

Assignments for Prob/Stat/Discrete

Unit 4: Chapter 2 Descriptive Statistics

		Assignment (Due the next class meeting)
		4.1 Worksheet
		4.2 Worksheet

NOTE: You should be prepared for daily quizzes.

HW reminders:

- If you cannot solve a problem, get help **before** the assignment is due.
- Help is available before school or during lunch.
- For extra practice, visit www.interactmath.com
- Click ENTER, then scroll down to Larson, Elementary Statistics 4th edition. Pick the assignment you need extra practice with. You can get immediate feedback and hints.
- Don't forget that you can get 24-hour math help from www.smarthinking.com!

Section 4.1, Frequency Distributions and Their Graphs

Section 4.1 Part I Objectives

- Can you construct and interpret frequency distributions?
- Can you calculate midpoints and frequencies?
- Can you explain in words the difference between a relative frequency and a cumulative frequency?
- Can you construct and interpret frequency histograms?
- Can you construct and interpret frequency polygons?

Frequency Distribution

- A table that shows _____ or _____ of data with a count of the number of entries in each class.
- The _____, f , of a class is the number of data entries in the class.

Class Width $6-1=5$

Class	Frequency, f
1- 5	5
6-10	8
11-15	6
16-20	8
21-25	5
26-30	4

Upper Class Limits

Lower Class Limits

Constructing a Frequency Distribution

1. Decide on the _____ of classes.
 - Usually between 5 and 20; otherwise, it may be difficult to detect any _____.
2. Find the class _____.
 - Determine the range of the data.
 - _____ the range by the number of classes.
 - Round up to the next convenient number.

3. Find the class limits.

- You can use the _____ data entry as the lower limit of the first class.
- Find the remaining lower limits (_____ the class width to the lower limit of the next class).
- Find the _____ limit of the first class. Remember that classes cannot overlap (look at the lower limit of the next class to help.)
- Find the remaining upper class limits.

4. Make a _____ mark for each data entry in the row of the appropriate class.

5. Count the tally marks to find the total _____ f for each class.

Example: Constructing a Frequency Distribution

The following sample data set lists the number of minutes 50 Internet subscribers spent on the Internet during their most recent session. Construct a frequency distribution that has seven classes.

50 40 41 7 11 7 22 44 28 21 19 23 37 51 54 42 86

41 78 56 72 56 17 7 69 30 80 56 29 33 46 31 39 20

18 29 34 59 73 77 36 39 30 62 54 67 39 31 53 44

1. Number of classes = _____

2. Find the class width _____ Round up to _____

3. Use _____ (minimum value) as first lower limit. Add the class width of _____ to get the lower limit of the next class.

$$7 + \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

Find the remaining lower limits by adding _____ each time.

Class Width =

Lower Limit	Upper Limit

The upper limit of the first class is _____ (one less than the lower limit of the second class).
Add the class width of _____ to get the upper limit of the next class.

Find the remaining upper limits by adding _____.

Lower Limit	Upper Limit

Class Width
= _____

4. Make a tally mark for each data entry in the row of the appropriate class.
5. Count the tally marks to find the total frequency f for each class

Class	Tally	Frequency, f
7 – 18		
19 – 30		
31 – 42		
43 – 54		
55 – 66		
67 – 78		
79 – 90		

$\Sigma f = 50$



What is that symbol at the bottom of the chart?

Σ is the Greek letter _____, and it means the “_____”.

So Σf means the “_____.”

Determining the Midpoint:

Midpoint of a class: the point in the _____ of a class.

$$\frac{(\text{Lower class limit}) + (\text{Upper class limit})}{2}$$

Class	Midpoint	Frequency, f
7-18		6
19-30		10
31-42		13

Class Width=12

Determining the Relative Frequency

Relative Frequency of a class

- Portion or _____ of the data that falls in a particular class.

$$\text{relative frequency} = \frac{\text{frequency}}{\text{Sample size}} = \frac{f}{n}$$

Class	Frequency, f	Relative frequency
7-18	6	
19-30	10	
31-42	13	

Cumulative frequency of a class

- The _____ of the frequency for that class and all _____ classes.

Class	Frequency, f	Cumulative frequency
7-18	6	6
19-30	+ 10	
31-42	+ 13	

Expanded Frequency Distribution

Class	Frequency, f	Midpoint	Relative Frequency	Cumulative Frequency
7 – 18	6	12.5	0.12	6
19 – 30	10	24.5	0.20	16
31 – 42	13	36.5	0.26	29
43 – 54	8	48.5	0.16	37
55 – 66	5	60.5	0.10	42
67 – 78	6	72.5	0.12	48
79 – 90	2	84.5	0.04	50

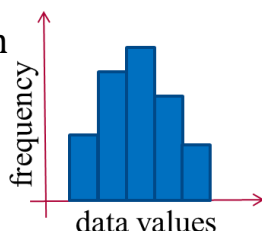
$$\sum f = 50$$

$$\sum \frac{f}{n} = 1$$

Graphs of Frequency Distributions

Frequency Histogram

- A _____ graph that represents the frequency distribution.
- The _____ scale is quantitative and measures the data values.
- The vertical scale measures the _____ of the classes.
- Consecutive bars must touch



Class Boundaries

- The numbers that separate classes without forming _____ between them
- The distance from the upper limit of the first class to the lower limit of the second class is $19 - 18 = 1$.
- _____ this distance is 0.5.
- First class lower boundary = $7 - 0.5 = 6.5$
- First class upper boundary = $18 + 0.5 = 18.5$

