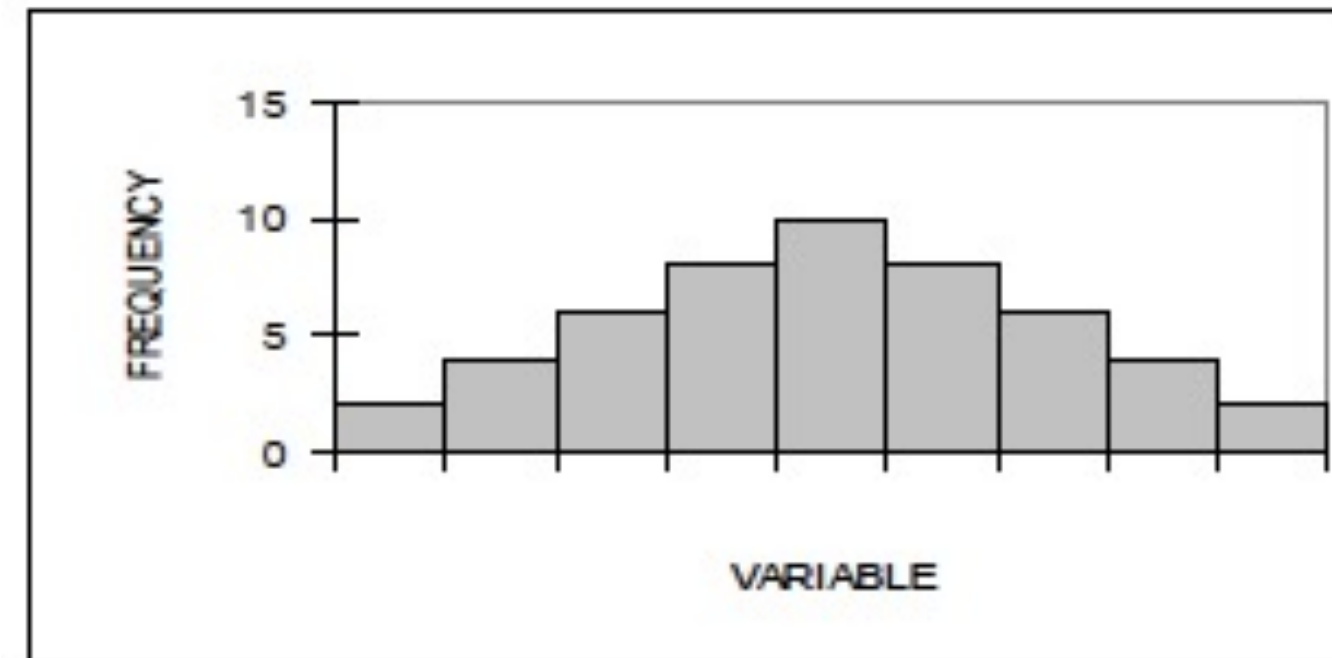


Figure 10.5 Symmetric histograms

- skewed

