

Unit E: Data Analysis and Interpretation

Half Course III

HALF COURSE III

Unit E: Data Analysis and Interpretation

Hours: 13

General Learning Outcome:

Analyze data with a focus on the validity of their presentation and the inferences made.

The intent is to motivate students to examine analytically claims with data and to understand how data are manipulated to represent a particular point of view.

Specific Outcomes

E-1 Display and analyze data on a line plot.

E-2 Use measures of central tendency to support decisions.

E-3 Manipulate the presentation of data to represent a point of view.

DATA ANALYSIS AND INTERPRETATION

Instructional Materials

- calculator
- spreadsheet
- Internet
- *Essentials of Mathematics 11*

Connections with Problem Analysis and Analysis of Games and Numbers

Any of the Problem Analysis and Analysis of Games and Numbers activities may be interspersed with problems from the Data Analysis and Interpretation unit.

Manitoba Statistics in Your Life (Half Course IV)

**PRESCRIBED LEARNING
OUTCOMES**

General Outcome

Analyze data with a focus on the validity of their presentation and the inferences made.

Specific Outcome(s)

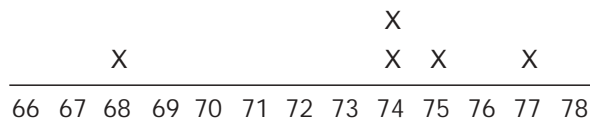
E-1 display and analyze data on a line plot

SUGGESTIONS FOR INSTRUCTION

Example 1

A line plot is a means of displaying data one-dimensionally on a horizontal line. For example:

Golfers	Score
Allen	74
Brad	77
Cora	68
Donna	74
Ellen	75



Steps for displaying data on a line plot

1. Draw a horizontal line with a ruler.
2. Using your ruler, put a scale below the line. To do this, find the smallest and largest values and determine a suitable scale.
3. Plot each value by placing an X above the line at the appropriate location.
4. Continue until you have plotted all the data.

Note: For values that are approximately the same, you may want to place the Xs directly above each other in order to avoid cramming.

From the plotted data, it is now possible to see features that were not apparent from the table. These features include:

- *outliers* are data values that are much smaller or larger than the other values.
- *range* is the difference between the smallest and largest value.
- *clusters* are isolated groups of values.
- *gaps* are large spaces between values.

(continued)

- | | |
|------------------------------|-----------------|
| ✓ Communications | Patterns |
| ✓ Connections | Problem Solving |
| ✓ Number Sense | ✓ Reasoning |
| ✓ Organization and Structure | Technology |
| | ✓ Visualization |

SUGGESTIONS FOR ASSESSMENT

Problems

- Construct a line plot of the NHL salaries for the Toronto Maple Leafs.

Player	Position	Salary (U.S.)
Matts Sundin	C	7 500 000
Robert Reichel	C	3 750 000
Bryan McCabe	D	2 350 000
Shayne Corson	LW	2 250 000
Dmitry Yushkevich	D	2 200 000
Tie Domi	D	1 687 383
Anders Eriksson	D	1 250 000
Dave Manson	D	922 625
Petr Svoboda	D	750 000
Garry Valk	LW	700 000

- Which player(s) form the outlier(s) for these data?
- What are the outliers?
- Determine the range of these NHL salaries.
- What are the most obvious gap(s) between the values on this line plot?
- Describe what information you have learned from looking at this line plot.

SUGGESTED LEARNING RESOURCES

Print

Senior 3 Consumer Mathematics (35S) Part III: A Course for Distance Learning. Winnipeg, MB: Manitoba Education, Training and Youth, 2001. — Module 2, Lesson 1

Baron, C., et al. *Essentials of Mathematics 11.* Victoria, BC: British Columbia Ministry of Education, 2002.

Dewdney, A.K. *200% of Nothing.* New York, NY: W.W. Norton, 1993. (ISBN 0-393-301072-8)

Huff, D. *How to Lie with Statistics.* Toronto, ON: John Wiley, 1954/1983. (ISBN 0-471-14574-2)

A variety of magazines or newspapers are valuable resources.