Class	Class Boundaries	Frequency, f
7 – 18	6.5-18.5	6
19 – 30		10
31 – 42		13

Class Boundaries

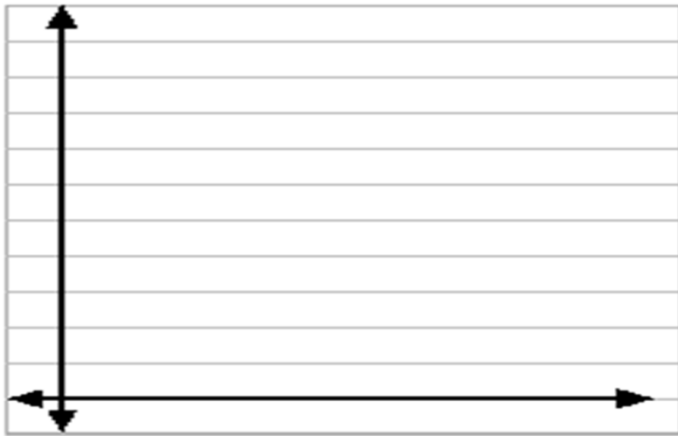
Class	Class Boundaries	Frequency, f
7 – 18	6.5 – 18.5	6
19 – 30		10
31 – 42		13
43 – 54		8
55 – 66		5
67 – 78		6
79 – 90		2

Example: Frequency Histogram

Construct a frequency histogram for the Internet usage frequency distribution.

Class	Class Boundaries	Midpoint	Frequency, f
7 – 18	6.5 – 18.5	12.5	6
19 – 30	18.5 – 30.5	24.5	10
31 – 42	30.5 – 42.5	36.5	13
43 – 54	42.5 – 54.5	48.5	8
55 – 66	54.5 – 66.5	60.5	5
67 – 78	66.5 – 78.5	72.5	6
79 – 90	78.5 – 90.5	84.5	2

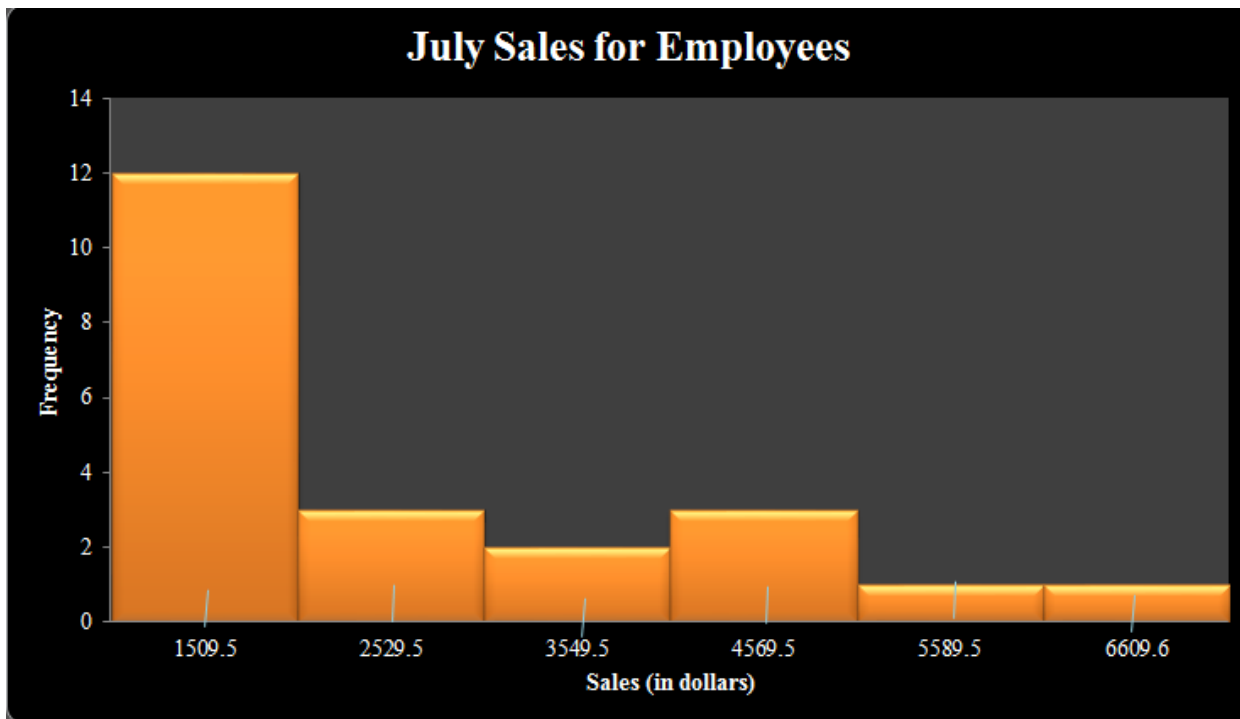
Solution: Frequency Histogram (using Midpoints)



Solution: Frequency Histogram (using class boundaries)



Example: Interpreting frequency histograms

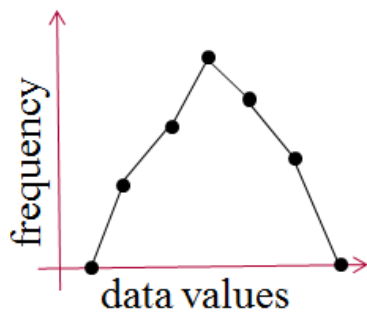


1. How many classes?
2. What is the class width?
3. What is the frequency of the class with the greatest frequency?
4. Find Σf .
5. Describe any patterns.

Graphs of Frequency Distributions

Frequency Polygon

- A line graph that emphasizes the continuous _____ in frequencies.



Example: Frequency Polygon

Construct a frequency polygon for the Internet usage frequency distribution. Plot the midpoint on the _____ axis and the frequency on the _____ axis.

Class	Midpoint	Frequency, f
7 – 18	12.5	6
19 – 30	24.5	10
31 – 42	36.5	13
43 – 54	48.5	8
55 – 66	60.5	5
67 – 78	72.5	6
79 – 90	84.5	2

Solution: Frequency Polygon

The graph should begin and end on the horizontal axis, so extend the left side to one class width before the first class midpoint and extend the right side to one class width after the last class midpoint.