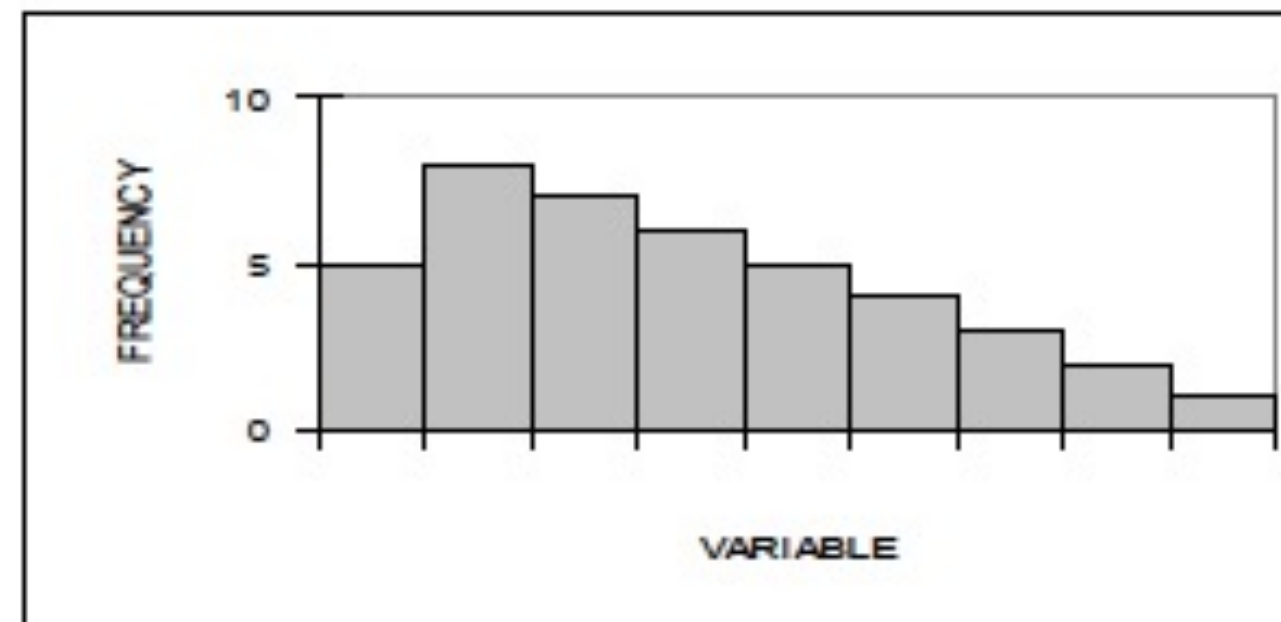
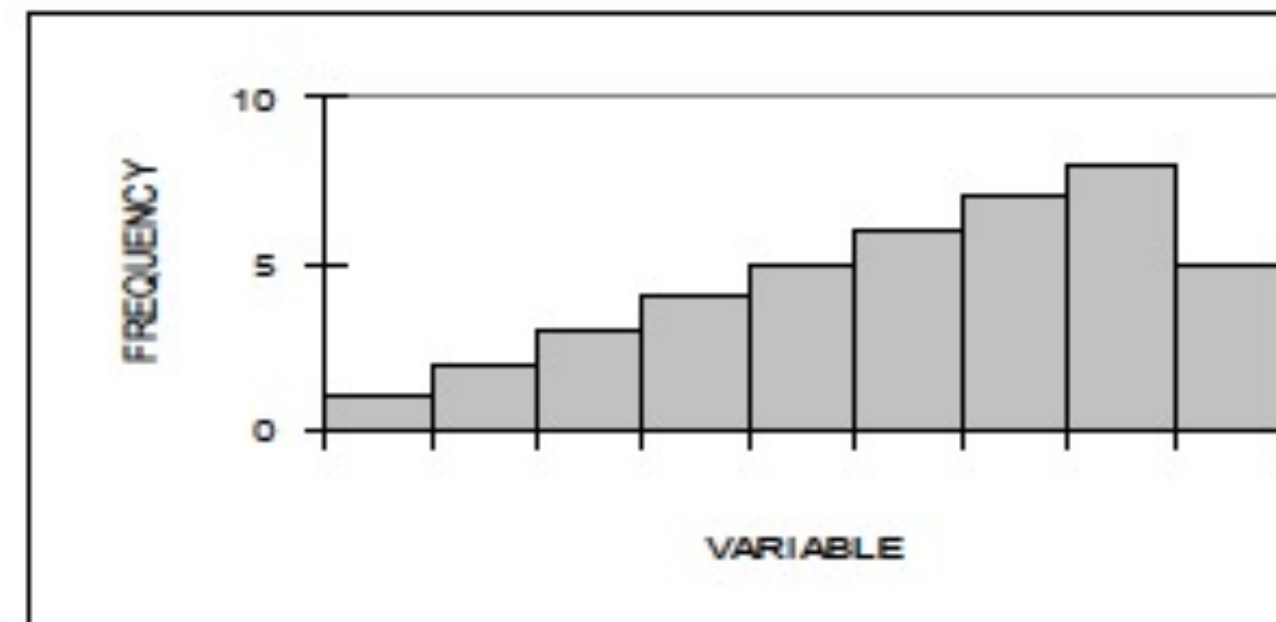


