Section C
Summarizing Quantitative Data

Recall, there are two types of quantitative data; discrete (countable) and continuous (measurable). In this section, you will learn how to organize and summarize the two types of **quantitative data** using tables and graphs.

Classes are distinct data values or intervals of equal width that cover all the values in a data set.

Organizing Discrete Data in a Table: use the values of the discrete variable to create classes when the number of distinct data values is small.

Organizing Discrete/Continuous Data in a Table: when a data set consists of a large number of different discrete data values or when a data set consists of continuous data, we must create classes by using intervals of numbers. Width of each class/interval must be the same.

Lower class limit: the smallest value that can go in the class

Upper class limit: the smallest value that can go in the next higher class; the upper class limit of the class is the same as the lower class limit of the next higher class

Class width: the difference between the upper and lower class limits

To make creating frequency tables easier we will use the symbol $\leqslant$ which means "**up to but not including**".

For example, an interval written $55 \leqslant 65$ would contain data values 55 up to but not including 65.

The frequency of a class is the number of observations in the class.

A frequency distribution lists each class together with its frequency.

The relative frequency is the ratio (proportion or fraction) of the frequency of each class to the total frequency and it is found by

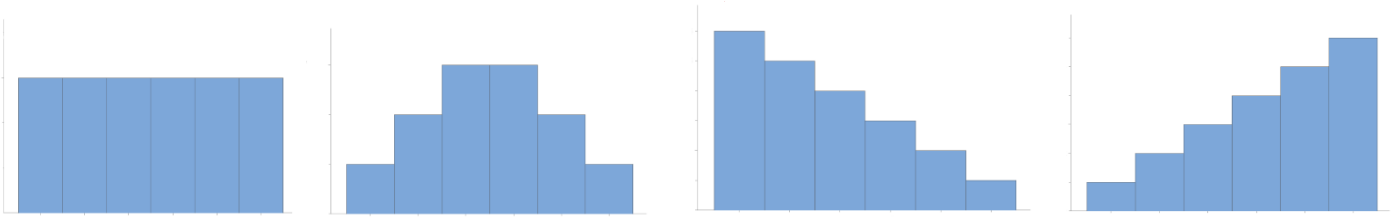
$$\text{relative frequency} = \frac{\text{frequency}}{\text{Sum of all frequencies}}$$

A relative frequency distribution lists each class together with its relative frequency.

A **histogram** is a graphical display of a quantitative frequency table and it is constructed by drawing rectangles for each class of data on the xy- coordinate system. x –axis is the class limits and the y-axis is the frequency or relative frequency of the class.

- Width of each rectangle are the same
- Rectangles touch

Identifying the shape of a Distribution



Uniform | Symmetric (Bell-shaped) | Right Skewed | Left Skewed

Mode – peak or high point of a histogram: unimodal – one mode, bimodal – two modes

Examples

1) A researcher with A.C. Nielson wanted to determine the number of televisions in households. He conducts a survey of 40 randomly selected households and obtains the following data.

1 1 4 2 3 3 5 1 1 2 2 4 1 1 0 3 1 2 2 1
3 1 1 3 2 3 2 2 1 2 3 2 1 2 2 2 1 3 1 3

a) Construct a frequency table.

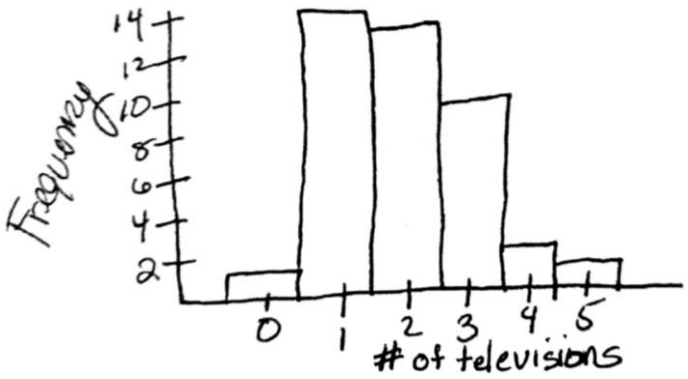
b) Add a relative frequency column to the frequency table you constructed in part (a). Round answers to three decimal places.