You can see that the frequency of subscribers increases up to 36.5 minutes and then decreases

4.1 Part II Notes

More Frequencies Graphs

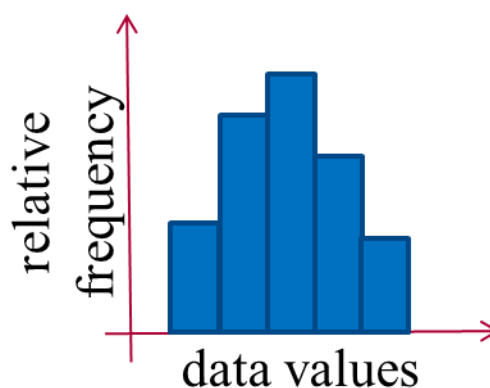
Section 4.1 Part II Objectives

- Can you construct and interpret relative frequency histograms?
- Can you explain the difference between relative frequencies and cumulative frequencies?
- Can you construct and interpret ogives?
- Can you use technology to create displays

Graphs of Frequency Distributions

Relative Frequency Histogram

- Has the same shape and the same horizontal scale as the corresponding frequency histogram.
- The vertical scale measures the _____ **frequencies**, not frequencies.



Example: Relative Frequency Histogram

Construct a relative frequency histogram for the Internet usage frequency distribution.

Class	Class Boundaries	Frequency, f	Relative Frequency
7 – 18	6.5 – 18.5	6	0.12
19 – 30	18.5 – 30.5	10	0.20
31 – 42	30.5 – 42.5	13	0.26
43 – 54	42.5 – 54.5	8	0.16
55 – 66	54.5 – 66.5	5	0.10
67 – 78	66.5 – 78.5	6	0.12
79 – 90	78.5 – 90.5	2	0.04

Solution: Relative Frequency Histogram

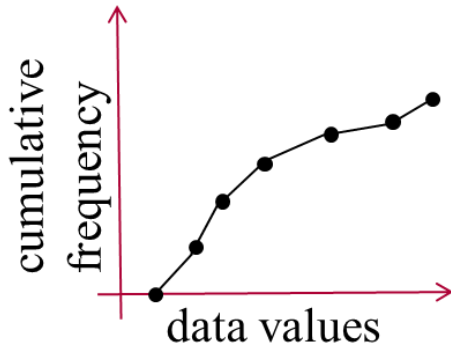


From this graph you can see that _____% of Internet subscribers spent between 18.5 minutes and 30.5 minutes online.

Graphs of Frequency Distributions

Cumulative Frequency Graph or Ogive

- A line graph that displays the _____ frequency of each class at its upper class boundary.
- The _____ boundaries are marked on the horizontal axis.
- The cumulative frequencies are marked on the _____ axis.



Constructing an Ogive

1. Construct a frequency distribution that includes cumulative frequencies as one of the columns.
2. Specify the horizontal and vertical scales.
 - The horizontal scale consists of the upper class boundaries.
 - The vertical scale measures cumulative frequencies.
3. Plot points that represent the upper class boundaries and their corresponding cumulative frequencies.
4. Connect the points in order from left to right.
5. The graph should start at the _____ boundary of the first class (cumulative frequency is _____) and should end at the upper boundary of the last class (cumulative frequency is equal to the sample size n).

Example: Ogive

Construct an ogive for the Internet usage frequency distribution.

Class	Class Boundaries	Frequency, f	Cumulative Frequency
7 – 18	6.5 – 18.5	6	6
19 – 30	18.5 – 30.5	10	16
31 – 42	30.5 – 42.5	13	29
43 – 54	42.5 – 54.5	8	37
55 – 66	54.5 – 66.5	5	42
67 – 78	66.5 – 78.5	6	48
79 – 90	78.5 – 90.5	2	50

Solution: Ogive



From the ogive, you can see that about _____ subscribers spent 60 minutes or less online during their last session. The greatest increase in usage occurs between _____ minutes and _____ minutes

Technology Directions: Graphing Calculator directions (entering a list)

Button	Comments
STAT	
EDIT	(or just hit ENTER)
Arrow up to L1	
CLEAR	to erase previous entries
ENTER	
Type in 1 st entry	
ENTER	
Enter all other items in the same fashion.	

Don't forget to erase L1 if a list has already been entered.
There could be "hidden" entries that will impact your calculations.

Technology Directions: Graphing Calculator directions (plotting a list)

Button	Comments
STATPLOT	Note: you must have entered L1 (and possibly L2) before you can display any data.
2 nd	
y=	
ENTER	to choose Plot 1 (Use arrow and ENTER to turn the plot on, if it already isn't on.)
Arrow down and then right to choose appropriate graph.	
ENTER	Some displays require L1 and L2.
ZOOM 9	This chooses the window to fit your data automatically.

Section 4.2 Part I

More Graphs and Displays

Section 4.2 Part I Objectives

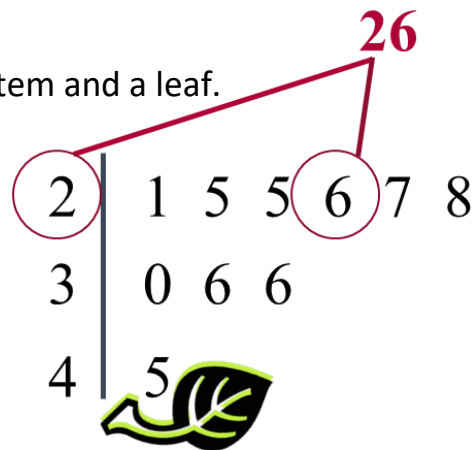
- Can you graph quantitative data using stem-and-leaf plots and dot plots?
- Can you graph qualitative data using pie charts and Pareto charts?