Internet References

<<http://billboard.com>>

<<http://www.refdesk.com>>

Power from Data

<<http://www.statcan.ca/english/edu/teachers.htm>>

SUGGESTIONS FOR ASSESSMENT

**SUGGESTED LEARNING
RESOURCES**

Problems (continued)

2. The following data represents Frank's math test results.

Test	Mark	Test	Mark
1	88	11	73
2	83	12	80
3	80	13	89
4	73	14	93
5	90	15	85
6	90	16	82
7	77	17	78
8	86	18	91
9	92	19	88
10	94	20	92
		21	89

- Complete a line plot of these data.
- Determine the range of the data.
- What is the most obvious cluster for the data?
- Summarize the information from this line plot.

**PRESCRIBED LEARNING
OUTCOMES**

E-1 display and analyze data
on a line plot
– *continued*

SUGGESTIONS FOR INSTRUCTION

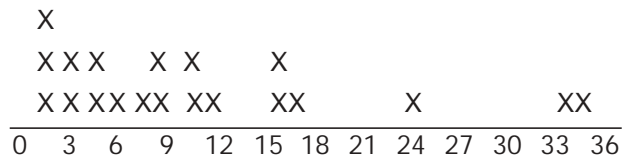
Example 3

The 2002 Winter Olympics were held in Salt Lake City, Utah. The following table lists the top-20 medal-winning countries.

Country	Total Medals	Country	Total Medals
Germany	35	China	8
United States	34	Finland	7
Norway	24	Sweden	6
Canada	17	Croatia	4
Austria	16	South Korea	4
Russia	16	Estonia	3
Italy	12	United Kingdom	3
France	11	Spain	2
Switzerland	11	Australia	2
The Netherlands	8	Czech Republic	2

Draw a line plot of the number of medals.

Solution



Discussion Questions

- Determine the range of medals won for these countries.
($35 - 2 = 33$)
- Are there any clusters that are evident? (between 2 and 8)
- Are there any obvious gaps between values on this line plot?
(from 12 to 16 , 17 to 24 and from 25 to 34)
- Describe how Canada compares to the other countries in these data. (Canada is in the top-four countries.)

- ✓ Communications
- ✓ Connections
- ✓ Number Sense
- ✓ Organization and Structure
- Patterns
- Problem Solving
- ✓ Reasoning
- Technology
- ✓ Visualization

SUGGESTIONS FOR ASSESSMENT**SUGGESTED LEARNING
RESOURCES****Problems (continued)**

4. The following data represents the average number of tornados per year in the U.S. plains area from 1950-1998.

State	Average Number of Tornados
Iowa	31
Kansas	48
Louisiana	24
Minnesota	20
Missouri	25
Nebraska	38
North Dakota	18
Oklahoma	52
South Dakota	25
Texas	125

- Complete a line plot of these data.
- Determine the range of the data.
- What is the most obvious cluster for the data?
- What are the outliers(s)?
- What are the most obvious gap(s) between values on the line plot?
- Summarize the information from this line plot.

**PRESCRIBED LEARNING
OUTCOMES**

E-2 use measures of central tendency to support decisions

SUGGESTIONS FOR INSTRUCTION

A measure of central tendency is often called the average of a set of data. There are, however, various ways of calculating the “average” of a set of data.

Definitions

- *mean* is the sum of a set of numbers divided by the number of numbers in the set.
- *median* is the middle number of a set of data when the data are arranged in numerical order.
- *mode* is the number which occurs most often in a set of numbers (if all values occur only once, there would be no mode).

Note: With an even number of pieces of data, the median is found by calculating the mean of the two pieces of data that are at the middle of the data set.

Example 1

On your first five consumer math tests, you received the following scores: 70%, 94%, 82%, 96%, 70%

a) Find the mean score of your test results.

Solution

$$(70\% + 94\% + 82\% + 96\% + 70\%) \div 5 = 82.4$$

b) Find the median score of your test results.

Solution

70% 70% 82% 94% 96%

c) Find the mode of your test results.