Figure 10.6 (a) Skewed to the right



(b) Skewed to the left

- uniform or rectangular

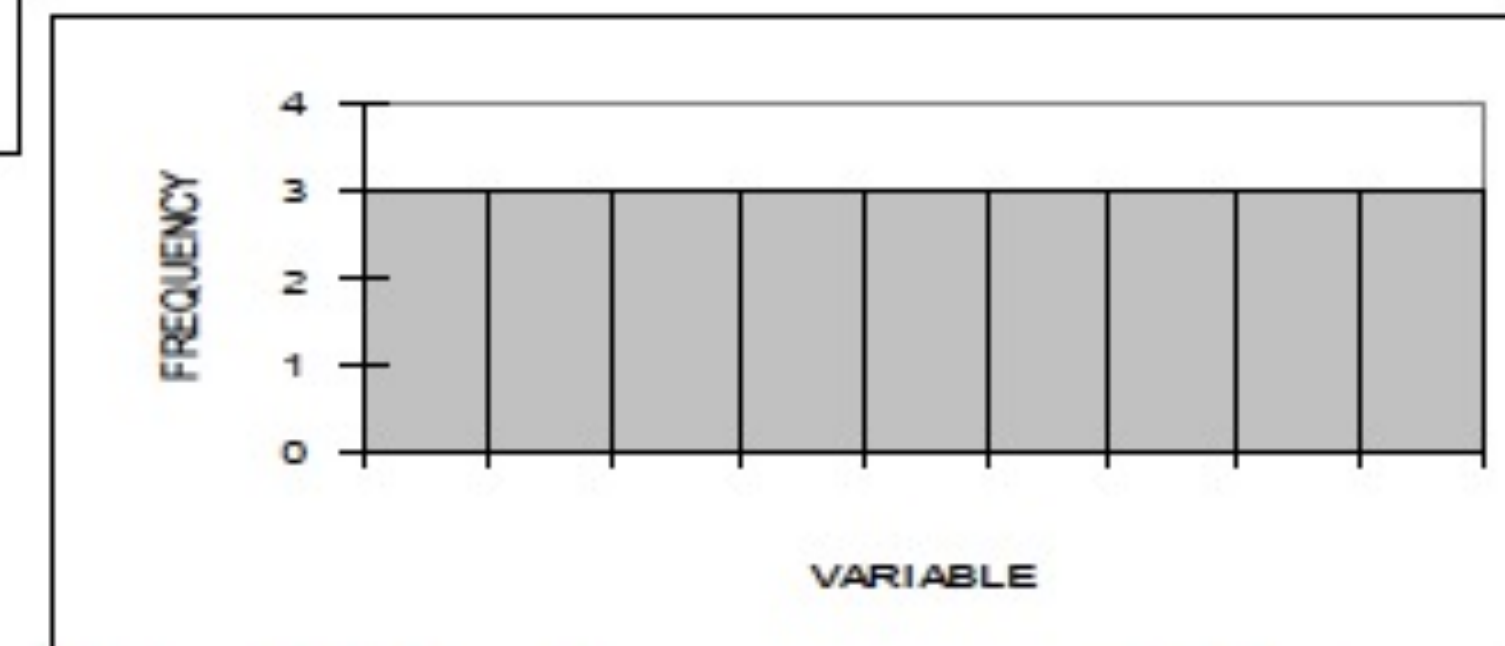


Figure 10.7 Uniform or rectangular histogram

10.6 Constructing Stem-and-Leaf Display

1. Identify the **minimum** and the **maximum** score in the data set.
2. **Split** each score **into two parts**. The **first part** contains the first digit, which is called the **stem**. The **second part** contains the second digit, which is called the **leaf**.
3. **Draw** the **vertical line** and write **the stems on the left side**, the **leaves on the right** side of it.
4. **List the stems in order** in a column, **starting** with the **smallest stem** and **ending** with the **largest**.
5. **Record the leaf** for each score in the appropriate stem on the right side of the vertical line (you may want to record the leaves of each stem **in increasing order**).