Graphing Quantitative Data Sets

Stem-and-leaf plot

- Each number is _____ into a stem and a leaf.
- Similar to a _____.
- Still contains original data values.
- No _____!

Data: 21, 25, 25, **26**, 27, 28,
30, 36, 36, 45



Example: Constructing a Stem-and-Leaf Plot

The following are the numbers of text messages sent last month by the cellular phone users on one floor of a college dormitory. Display the data in a stem-and-leaf plot.

155 159 144 129 105 145 126 116 130 114 122 112 112 142 126
118 118 108 122 121 109 140 126 119 113 117 118 109 109 119
138 139 122 78 133 126 123 145 121 134 124 119 132 133 124
129 112 126 148 147

Solution: Constructing a Stem-and-Leaf Plot

- Start by ordering the data!
- The smallest stem should be the 10s digit from the smallest number in the list.
- Include a key.

Include a key to identify the values of the data.

From the display, you can conclude that more than _____% of the cellular phone users sent between 110 and 130 text messages

Example: A stem-and-leaf plot with decimals...

Make a stem-and-leaf plot of the shoe sizes for family members.

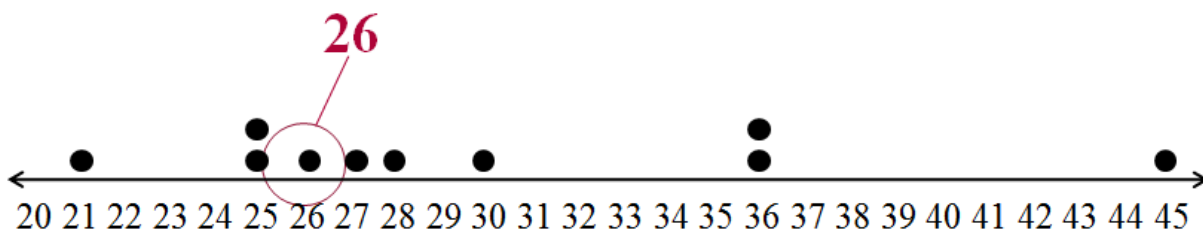
1.5, 7, 6.5, 10, 7.5, 3, 10.5, 11, 6.5

Graphing Quantitative Data Sets

Dot plot

- Each data entry is plotted, using a point, above a horizontal axis (a _____ line.)

Data: 21, 25, 25, 26, 27, 28, 30, 36, 36, 45



Example: Constructing a Dot Plot

Use a dot plot to organize the text messaging data.

155 159 144 129 105 145 126 116 130 114 122 112 112 142 126
118 118 108 122 121 109 140 126 119 113 117 118 109 109 119
139 139 122 78 133 126 123 145 121 134 124 119 132 133 124
129 112 126 148 147

- So that each data entry is included in the dot plot, the horizontal axis should include numbers between _____ and _____.
- There is no _____ axis.
- To represent a data entry, plot a point above the entry's position on the axis.
- There is no need to _____ the data prior to creating the plot.
- If an entry is repeated, plot another point above the previous point.

Solution: Constructing a Dot Plot

155 159 144 129 105 145 126 116 130 114 122 112 112 142 126
118 118 108 122 121 109 140 126 119 113 117 118 109 109 119
139 139 122 78 133 126 123 145 121 134 124 119 132 133 124
129 112 126 148 147

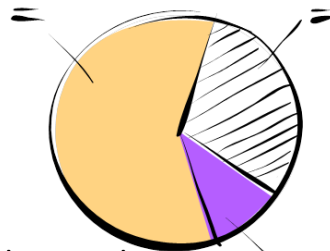


From the dot plot, you can see that most values cluster between 105 and 148 and the value that occurs the most is _____. You can also see that _____ is an unusual data value (an _____).

Graphing Qualitative Data Sets

Pie Chart

- A circle is divided into sectors that represent categories.
- The _____ of each sector is proportional to the frequency of each category.



Example: Constructing a Pie Chart

The numbers of motor vehicle occupants killed in crashes in 2005 are shown in the table. Use a pie chart to organize the data. (Source: U.S. Department of Transportation, National Highway Traffic Safety Administration)

Vehicle Type	Killed:
Cars	18,440
Trucks	13,778
Motorcycles	4,553
Other	823

Solution: Constructing a Pie Chart

Find the relative frequency (percent) of each category

Vehicle Type	Frequency, f	Relative Frequency
Cars	18,440	
Trucks	13,778	
Motorcycles	4,553	
Other	823	

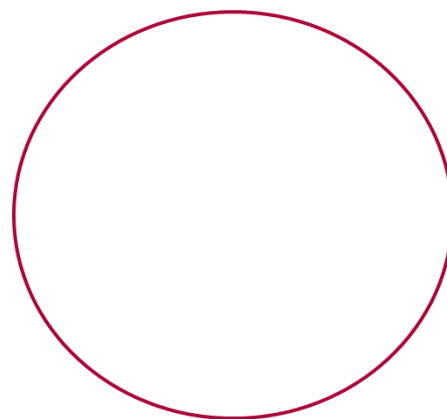
$$\Sigma f =$$

- Construct the pie chart using the central angle that corresponds to each category.
- To find the central angle, multiply _____° by the category's relative frequency.
- For example, the central angle for cars is

$$360(0.49) \approx \text{_____}^\circ$$

Vehicle Type	Frequency, f	Relative Frequency	Central Angle
Cars	18,440	0.49	
Trucks	13,778	0.37	
Motorcycles	4,553	0.12	
Other	823	0.02	

Vehicle type	Relative frequency	Central angle
Cars	0.49	176°
Trucks	0.37	133°
Motorcycles	0.12	43°
Other	0.02	7°



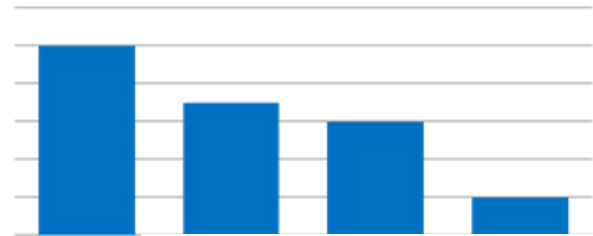
From the pie chart, you can see that most fatalities in motor vehicle crashes were those involving _____.