Solution: 70%

d) Suppose you wrote a sixth test and scored 5%. Calculate the new mean, median, and mode. How does this low mark affect the mean, median, and mode?

Solution

$$\text{Mean: } (70\% + 94\% + 82\% + 96\% + 70\% + 5\%) \div 6 = 69.5\%$$

Median: 5% 70% 70% 82% 94% 96%

$$(70\% + 82\%) \div 2 = 76\%$$

Mode: 70

Both the mean and the median dropped in value, but a lower outlier caused the mean to drop more than the median. The mode was unaffected.

(continued)

- ✓ **Communications**
- ✓ **Connections**
Number Sense
- ✓ **Organization and Structure**
- Patterns
Problem Solving
- ✓ **Reasoning**
Technology
Visualization

SUGGESTIONS FOR ASSESSMENT

Mental Math

For each set of numbers, find the

1. range of the data
2. mean
3. median
4. mode

Set 1: 3, 7, 6, 9, 10, 10, 11

Set 2: 10, 20, 20, 30, 50, 70

Set 3: 6, 4, 3, 7, 7, 6

Journal Entries

1. Explain why there will always be a median and a mean but not necessarily a mode.
2. Why do statisticians use more than one measure of central tendency to describe a set of data?
3. Based on your test results in consumer math, which measure of central tendency would you like used to report your final mark?

Problems

1. In some Olympic events such as gymnastics, the final mark is determined by dropping the lowest and highest scores that a contestant receives from the panel of judges. Use the scores given below to answer the following questions.

Gymnast #1
8.8 8.7 8.6 8.8 7.5 9.2 9.0 8.9 8.6 9.1
Gymnast #2
9.4 9.6 7.5 9.0 9.2 9.2 9.5 9.1 9.4 9.4
Gymnast #3
9.3 9.7 8.7 8.8 9.4 9.2 9.1 9.5 9.3 9.3

- a) Without dropping the high and low score, calculate the three measures of central tendency for each gymnast.
- b) Which gymnast would win the gold if the mean was used? The median? The mode?
- c) Drop the high and low scores, then recalculate the three measures of central tendency for each gymnast.
- d) In real Olympic competition, the mean is used to decide the medal winners. Which gymnast would win?
- e) Why do you think the high and low scores are dropped?
- f) Explain how dropping a high and a low score might not affect the mean.

SUGGESTED LEARNING RESOURCES

Print

Senior 3 Consumer Mathematics (35S) Part III: A Course for Distance Learning. Winnipeg, MB: Manitoba Education, Training and Youth, 2001. — Module 2, Lessons 2-5

Internet Reference

<www.statcan.ca/english/kits/height.htm>

**PRESCRIBED LEARNING
OUTCOMES**

E-2 use measures of central tendency to support decisions
– *continued*

SUGGESTIONS FOR INSTRUCTION

Example 1 (continued)

e) You studied more for the seventh test and scored 100%. Recalculate all three measures of central tendency.

Solution

Mean: $(70\% + 94\% + 82\% + 96\% + 70\% + 5\% + 100\%) \div 7 = 73.9$

Median: 5% 70% 70% 82% 94% 96%

$(70\% + 82\%) \div 2 = 76\%$

Mode: 70%

f) For your seven test scores, which measure of central tendency would you want to use in order to determine your grade for your report card?

Solution

Solutions may vary.

One Possible Answer: Since the median gives the highest mark, the median would be selected.

Example 2

Create a list of 12 numbers from 0 to 10 having these characteristics.

- the mean is 7
- the median is 7
- the mode is 7
- no number occurs more than three times

Possible Solution: 3, 3, 5, 6, 7, 7, 7, 8, 9, 9, 10, 10

✓ Communications	Patterns
✓ Connections	Problem Solving
Number Sense	✓ Reasoning
✓ Organization and Structure	Technology
	Visualization

(continued)

SUGGESTIONS FOR ASSESSMENT

**SUGGESTED LEARNING
RESOURCES**

Problems (continued)

2. A recent newspaper article stated the average income for people living on Sine Street was \$95,500. A letter was written to the editor of the newspaper claiming that the average income for people living on Sine Street was \$30,000.