10.6 Constructing Stem-and-Leaf Display

stretched stem-and-leaf display

112	72	69	97	107	73	92	76	86	73
126	128	118	127	124	82	104	132	134	83
92	108	96	100	92	115	76	91	102	81
95	141	81	80	106	84	119	113	98	75
68	98	115	106	95	100	85	94	106	119

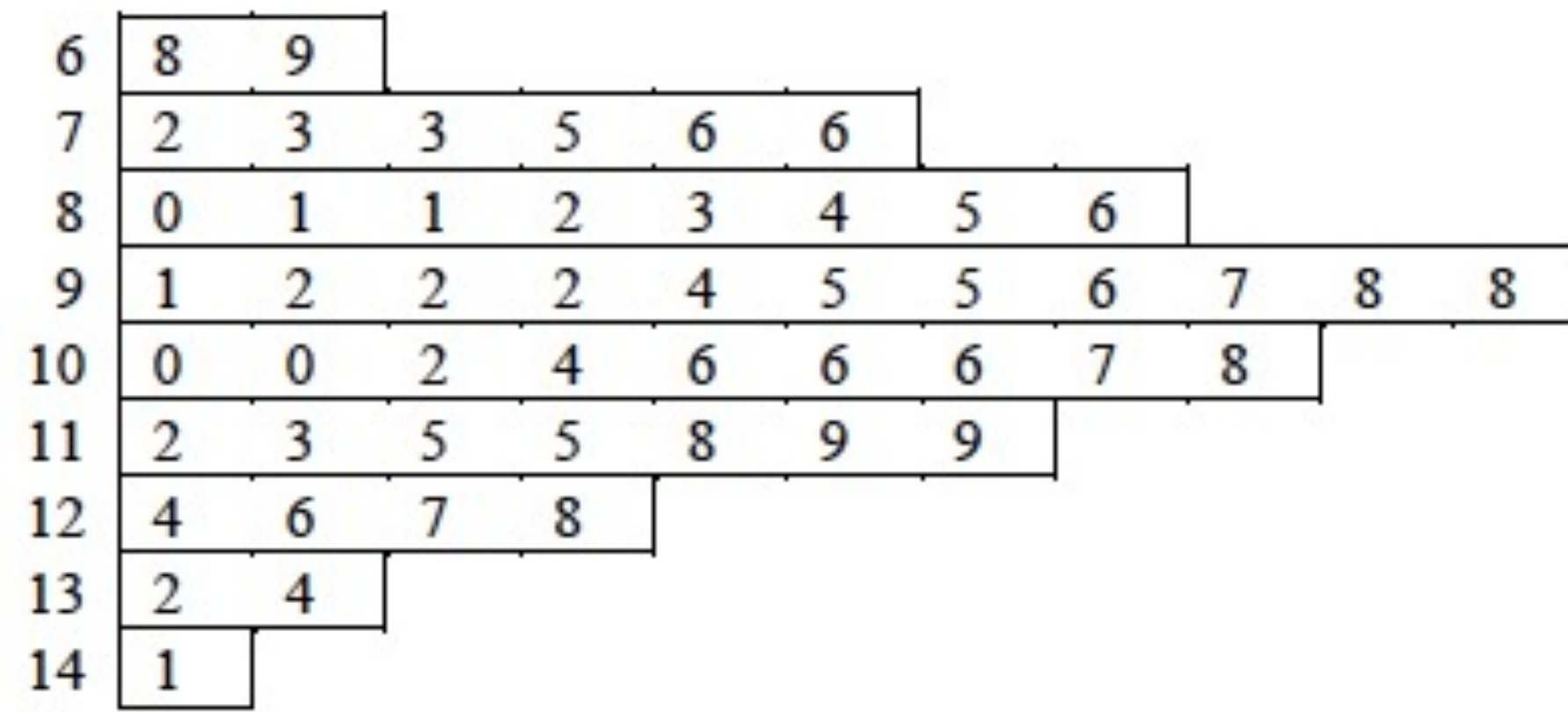
Stem	Leaf
6	8 9
7	2 3 3 5 6 6
8	0 1 1 2 3 4 5 6
9	1 2 2 2 4 5 5 6 7 8 8
10	0 0 2 4 6 6 6 7 8
11	2 3 5 5 8 9 9
12	4 6 7 8
13	2 4
14	1