Graphing Qualitative Data Sets

Pareto Chart

- A vertical bar graph in which the _____ of each bar represents frequency or relative frequency.
- The vertical axis should start at _____.
- The bars are positioned in order of decreasing height, with the tallest bar positioned at the _____.

Frequency



Categories

Example: Constructing a Pareto Chart

In a recent year, the retail industry lost \$41.0 million in inventory shrinkage. Inventory shrinkage is the loss of inventory through breakage, pilferage, shoplifting, and so on. The causes of the inventory shrinkage are administrative error (\$7.8 million), employee theft (\$15.6 million), shoplifting (\$14.7 million), and vendor fraud (\$2.9 million). Use a Pareto chart to organize this data.

(Source: National Retail Federation and Center for Retailing Education, University of Florida)

Solution: Constructing a Pareto Chart

Cause	\$ (million)
Admin. error	
Employee theft	
Shoplifting	
Vendor fraud	



From the graph, it is easy to see that the causes of inventory loss that should be addressed first are _____ and _____.

Section 4.2 Part II and Section 4.2 Part II Objectives

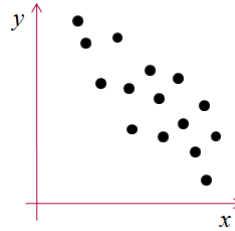
More Graphs and Displays

Can you graph paired data sets using scatter plots and time series charts?

Graphing Paired Data Sets

Paired Data Sets

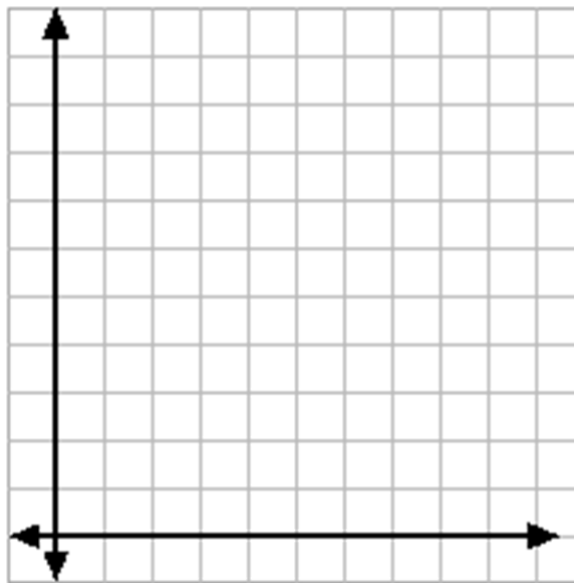
- Each entry in one data set _____ to one entry in a second data set.
- Graph using a scatter plot.
- The ordered pairs are graphed as _____ in a coordinate plane.
- Used to show the relationship between two quantitative variables.



A marketing manager conducts a study to see if there is a relationship between a person's age and the number of magazines to which that person subscribes. The results are shown below.

Solution: Create a scatter plot.

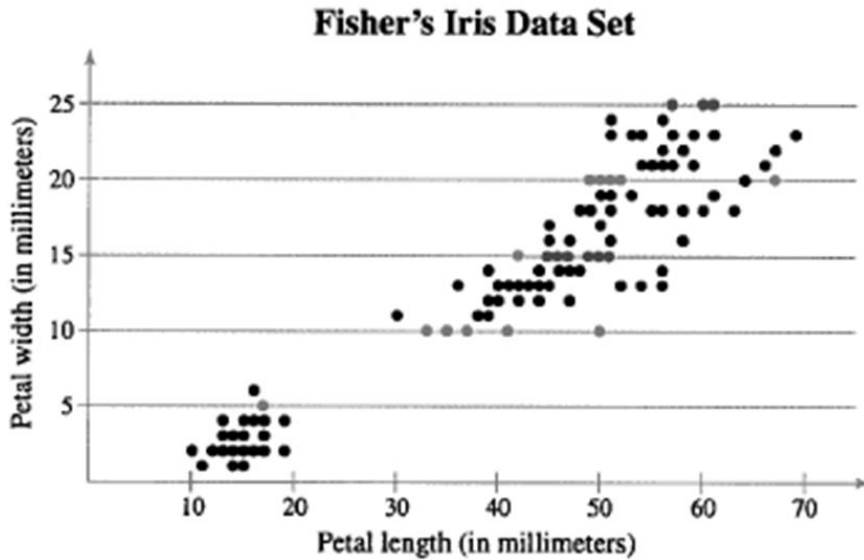
Age	55	48	26	21	33	50	64	35
# of Subscriptions	2	3	0	4	3	0	6	1



Is there a pattern?

Example: Interpreting a Scatter Plot

As the petal length increases, what tends to happen to the petal width?



Each point in the scatter plot represents the petal length and petal width of one flower.

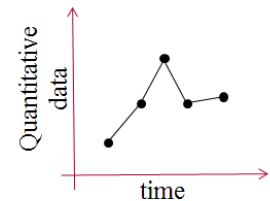


The British statistician Ronald Fisher introduced a famous data set called Fisher's Iris data set. This data set describes various physical characteristics, such as petal length and petal width (in millimeters), for three species of iris. The petal lengths form the first data set and the petal widths form the second data set.