Class	Frequency	Relative Frequency
0	**1**	**1/40 = 0.025**
1	**14**	**14/40 = 0.350**
2	**13**	**13/40 = 0.325**
3	**9**	**9/40 = 0.225**
4	**2**	**2/40 = 0.050**
5	**1**	**1/40 = 0.025**
Total	**40**	**1.00**

c) How many households have at least 3 televisions? **9 + 2 + 1 = 12**

d) What percent of households have 1 television? **35%**

e) Construct a frequency histogram of the data.



f) Describe the shape of the distribution. **Right skewed**

2) The Jefferson National Bank has five tellers available to serve customers. The data in the following table provide the number of busy tellers observed at 30 spot checks.

5	4	4	1	5	5	1	5	5	5	3	2	0	1	2
3	5	2	4	3	4	5	0	4	4	4	3	2	4	3

a) Construct a frequency table.

b) Add a relative frequency column to the frequency table you constructed in part (a). Round answers to three decimal places.

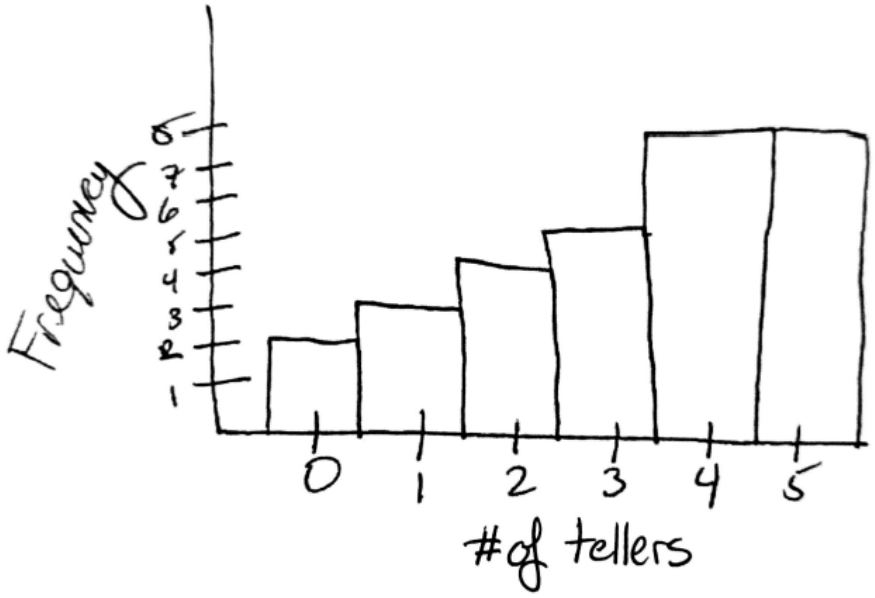
Class	Frequency	Relative Frequency
0	**2**	**2/30 = 0.067**
1	**3**	**3/30 = 0.100**
2	**4**	**4/30 = 0.133**
3	**5**	**5/30 = 0.167**
4	**8**	**8/30 = 0.267**
5	**8**	**8/30 = 0.267**
Total	**30**	**1.00**

c) How many times are more than 4 tellers busy? **8**

d) What percent of the time are less than 3 tellers busy? **6.7% + 10% + 13.3% = 30%**

or (2 + 3 + 4)/30 *100 = 30%

e) Construct a histogram of the data.



f) Describe the shape of the distribution. **Left Skewed**

3) The exam scores for the 25 students in an introductory statistics class are as follows:

34 39 54 58 60 63 64 67 70 75 77 78 76 81 82 84 85 86 88 89 89 90 96 96 99

a) Construct a frequency table. (Starting with 30 ⩽ 40)

b) Add a relative frequency column to the frequency table you constructed in part (a). Round answers to two decimal places.

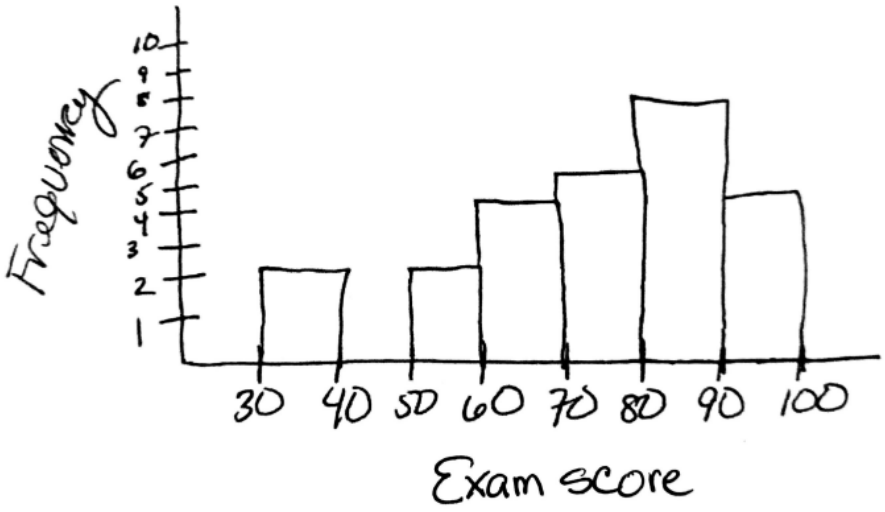
Interval	Frequency	Relative Frequency
30 ⩽ 40	**2**	**2/25 = 0.08**
40 ⩽ 50	**0**	**0/25 = 0**
50 ⩽ 60	**2**	**2/25 = 0.08**
60 ⩽ 70	**4**	**4/25 = 0.16**
70 ⩽ 80	**5**	**5/25 = 0.20**
80 ⩽ 90	**8**	**8/25 = 0.32**
90 ⩽ 100	**4**	**4/25 = 0.16**
Total	**25**	**1.00**