6	8	9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			</
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Stem	Leaf
6	
6	8 9
7	2 3 3
7	5 6 6
8	0 1 1 2 3 4
8	5 6
9	1 2 2 2 4
9	5 5 6 7 8 8
10	0 0 2 4
10	6 6 6 7 8
11	2 3
11	5 5 8 9 9
12	4
12	6 7 8
13	2 4
13	
14	1
14	

10.6 Constructing Stem-and-Leaf Display

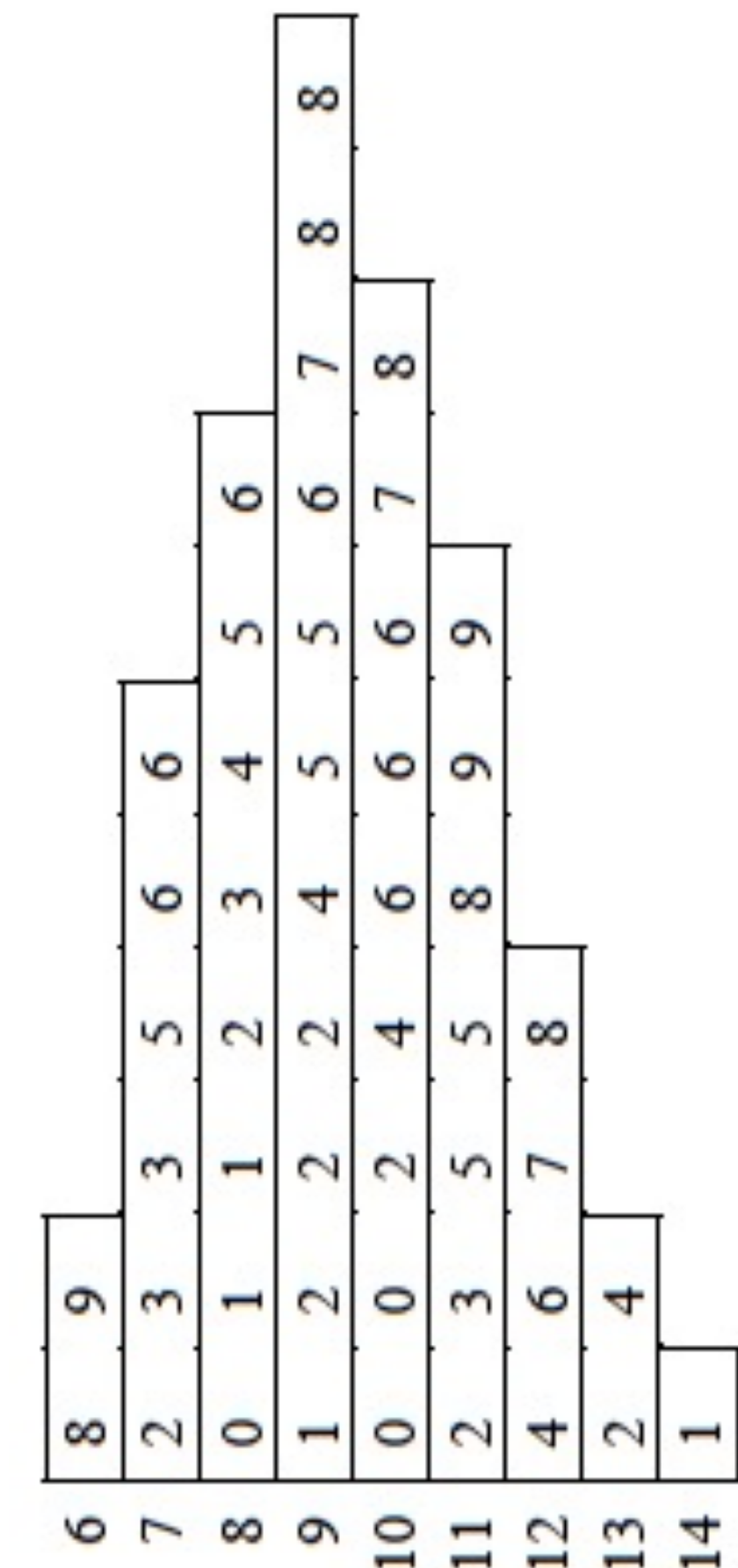
Stem-and-Leaf Display



Stem-and-Leaf Display has **two primary advantages**.

1. The stem-and-leaf display is **easier** to construct by hand.
2. Within a class interval, the stem-and-leaf display **provides more information** than the histogram because the stem-and-leaf **shows the actual data values**.

Histogram



10.6 Constructing Stem-and-Leaf Display

min max

1565 1852 1644 1766 1888 1912 2044 1812 1790 1679 2008 1852 1967 1954 1733

A stem-and-leaf display of these data follows.

Leaf Unit = 10

15	5 6	= 1560
16	4 7	= 1640 1670
17	3 6 9	
18	1 5 5 8	
19	1 5 6	
20	0 4	

Stem | Leaf

Note that a single digit is used to define each leaf and that only the first three digits of each observation have been used to construct the display. At the top of the display we have specified Leaf Unit = 10. To illustrate how to interpret the values in the display, consider the first stem, 15, and its associated leaf, 6. Combining these, we obtain the number 156. To reconstruct an approximation of the original observation, we must multiply this number by 10, the value of the leaf unit. Thus, $156 \times 10 = 1560$ is an approximation of the original observation used to construct the stem-and-leaf display.

1. A partial relative frequency distribution is given.

Class	Relative Frequency
A	0.22
B	0.18
C	0.40
D	...?...

- What is the relative frequency of class D?
- The total sample size is 200. What is the frequency of class D?
- Show the frequency distribution.
- Show the percent frequency distribution.