Graphing Paired Data Sets

Time Series

- Data set is composed of quantitative entries taken at regular intervals over a period of _____.
 - e.g., The amount of precipitation measured each day for one month.
- Use a **time series** chart to graph.



Example: Constructing a Time Series Chart

The table on the following page lists the number of cellular telephone subscribers (in millions) for the years 1995 through 2005. Construct a time series chart for the number of cellular subscribers. *(Source: Cellular Telecommunication & Internet Association)*

Solution: Constructing a Time Series Chart

- Let the horizontal axis represent the _____ (in _____).
- Let the vertical axis represent the number of _____ (in millions).
- Plot the paired data and _____ them with line segments.



Year	Subscribers (in millions)
1995	33.8
1996	44.0
1997	55.3
1998	69.2
1999	86.0
2000	109.5
2001	128.4
2002	140.8
2003	158.7
2004	182.1
2005	207.9

The graph shows that the number of subscribers has been _____ since 1995, with greater increases recently

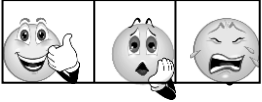
Using the graphing calculator to create a scatter plot

Age	55	48	26	21	33	50	64	35
# of Subscriptions	2	3	0	4	3	0	6	1

Button	Comments
STAT	
EDIT	(or just hit ENTER)
Clear L1 and L2	
Input data for L1 and L2	Scatterplots are used with 2 quantitative variables
STATPLOT	2 nd , Y=
ENTER	to choose Plot 1
Use arrow and ENTER to turn on the plot, if it isn't already on.	
Use arrow to choose the scatterplot.	L1 and L2 are automatically chosen. If you want two different lists, use 2ND and the appropriate lists, separated by a common (above 7)
ZOOM	
9	

Using the graphing calculator to graph a time series chart

Year	Subscribers (in millions)	Button	Comments
1995	33.8	STAT	
1996	44.0	EDIT	(or just hit ENTER)
1997	55.3	Clear L1 and L2	if needed (arrow to the top, hit CLEAR, ENTER)
1998	69.2	Input data for L1 and L2	Scatterplots are used with 2 quantitative variables
1999	86.0	STATPLOT	2 nd , Y=
2000	109.5	ENTER	to choose Plot 1
2001	128.4	Use arrow and ENTER to turn on the plot, if it isn't already on.	
2002	140.8	Use arrow to choose the time plot.	L1 and L2 are automatically chosen. If you want two different lists, use 2ND and the appropriate lists, separated by a common (above 7)
2003	158.7	ZOOM	
2004	182.1	9	
2005	207.9		



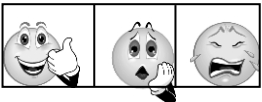
Objective #1: Can you construct and interpret frequency distributions?

a) Amount (in dollars) of money spent each semester on books by college students. Use 6 classes.

Class interval	Frequency	Relative Frequency	Cumulative Frequency

91, 472, 279, 349, 530, 376, 188, 341, 266, 199, 142, 273, 189, 130, 489, 266, 248, 101, 375, 486, 190, 398, 188, 269, 43, 30, 127, 354, 84

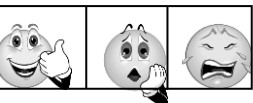
b) What is the class width for part a)?



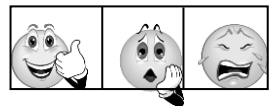
Objective #2: Can you calculate midpoints and boundaries?

Extend the frequency distributions you made above to include midpoints, relative frequencies, and cumulative frequencies.

Class interval	Frequency	Midpoint	Class Boundary	Relative Frequency	Cumulative Frequency



Objective #3: Can you explain in words the difference between a relative frequency and a cumulative frequency?



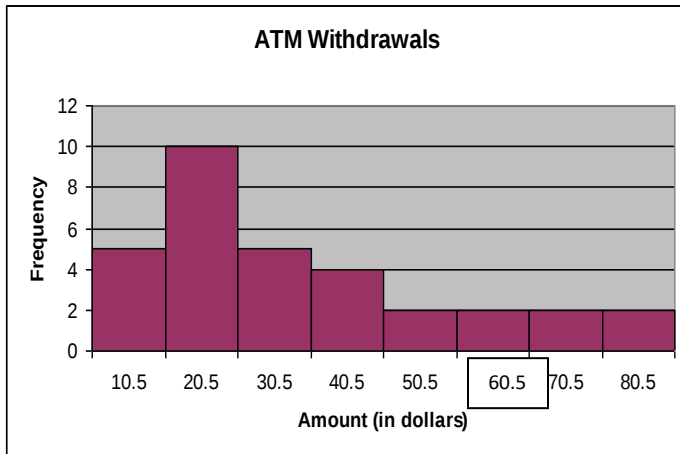
Objective #4: Can you construct and interpret frequency histograms?

- a) Use the dollar amounts from 1a) to construct a frequency histogram using midpoints.

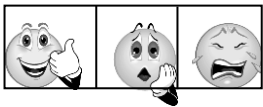


- b) Use the dollar amounts from 1a) to construct a frequency histogram using class boundaries.



