

13.4 STATISTICAL GRAPHS

Mathematical Concepts

March 31, 2009

We look at ways of displaying a given set of data information in a way that would be helpful to a targeted reader.

To achieve this, we shall examine four types of graphs, namely

- ▶ Circle graphs (pie charts)
- ▶ Histograms
- ▶ Frequency polygons
- ▶ Stem-and-leaf display

Six hundred people who attended a Ringling Bros. and Barnum & Bailey circus were asked to indicate their favorite performance. The results are illustrated below.

Performance	Number of People
Tigers	230
Elephants	154
Acrobats	99
Jugglers	91
Other	<u>26</u>
	600

Use this information to construct a circle graph illustrating the percent of people whose favorite circus performance was tigers, elephants, acrobats, jugglers, and other performances.

Solution: Start by determining the measure of the central angle.

Performance	Number of People	Percent of Total (to the nearest tenth percent)	Measure of Central Angle
Tigers	230	$\frac{230}{600} \times 100 \approx 38.3\%$	$0.383 \times 360 = 137.9^\circ$
Elephants	154	$\frac{154}{600} \times 100 \approx 25.7\%$	$0.257 \times 360 = 92.5^\circ$
Acrobats	99	$\frac{99}{600} \times 100 \approx 16.5\%$	$0.165 \times 360 = 59.4^\circ$
Jugglers	91	$\frac{91}{600} \times 100 \approx 15.2\%$	$0.152 \times 360 = 54.7^\circ$
Other	26	$\frac{26}{600} \times 100 \approx 4.3\%$	$0.043 \times 360 = 15.5^\circ$
Total	600	100%	360.0°

Use a protractor to construct a circle graph similar to the one below, Figure 1.

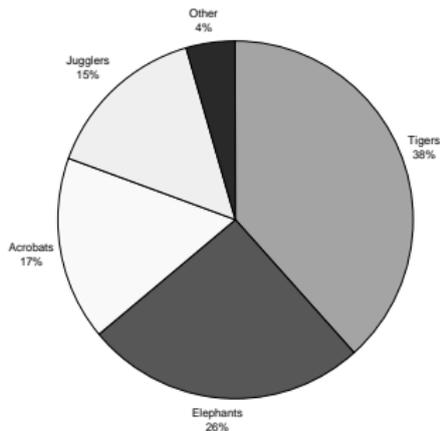


Figure: Favorite Performance at the Circus

- ▶ A **histogram** is a graph with observed values on its horizontal scale and frequencies on its vertical scale.
- ▶ A bar is constructed above each observed value (or class when classes are used), indicating the frequency of that value (or class).
- ▶ The horizontal scale need not start at zero.
- ▶ The vertical scale must start at zero.
- ▶ The calibrations on the horizontal and vertical scales do not have to be the same.

The frequency distribution for the number of children per family is given below. Construct a histogram of this frequency distribution

Number of Children (Observed Values)	Number of Families (Frequency)
0	8
1	11
2	18
3	11
4	6
5	4
6	2
7	1
8	2
9	1

Solution:

- ▶ The vertical scale must extend at least to the number 18 since that is the greatest recorded frequency.
- ▶ The horizontal scale must include the numbers 0-9, the number of children observed
- ▶ Eight families have no children. We indicate that by constructing a bar above the number 0, centered at 0, on the horizontal scale extended up to 8 on the vertical scale.
- ▶ Eleven families have one child, on the horizontal scale, so we construct a bar extending to 11 above the number 1, centered at 1, on the horizontal scale.
- ▶ Continue the procedure for each observed value.
- ▶ Both the horizontal and vertical scales should be labeled, the bars should be the same width and centered at the observed value.

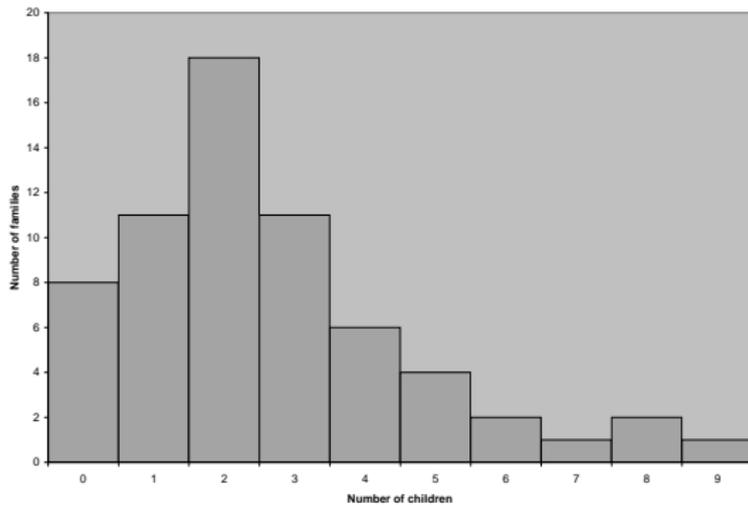


Figure: Number of Children per Family

Frequency polygons are line graphs with scales the same as those of the histogram

- ▶ To construct a frequency polygon
 - ▶ place a dot at at the corresponding frequency above each each of the observed values.
 - ▶ connect the dots with straight-line segments.
- ▶ Always put in two additional class marks, one at the lower end and one at the upper end on the horizontal scale (values for these added class marks are not needed on the frequency polygon).