Assignment 11

Deadline for submission: Monday Sep 13, 2021

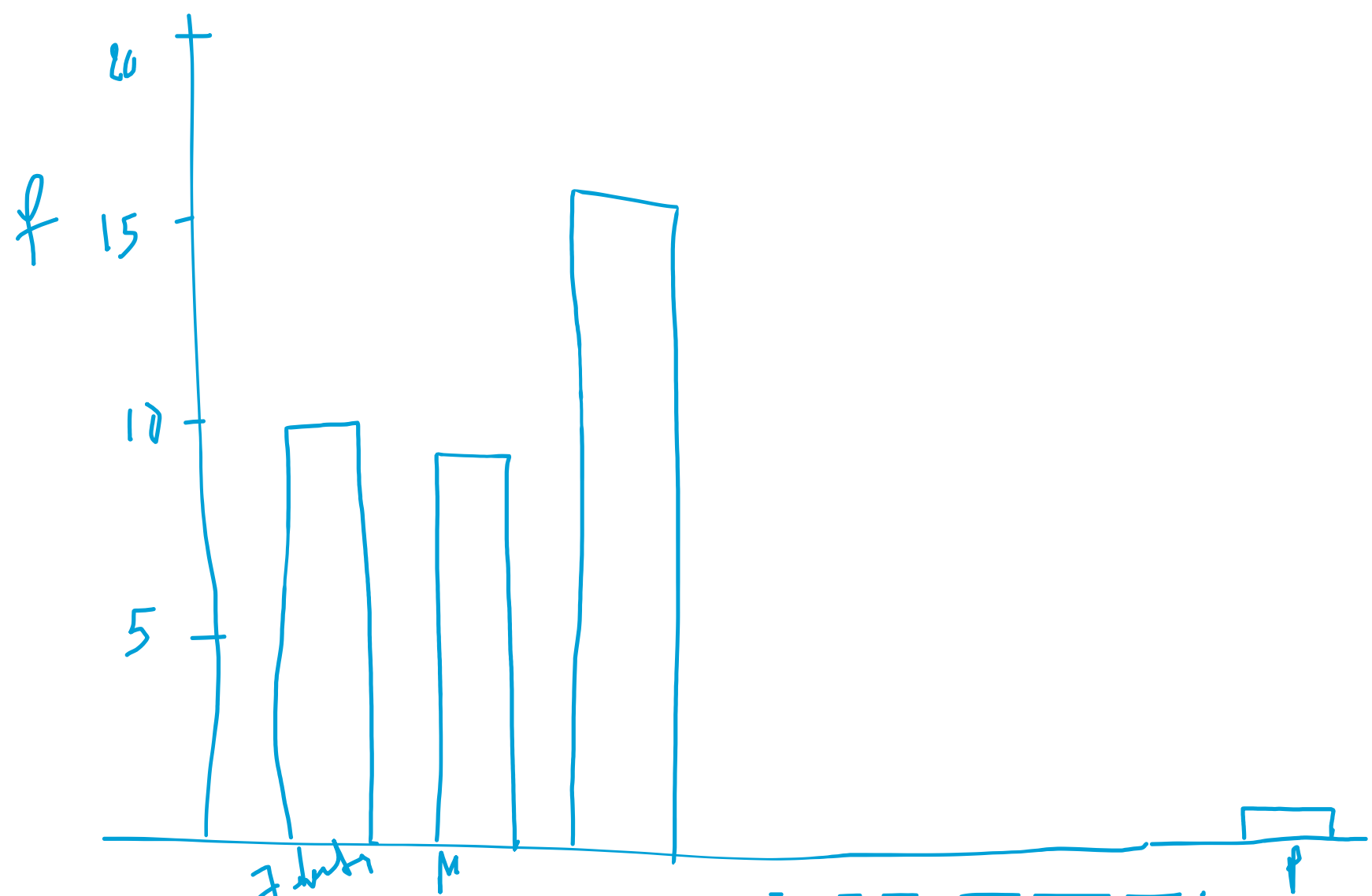
- Exercises 10
- No.3 – Construct Frequency Distribution Table and Draw bar chart and pie chart. (Quali)
- No. 9 - Construct Frequency Distribution Table and Draw histogram and stem & leaf display. (Quanti)

3 7 habits	Dad	7 habits	Millionaire	Millionaire	WSJ Guide
Motley	Millionaire	Tax Guide	7 habits	Dad	Dummies
Millionaire	Motley	Dad	Dad	Parachute	Dad
Dad	7 habits	WSJ Guide	WSJ Guide	WSJ Guide	7 habits
Motley	WSJ Guide	Millionaire	7 habits	Millionaire	Millionaire
Millionaire	7 habits	Millionaire	7 habits	Motley	Motley
Motley	7 habits	Dad	Dad	Dad	Dad
7 habits	WSJ Guide	Tax Guide	Millionaire	Motley	Tax Guide
Motley	Motley	Millionaire	Millionaire	Dad	Dummies
Millionaire	Millionaire	Millionaire	Dad	Millionaire	Dad

Name	f	RF	P (%)
7 habits	10	$\frac{10}{60} = 0.16$	16%
Motley	9		
WSJ	15		
Tax	12		
Dummies	6		
Total	60	1.0	100%