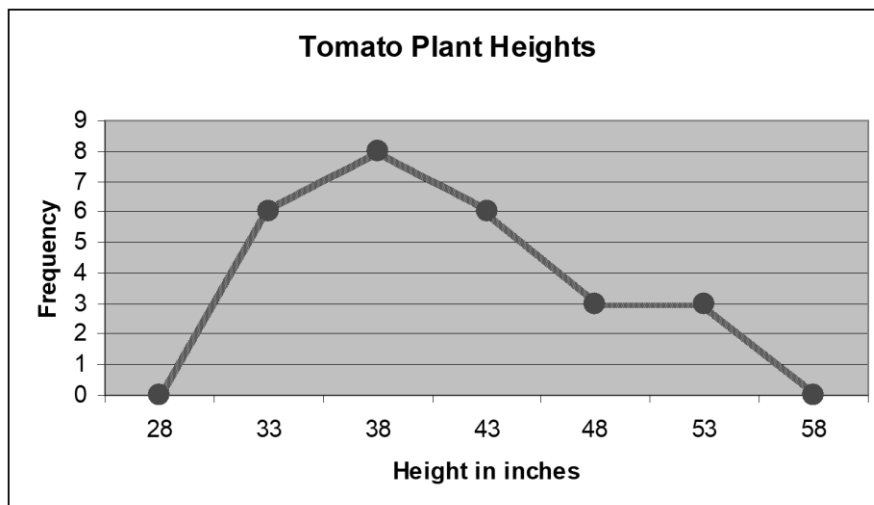
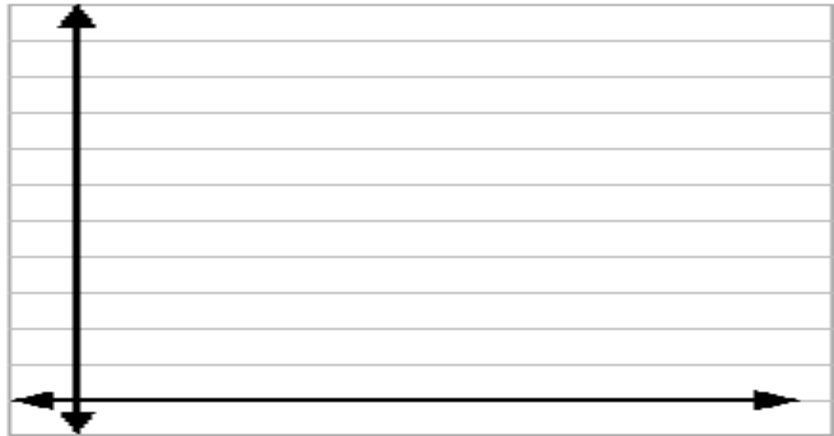


- c) Determine the number of classes.
- d) What are the class boundaries of the class with the highest frequency?
- e) What is the class width?
- f) What is Σf ?

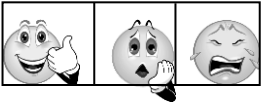


Objective #5: Can you construct and interpret frequency polygons?

- a) Construct a frequency polygon with the data from Objective 1a).

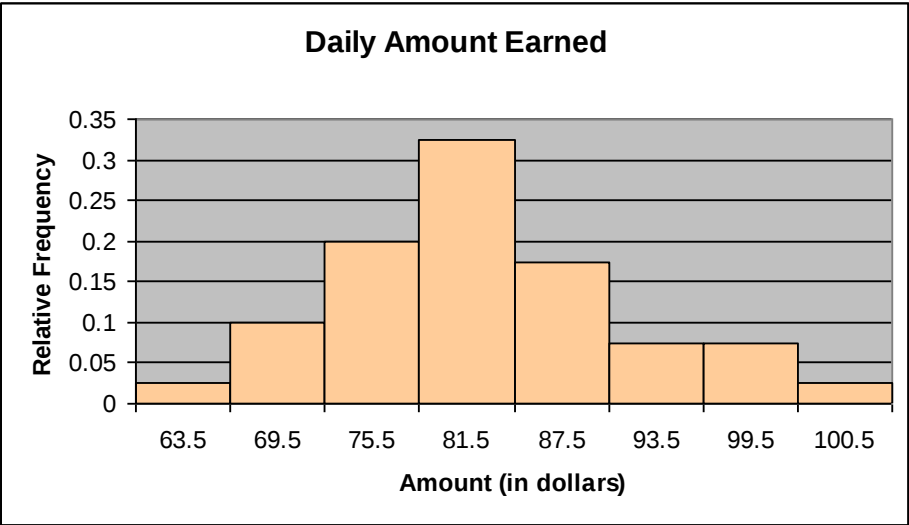
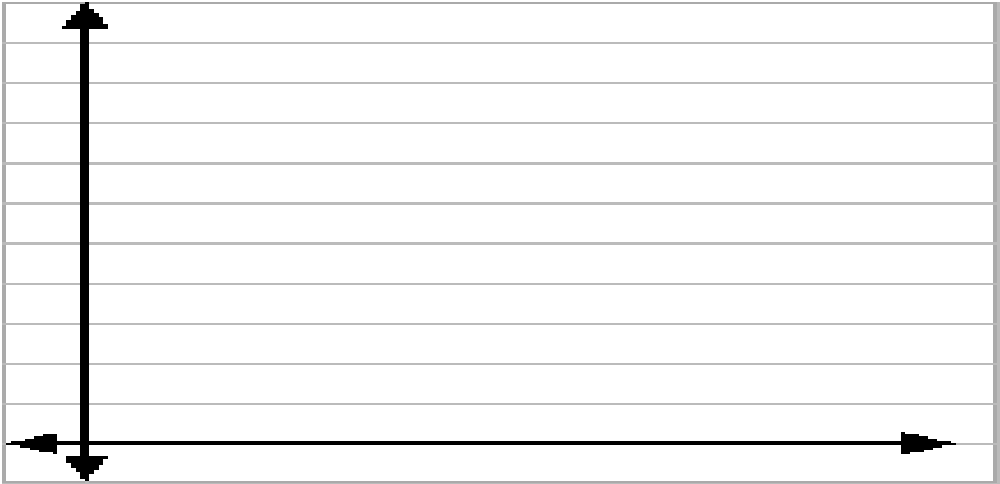


- b) Identify the class with the greatest frequency.
- d) Identify the class(es) with the least frequency.



Objective #6: Can you construct and interpret relative frequency histograms?

