Minitab

ACTIVITY SHEET: DESCRIBING DATA *GRAPHICALLY*
This activity sheet includes exercises to assess students' understanding of important concepts presented in the *Describing Data Graphically* lesson.

Describing Data *Graphically*

The data for these exercises are in the Minitab file ***DescribingDataGraphically_Activity.mtw***.

Exercise 1

The following table shows the film lengths (in minutes) of a sample of videotape versions of n = 22 films directed by Alfred Hitchcock. Films are listed in alphabetical order. The data are in the Minitab columns "Hitchcock Movies" and "Film Lengths (min)."

Film	Lengths (min)	Film	Lengths (min)
The **B**irds	119	**P**sycho	108
Dial M for Murder	105	**R**ear Window	113
Family Plot	120	**R**ebecca	132
Foreign Correspondent	120	**R**ope	81
Frenzy	116	**S**hadow of a Doubt	108
I Confess	108	**S**pellbound	111
The **M**an Who Knew Too Much	120	**S**trangers on a Train	101
Marnie	130	**T**o Catch a Thief	103
North by Northwest	136	**T**opaz	126
Notorious	103	**U**nder Capricorn	117
The **P**aradise Cane	116	**V**ertigo	128

(a) Construct a histogram of this data in Minitab.

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1 Choose **Graph** > **Histogram**.

2 Choose **Simple**, then click **OK**.
3 Under **Graph variables**, enter *'Film Lengths (min).'*
4 Click **OK**.

Minitab Express

1 Open the histogram dialog box.
   - Mac: **Graphs > Histogram > Simple**
   - PC: **GRAPHS > Histogram > Simple**
2 In **Variables**, enter *'Film Lengths (min).'*
3 Click **OK**.

(b) Change the histogram bins to **cutpoints** (boundary values), instead of **midpoints**. In the histogram for part **(a)**, Minitab has a midpoint labelled in each bin. Using cutpoints may be preferred since the bin locations are not printed directly on the graph when using midpoints.

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1 Double-click the histogram bins.
2 Click the **Binning** tab.
3 Under Interval Type, choose **Cutpoint**.
4 Click **OK**.

Minitab Express

1 Click the graph to select it.
2 Click the plus sign to open the graph elements menu.
3 Click the arrow next to **Binning**.
4 Choose **Cutpoint**. Select 8 for **Number of Bins**.
5 Click **OK**.

(c) Add the following enhancements to the histogram from part **(b)**.

1. Add a **footnote** that the histogram bins contain their left endpoints. For example, a bin from 136 to 144 contains film lengths such that 136 ≤ film lengths < 144. A footnote is helpful in making notes about your output for easy interpretation.

   Minitab 17

   1 Right-click anywhere inside the graph.
   2 Choose **Add > Footnote**.
   3 Enter footnote text, such as "Bins contain their left endpoints."
   4 Click **OK**.

Minitab Express

1. Click the graph to select it.
2. Click the plus sign to open the graph elements menu.
3. Select **Footnote**.
4. Select the graph, then click the footnote to edit it.
5. Enter footnote text, such as "Bins contain their left endpoints."
6. Press **Enter**.

2. Include a more descriptive **title** with the histogram, such as "Histogram of a Sample of Hitchcock Film Lengths (min)."

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1. Double-click the title.
2. In the **Edit Title** dialog under **Text**, enter a new title.
3. Click **OK**.

Minitab Express

1. Select the graph, then click the title to edit it.
2. Enter a new title.
3. Press **Enter**.

(d) Which film appears to be an outlier with respect to film length?

(e) Construct a stem-and-leaf plot of the "Film Lengths (min)" data in Minitab. Let Minitab choose the increment value.

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1. Choose **Graph > Stem-and-Leaf**.
2. In **Graph variables**, enter *'Film Lengths (min).'*
3. Click **OK**.

Minitab Express

1. Open the stem-and-leaf-plot dialog box.
   - Mac: **Graphs** > **Stem-and-Leaf Plot**
   - PC: **GRAPHS** > **Stem-and-Leaf Plot**
2. In **Variable**, enter *'Film Lengths (min).'*
3. Click **OK**.

(f) Use your plot in part **(e)**. Ignore the first column for now [1, 1, 1, 1, 4, 8, 10, (4), 8, 5, 3, 1], and interpret row 6. What are the lengths of these Hitchcock films?

As an example, let's ignore the first column and interpret row 5, which should contain the following: 10 | 133. These results indicate that the sample data contain Hitchcock film lengths of 101, 103, and 103 minutes, respectively.

(g) What is the longest film length from this sample of Hitchcock films?

(h) Are there any Hitchcock films in this sample that have lengths between 85 and 100 minutes?

(i) Now let's use the first column, or the "count" column, of the stem-and-leaf plot for Hitchcock film lengths. How many of the sample Hitchcock films have lengths less than 110 minutes?

(j) What is the mode or modes of the sample of Hitchcock film lengths?

(k) This is a personal preference question. Which graph do you prefer for gathering information about the length of Hitchcock films—the histogram or stem-and-leaf plot? Briefly state why.