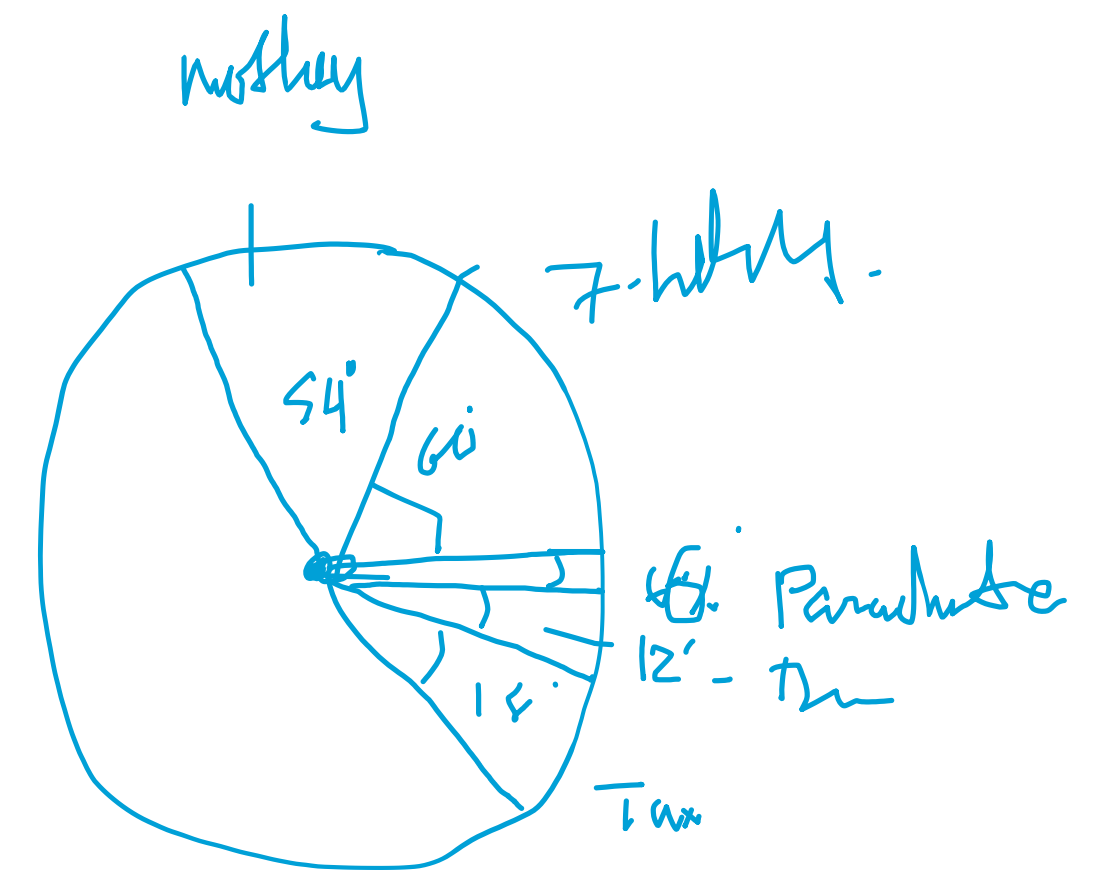
Frequency Distribution Table

Soft Drink	Frequency (f)	Relative Frequency	Percent (%)
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$$7 \text{ habits} = \frac{10}{60} \times 360 = 60^\circ$$

$$\text{Motley} = \frac{9}{60} \times 360 = 54^\circ$$



9.)

145	95	148	112	132	140	162	118	170	144
145	127	148	165	138	173	113	104	141	142
116	178	123	141	138	127	143	134	136	137
155	93	102	154	142	134	165	123	124	124
138	160	157	138	131	114	135	151	138	157

$n = 50$

2^6
 $64 > 50$

Frequency Distribution Table

class width

+15

+15

Class	Class Limit	Tally	Class ± 0.5 Boundary	Midpoint	Frequency (f)	Relative Frequency (%)	CF
1	93 - 107		92.5 - 107.5	100			
2	108 -		107.5 -				
3	123 -						
4							
5							
6							
					50	100%	

$$\text{Range} = \text{max} - \text{min} = 178 - 93 = 85$$

$$\text{no. of classes} \Rightarrow 2^k \geq n ; 2^6 \geq 50, 64 \geq 50 \Rightarrow \text{no. of classes} = \underline{\underline{6}}$$

$$\text{class width} = \frac{\text{range}}{\text{no. of classes}} = \frac{85}{6} = 14.16 \approx \underline{\underline{15}}$$

$$\text{midpoint} = \frac{93 + 107}{2} = 100$$

(class - 1)