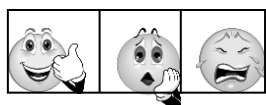
a) Construct a relative frequency histogram from the data in Objective 1a).



b) What is the relative frequency for the class with a midpoint of 69.5?

c) What percent of the subjects earned less than \$78.50 per day?

d) What is the greatest relative frequency?



Objective #7: Can you construct and interpret ogives?

a) Data set: Daily saturated fat intakes (in grams) of a sample of people:

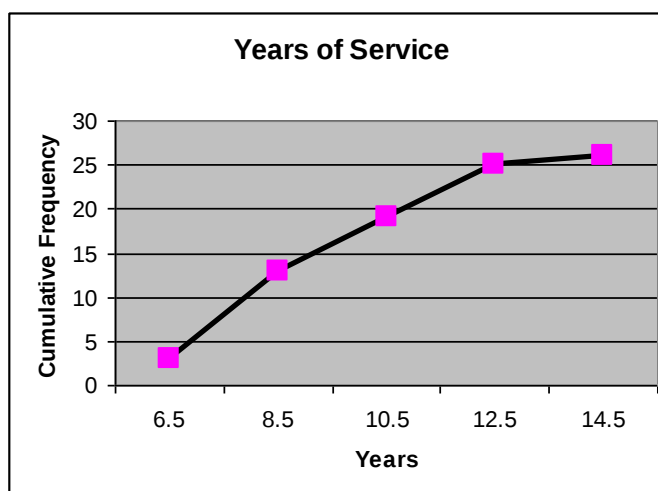
38, 32, 34, 39, 40, 54, 32, 17, 29, 33, 57, 40, 25, 36, 33, 24, 42, 16, 31, 33

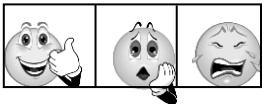


b) What is the approximate cumulative frequency for 8.5 years of service?

c) What is the number of years for an approximate cumulative frequency of 19?

d) What is the sample size?



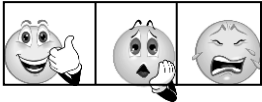
**Objective #8: Can you use technology to create displays?**

Create the requested displays on your graphing calculator. Compare your results with the ones done by the teacher.

a) Histogram: 17, 20, 45, 68, 33, 19, 52, 40, 37, 20, 29, 31, 60, 51, 43, 38, 33, 35, 28

b) Scatter plot:

List 1	5	9	7	11	3	6	4
List 2	24	11	15	7	25	19	27

**Objective #9: Can you graph quantitative data using stem-and-leaf plots and dot plots?**

a) Exam scores for a Biology test: 75, 85, 90, 80, 87, 67, 82, 88, 95, 91, 73, 80, 83, 92, 94, 68, 75, 91, 79, 95, 87, 76, 91, 45. Make a stem-and-leaf plot.

b) Thickness (in cm) of ice measured at different locations on a frozen lake: 5.8, 6.4, 6.8, 7.2, 5.1, 4.9, 4.3, 5.8, 7.0, 6.8, 8.1, 7.5, 7.2, 6.8, 5.8, 7.2, 8.0, 7.0, 6.8, 5.9. Make a stem-and-leaf plot.

c) Number of advertisements seen or heard in one week by a sample of 30 people from the United States: 598, 494, 703, 598, 728, 690, 684, 486, 735, 808, 734, 590, 673, 598, 702, 481, 598, 135, 846, 764, 135, 649, 732, 582, 637, 588, 540, 728, 486, 703. Make a dot plot.



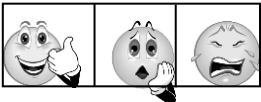
Objective #10: Can you graph qualitative data using pie charts and Pareto charts?

a) Make a pie chart of the number of countries in the United Nations for various continents:

North America: 23
Europe: 43
Africa: 53
South America: 12
Oceania: 14
Asia: 47

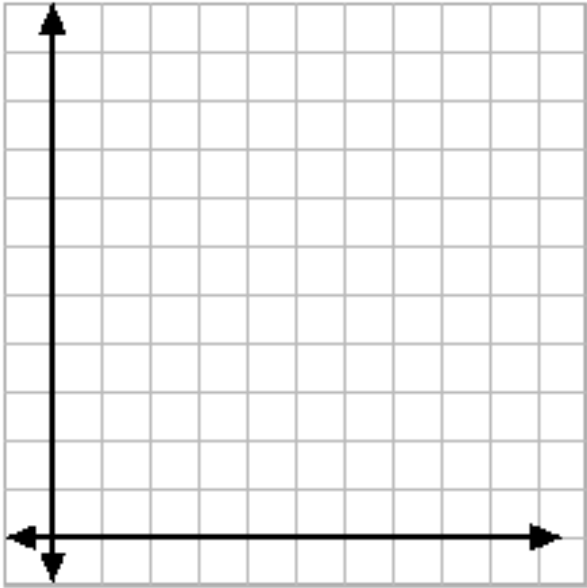
b) Make a Pareto Chart of the types of incidents involving cell phone usage while driving:

Swerved: 46 Speeding: 40 Cut off a car: 21 Hit a car: 9



Objective #11: Can you graph paired data sets using scatter plots and time series charts?
a) Use a scatter plot to display the data in the table. Describe any trends shown.

Hours Worked in One Week	Hourly Wages (\$)
33	12.16
37	9.98
34	10.79
40	11.70
35	11.80
33	11.51
40	13.65
33	12/05
28	10.54
45	10.30
37	11.50
38	10.37



b) The table below shows the daily high temperatures for a city for a period of 12 days. Use a time series to display the data.

Date	Temperature (in F°)
May 1	77
May 2	77
May 3	79
May 4	81
May 5	82
May 6	80
May 7	85
May 8	87
May 9	90
May 10	84
May 11	89
May 12	85