c) How many students had exam scores between 70 and 90, including 70 but not including 90? **5 + 8 = 13**

d) What percent of the students had exam scores less than 60? **8% + 0% + 8% = 16%**

or (2 + 0 + 2)/25*100= 16%

e) Construct a frequency histogram of the data.



f) Describe the shape of the distribution. **Left Skewed**

4) The Food and Nutrition Board of the National Academy of Sciences states that the recommended daily allowance of iron is 18mg for adult females under the age of 51. The amounts of iron intake, in milligrams, during a 24-hour period for a sample of 45 such females follows.

9.1	9.4	10.7	10.9	11.0	11.5	11.8	12.2	12.3
12.5	12.6	12.8	13.1	13.4	13.6	13.6	13.8	14.2
14.4	14.5	14.6	14.6	14.7	15.0	15.1	15.3	15.6
16.0	16.3	16.3	16.4	16.6	16.6	16.8	17	17.3
18.1	18.1	18.2	18.3	18.3	18.6	19.5	19.8	20.7

a) Construct a frequency table, using 6 classes starting with a value of 9.

b) Add a relative frequency column to the frequency table you constructed in part (a). Round answers to three decimal places.

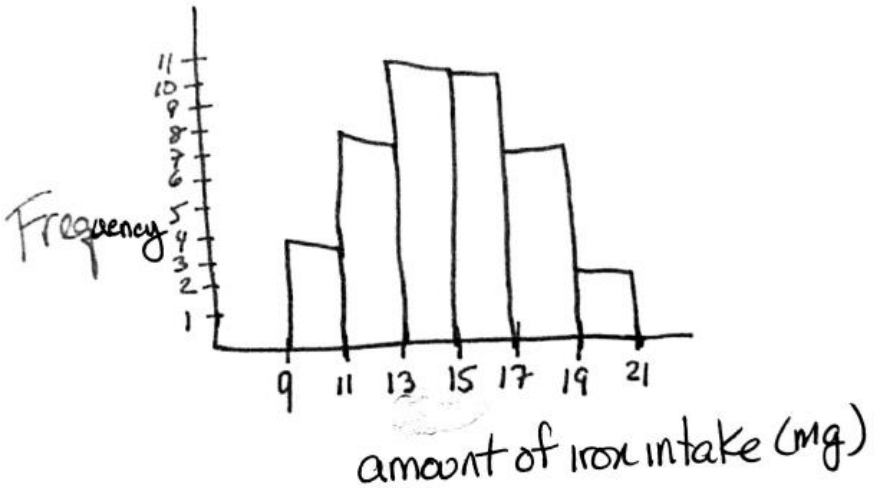
Interval	Frequency	Relative Frequency
$9 \leqslant 11$	**4**	**4/45 = 0.089**
$11 \leqslant 13$	**8**	**8/45 = 0.178**
$13 \leqslant 15$	**11**	**11/45 = 0.244**
$15 \leqslant 17$	**11**	**11/45 = 0.244**
$17 \leqslant 19$	**8**	**8/45 = 0.178**
$19 \leqslant 21$	**3**	**3/45 = 0.067**
Total	**45**	**1.00**

c) How many females had an iron intake of at least 15 milligrams? **11 + 8 + 3 = 22**

d) What percent of the females had an iron intake of between 9 and 17, including 9 but not including 17?

8.9% + 17.8% + 24.4% + 24.4% = 75.5% or (4 + 8 + 11 + 11)/45*100 = 75.6%

e) Construct a frequency histogram of the data.



f) Describe the shape of the distribution. **Symmetric**