Construct a frequency polygon of the frequency distribution in the previous example.

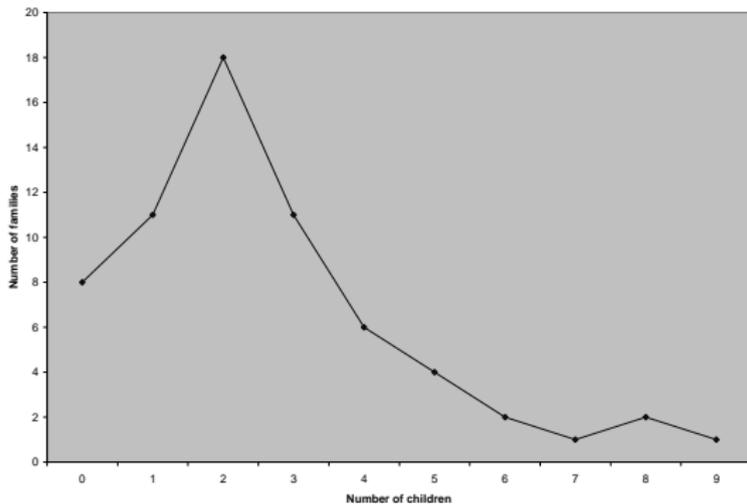


Figure: Number of Children per Family

The frequency distribution of the one-way commuting distances for 70 workers is listed in Table below. Construct a histogram and then construct a frequency polygon.

Distance (miles)	Number of Workers
1-7	15
8-14	24
15-21	13
22-28	8
29-35	5
36-42	5

Chart4

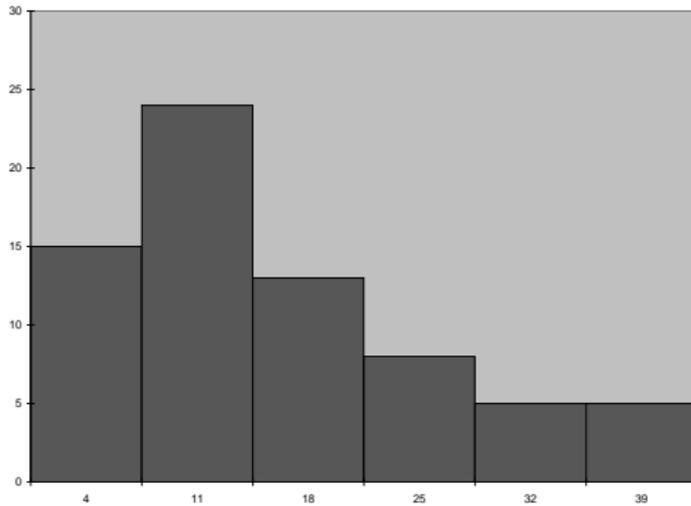


Figure: One way commuting Distance

The histogram below shows the weights of selected pieces of carry-on luggage at an airport. Construct the frequency distribution from the histogram.

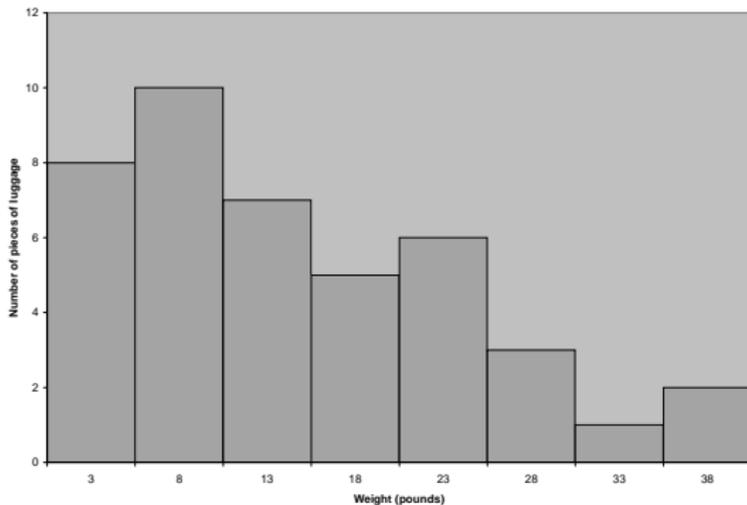


Figure: Weight of Selected Pieces of Carry-on Luggage

Note that each there are five units between class midpoints, so each class width must also be five units.

Weight (pounds)	Number of Pieces of Luggage
1-5	8
6-10	10
11-15	7
16-20	5
21-25	6
26-30	3
31-35	1
36-40	2

A **stem-and-leaf display** is a tool that organizes and groups the data while allowing us to see the actual values that make up the data.

To construct a stem-and-leaf display each value is represented with two different groups of digits.

The left group of digits is called the *stem*. The remaining group of digits on the right is called the *leaf*.

There is no rule for the number of digits to be included in the stem. Usually the units digit is the leaf and the remaining digits are the stem.

For example, the number 53 would be broken up into 5 and 3. The 5 would be the stem and the 3 would be the leaf. The number 417 would be broken up into 41 and 7. The 41 would be the stem and the 7 would be the leaf.