Name	Income
Barker	\$500,000
Smith	\$220,000
Chaplin	\$70,000
Ford	\$60,000
Chan	\$40,000
Olsen	\$30,000
Grant	\$30,000
Regan	\$20,000
Burns	\$15,000
Milhouse	\$10,000

- a) What is the truth: the information in the newspaper article or the information in the letter to the editor?
- b) Using measures of central tendency, determine the position each person took on this issue.
- c) Which measure of central tendency do you think gives the best picture of the "average" income on Sine Street?

**PRESCRIBED LEARNING
OUTCOMES**

E-2 use measures of central tendency to support decisions
– *continued*

SUGGESTIONS FOR INSTRUCTION

Example 3

City council needs to study the number of accidents that occur at the corner of Washington Street and Macdonald Avenue.

Year	Number of Accidents
1994	4
1995	5
1996	4
1997	2
1998	10
1999	5
2000	3
2001	5

a) Find the mean.

Solution: $(4 + 5 + 4 + 2 + 10 + 5 + 3 + 5) \div 8 = 4.75$

b) Find the median.

Solution: 2 3 4 4 5 5 5 10
 $(4 + 5) \div 2 = 4.5$

c) Find the mode.

Solution: 5

d) In order to have a traffic light erected at that corner, you need to present the data to city council. Which measure of central tendency would you use in your presentation and why?

Solution: Answers will vary

- ✓ **Communications**
- ✓ **Connections**
- ✓ **Organization and Structure**
- Patterns
- Problem Solving
- ✓ **Reasoning**
- Technology
- Visualization

(continued)

SUGGESTIONS FOR ASSESSMENT

**SUGGESTED LEARNING
RESOURCES**

Problems (continued)

3. Below is the Billboard Top 15 as of May 4, 2002.

This Week	Weeks on Chart	Title
1	34	Wherever You Will Go
12	28	How You Remind Me
3	15	Hands Clean
4	7	Here Is Gone
5	17	All You Wanted
6	9	Soak Up the Sun
7	16	Blurry
8	27	My Sacrifice
9	29	Standing Still
10	8	A Thousand Miles
11	63	Drops of Jupiter
12	63	Hanging By a Moment
13	11	No Such Thing
14	50	Superman
15	50	Wasting My Time

Using the three measures of central tendency, determine the average number of weeks that a song remains in the Top 15. Justify your answer.

PRESCRIBED LEARNING OUTCOMES

E-2 use measures of central tendency to support decisions
– *continued*

SUGGESTIONS FOR INSTRUCTION

Example 4

The tables show the height of roller coasters in the United States and the rest of the world. Based on measures of central tendency, where do you find the highest roller coasters: in the United States or in the rest of the world? Justify your answer.

Roller Coasters (United States)	
Roller Coaster	Height (ft.)
Tower of Terror	377
Steel Dragon	318
Fujiyama	259
Silver Star	239
Pepsi Max	200
Titan	196
Expedition	188
Dodonpa	170
Colossos	169
Katun	154

Roller Coasters (Rest of World)	
Roller Coaster	Height (ft.)
Superman the Escape	415
Millennium Force	310
Titan	245
Goliath	235
Nitro	230
Speed	224
Mr. Freeze	218
Desperado	209
Superman: Ride of Steel	208
Wild Thing	207

Solution

United States

Mean: $(377 + 318 + 259 + 239 + 200 + 196 + 188 + 170 + 169 + 154) \div 10 = 227$

Median: 377 318 259 239 200 196 188 170 169 154
 $(200 + 196) \div 2 = 198$

Mode: None

Rest of the World

Mean: $(415 + 310 + 245 + 235 + 230 + 224 + 218 + 209 + 208 + 207) \div 10 = 250.1$

Median: 415 310 245 235 230 224 218 209 208 207
 $(230 + 224) \div 2 = 227$

Mode: None

The highest roller coasters are found in the rest of the world. Both the mean and median are higher for the rest of the world than for the United States.