Exercise 2

Below are stem-and-leaf plots of n = 40 Statistics Exam 1 scores. One plot uses an increment of 10 and the other uses an increment of 5, where the **increment** indicates the difference in value between stems.

Stem increments of 10:

Stem-and-Leaf Display: Exam I Scores

```
Stem-and-leaf of Exam I Scores  N  = 40
Leaf Unit = 1.0

 9    6  034667899
 17   7  00122244
(19)  8  0011111223445557899
 4    9  0358
```

Stem increments of 5:

Stem-and-Leaf Display: Exam I Scores

```
Stem-and-leaf of Exam I Scores  N  = 40
Leaf Unit = 1.0

 3    6  034
 9    6  667899
 17   7  00122244
 17   7
(12)  8  001111122344
 11   8  5557899
 4    9  03
 2    9  58
```

What does the second stem-and-leaf plot (with an increment of 5) reveal about the data that is not visibly apparent in the first stem-and-leaf plot (with an increment of 10)?

Exercise 3

Below is a stem-and-leaf plot of the NBA teams' payroll salaries for the 2013-14 season, in millions of dollars.

Stem-and-Leaf Display: Rounded Salaries (millions)

```
Stem-and-leaf of NBA Team Salaries (in millions)  N  = 30
Leaf Unit = 1.0

 1    4   7
 2    5   1
 5    5   779
 13   6   01122344
(6)   6   578888
 11   7   011124
 5    7   9
 4    8   24
 2    8   9
 1    9
 1    9
 1    10  3
```

(a) How many teams had salaries of at least 70 million dollars?

(b) What is the median team salary for the 30 NBA teams?

Exercise 4

The following data are commute times (in minutes) from your professor's home to work for 25 consecutive work days. The data are in the Minitab column "Commute Times."

18.1	18.2	18.0	17.9	17.8	18.0	17.8	18.1	18.2	18.0	18.3	18.5	18.0
17.5	17.8	18.3	18.6	18.8	17.4	18.6	37.4	18.7	18.0	17.2	19.1	

(a) Construct a histogram in Minitab of your professor's commute times. Refer to **Exercise 1** for instructions on constructing a histogram in Minitab.

Make sure your histogram includes the following:

- Cutpoints instead of midpoints
- Appropriate title

- Appropriate time units identified in the plot
- Footnote explaining which endpoint is contained in the histogram bins

(b) The 21st commute time, 37.4 minutes, reflects a day when your professor left home without his laptop computer and had to turn around to retrieve it. Remove this outlier from the data set and reconstruct the histogram.

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1 In the "Commute Times" column, click on row 21. Press the **Delete** key to convert the data point to an asterisk.
2 Right-click anywhere inside the histogram and select **Update Graph Automatically**.

Minitab Express

1 In the "Commute Times" column, click on row 21. Press the **Delete** key to convert the data point to an asterisk.
2 Select **Make Similar** located above the Output Pane.
3 Click **OK**.

(c) How many days did your professor's commute time fall between 18 minutes (inclusive) and 18.5 minutes (exclusive); i.e. 18 ≤ commute time < 18.5? This can be found by hovering over the appropriate bin(s) in your histogram. Recall that Minitab includes its left endpoints in each bin frequency count.

Exercise 5

Below is a sample of the total times (in minutes) that you spent reading online news on a given day during the past two months. The data are in the Minitab column "News Reading Times."

28.1	31.2	13.7	46.0	25.8	16.8	34.8	62.3	28.0	17.9	19.5	21.1	31.9	28.9
60.1	23.7	18.6	21.4	26.6	26.2	32.0	43.5	17.4	38.8	30.6	55.6	25.5	52.1
21.0	22.3	15.5	36.3	19.1	38.4	72.8	48.9	21.4	20.7	57.3	40.9		

(a) Construct a histogram of this data using cutpoints. Label your axes (include time units) and make sure the title is appropriate. Also, the reader should be told how the histogram bins were constructed.

(b) What type of skewness, if any, does this data display?

(c) A **transformation** of data values by some mathematical function, such as $\sqrt{x}$ or $1/x$, can often yield a set of data values with "nicer" statistical properties than the original data, such as symmetry or a bell-shape.

Calculate $1/\sqrt{x}$ for each data value and put the new transformed data values in a new column in Minitab.

Minitab 17

1 Choose **Calc > Calculator**.
2 In **Store result in variable**, type C10 or 'Transformed Data' to store the transformed data in an empty column.
3 In the **Expression** box, enter *1/SQRT('News Reading Times')*.
4 Click **OK**.

Minitab Express

1 Open the formula dialog box.
   - Mac: **Data > Formula**
   - PC: **DATA** > **Formula**
2 In the **Expression** box, enter *1/SQRT('News Reading Times')*.
3 Click **OK**.
4 The column of data in which your expression resides will be named *'Expression.'* Double-click this name cell to change the name of your column if desired.

You will notice the transformed data begins with the following values:

0.188646 0.179029 0.270172 0.147442 0.196875 0.243975 0.169516

(d) Construct a histogram of the transformed data using cutpoints. As always, label your axes (include time units) and make sure the title is appropriate, which includes referring to the transformation applied to the data. Also, the reader should be told how the histogram bins were constructed.

(e) What is the effect of the transformation on the data?