(continued)

- ✓ **Communications**
- ✓ **Connections**
- Number Sense
- ✓ **Organization and Structure**
- Patterns
- Problem Solving
- ✓ **Reasoning**
- Technology
- Visualization

SUGGESTIONS FOR ASSESSMENT**SUGGESTED LEARNING
RESOURCES****Problems (continued)**

4. Members of Parliament have started to debate the need to create a new national park. The MP from Alberta states that the average number of parks per province/territory is two and, since no province is below the average, it should not matter which province/territory gets the new national park. The MP from Manitoba argues that, since the average number of parks per province/territory is three and Manitoba is below the average, Manitoba should receive the funding from the government for a new national park. Using the data in the table below, make a decision on who is right. Should a different province receive the funding? Justify your decision.

Province	Number of National Parks
Newfoundland and Labrador	2
Nova Scotia	2
New Brunswick	2
Prince Edward Island	2
Quebec	3
Ontario	5
Manitoba	2
Saskatchewan	2
Alberta	4
British Columbia	6
Yukon Territories	3
Northwest Territories	4
Nunavut	2

**PRESCRIBED LEARNING
OUTCOMES**

E-2 use measures of central tendency to support decisions
– *continued*

SUGGESTIONS FOR INSTRUCTION

Example 5

Employees of Manitoba Mining and Manufacturing are negotiating a new contract. The union leader wants a pay increase and states that no union member earns more than \$40,000 a year. The president of the company says that the company's profits are down and that the average salary in his company is over \$38,000. At a union meeting, a sales clerk points out that they make \$22,000 a year, and that most of the workers in the union make \$35,000.

Who is telling the truth: the president, the union head, or the sales clerk? In fact, all three are telling the truth. We will consider the measures of central tendency to prove this.

Type of Job	Number of Employees	Salary	Total Salary	Union Member
President	1	\$250,000		No
Vice-President	2	\$130,000		No
Plant Manager	2	\$75,000		No
Supervisor	12	\$40,000		Yes
Worker	30	\$35,000		Yes
Payroll Clerk	3	\$27,000		Yes
Secretary	6	\$24,000		Yes
Sales Clerk	10	\$22,000		Yes
Custodian	5	\$20,000		Yes
Total				

1. Determine all three measures of central tendency for all employees.

✓ Communications Patterns
 ✓ Connections Problem Solving
 Number Sense ✓ Reasoning
 ✓ Organization and Technology
 Structure Visualization

(continued)

SUGGESTIONS FOR ASSESSMENT

**SUGGESTED LEARNING
RESOURCES**

**PRESCRIBED LEARNING
OUTCOMES**

E-2 use measures of central tendency to support decisions
– *continued*

SUGGESTIONS FOR INSTRUCTION

Example 5 (continued)

Solution

Type of Job	Number of Employees	Salary	Total Salary	Union Member
President	1	\$250,000	\$250,000	No
Vice-President	2	\$130,000	\$260,000	No
Plant Manager	2	\$75,000	\$150,000	No
Supervisor	12	\$40,000	\$480,000	Yes
Worker	30	\$35,000	\$1,050,000	Yes
Payroll Clerk	3	\$27,000	\$81,000	Yes
Secretary	6	\$24,000	\$144,000	Yes
Sales Clerk	10	\$22,000	\$220,000	Yes
Custodian	5	\$20,000	\$100,000	Yes
Total	71		\$2,735,000	

Mean: $250,000 + (2 \times 130,000) + (2 \times 75,000) + (12 \times 40,000) + (30 \times 35,000) + (6 \times 24,000) + (10 \times 22,000) + (5 \times 20,000) \div (1 + 2 + 2 + 12 + 30 + 3 + 6 + 10 + 5)$
= \$38,521.13

Median: There are 71 employees; therefore, the median salary is #36 on an ordered list. Employee #36 would be in the worker category and earns \$35,000.

Mode: \$35,000 (30 employees earn this much)

2. Determine all three measures of central tendency for the union members only.

Solution

Mean: $(12 \times 40,000) + (30 \times 35,000) + (3 \times 27,000) + (6 \times 24,000) + (10 \times 22,000) + (5 \times 20,000) \div (12 + 30 + 3 + 6 + 10 + 5) = \$31,439.39$

Median: There are 66 union members; therefore, the median salary is the mean of #32 and #33 on an ordered list. Employees #32 and #33 both earn \$35,000. Therefore, the median is \$35,000.

Mode: \$35,000 (30 employees earn this much)

(continued)

- ✓ Communications
- ✓ Connections
- ✓ Organization and Structure
- Patterns
- Problem Solving
- ✓ Reasoning
- Technology
- Visualization

SUGGESTIONS FOR ASSESSMENT

**SUGGESTED LEARNING
RESOURCES**

**PRESCRIBED LEARNING
OUTCOMES**

E-2 use measures of central tendency to support decisions
– *continued*

SUGGESTIONS FOR INSTRUCTION

Discussion Questions

1. Why is the president able to say that the average salary is \$38,000?

Solution

The mean of all employees is \$38,521.13.

2. How many company employees earn more than this salary? How many earn less?

Solution:

There are 17 employees who earn more than \$38,521.13, and 54 employees who earn less.

3. Does either mean give a good picture of the salary for a typical union member? Explain.

Solution

Neither mean gives a good picture of the salary for a typical union member, because \$38,521.13 is higher than what most people make and \$31,439.39 is less than what most people make.

4. Which measure of central tendency did the sales clerk use to justify the statement that most workers make \$35,000?

Solution

The sales clerk would be using the mode, since the claim is that **most** workers make \$35,000.

5. Which measure of central tendency do you think gives the best picture of the salaries of all the company's employees? Only the union members? Explain.

Solution

Answers will vary. Look for a reasonable response.

Sample Response: I think the mode gives the best picture of the salaries for all the company's employees as well as for only the union members. Both are \$35,000 and most employees make this much.

✓ Communications	Patterns
✓ Connections	Problem Solving
Number Sense	✓ Reasoning
✓ Organization and Structure	Technology
	Visualization

(continued)

SUGGESTIONS FOR ASSESSMENT

**SUGGESTED LEARNING
RESOURCES**

**PRESCRIBED LEARNING
OUTCOMES**

E-2 use measures of central tendency to support decisions
– *continued*

SUGGESTIONS FOR INSTRUCTION

Discussion Questions (continued)

6. If the 24 lowest-paid employees had their salaries increased to \$35,000, what would be the new mean, median, and mode for all employees?

Solution

$$\begin{aligned} \text{Mean: } & (1 \times 250,000) + (2 \times 130,000) + (2 \times 75,000) + \\ & (12 \times 40,000) + (54 \times 35,000) \div \\ & (1 + 2 + 2 + 12 + 54) = \$42,676.06 \end{aligned}$$

Median: \$35,000 (still 71 employees with the 36th employee in an ordered list representing the median value)

Mode: \$35,000 (54 employees make this much)

7. Which measures of central tendency have not changed? Explain why.

Solution

The median and the mode have not changed. Since the median represents the middle salary, raising only the bottom salaries implies that the middle value doesn't move. Since the mode represents the most frequent salary, having more people earn this salary won't change the mode.

Emphasis should be placed on justification based on using measures of central tendency. Use questions by providing a context and then asking students to determine which measure of central tendency would be best under specific conditions.

- | | |
|-------------------------------------|--------------------|
| ✓ Communications | Patterns |
| ✓ Connections | Problem Solving |
| Number Sense | ✓ Reasoning |
| ✓ Organization and Structure | Technology |
| | Visualization |

SUGGESTIONS FOR ASSESSMENT

**SUGGESTED LEARNING
RESOURCES**

**PRESCRIBED LEARNING
OUTCOMES**

E-3 manipulate the presentation of data to represent a point of view

SUGGESTIONS FOR INSTRUCTION

The major focus of this section is on how different individuals or groups use mean, median, or mode to represent a particular point of view. There should be some exploration of the factors that influence these three measures of central tendency.

Students are expected to be able to manipulate a bar or line graph to represent a particular point of view. These manipulations could include changing the horizontal scale, changing the vertical scale, or changing the starting point of the scale.

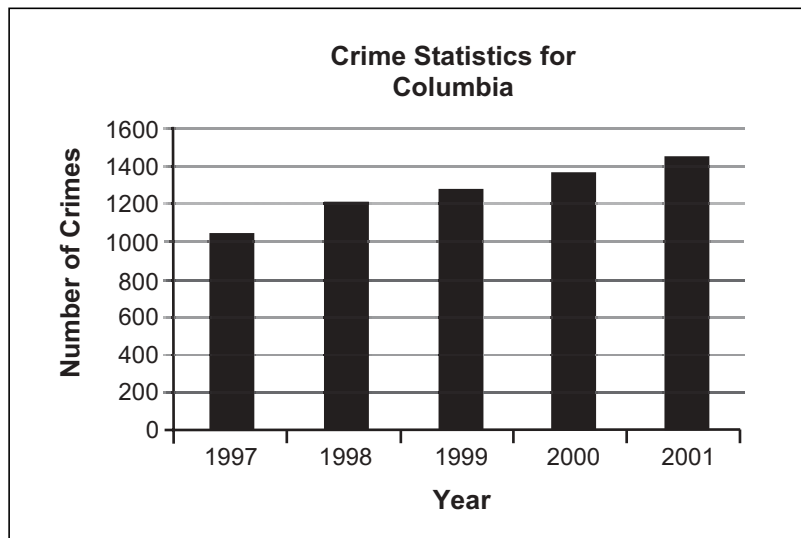
Students need to know how to draw and interpret a circle graph, and be able to make inferences from it.

Manipulating Data

The incidence of various types of crimes for the town of Columbia are shown below.

Year	1997	1998	1999	2000	2001
Number of Crimes	1109	1200	1287	1350	1443

a) Using this information, construct a bar graph using a vertical scale of 0 to 1600 crimes per year. A suitable interval might be 200.



- ✓ Communications
- ✓ Connections
- ✓ Number Sense
- ✓ Organization and Structure
- Patterns
- Problem Solving
- ✓ Reasoning
- Technology
- ✓ Visualization

(continued)

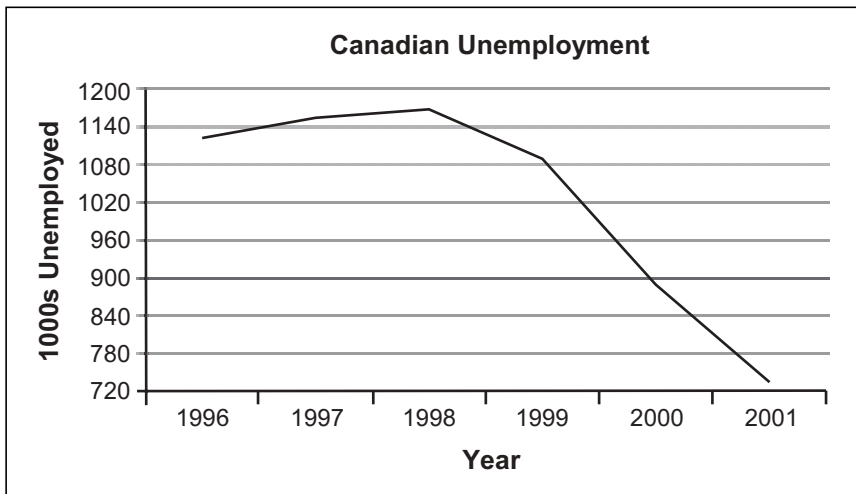
SUGGESTIONS FOR ASSESSMENT

Manipulating Data

Assume that the following data represent the number of Canadians who were unemployed during the years 1996-2001.

Thousands of Unemployed Canadians						
Year	1996	1997	1998	1999	2000	2001
Number	1105	1151	1164	1060	897	738

A federal employment agency wishes to demonstrate that the government's policies and practices have caused a dramatic decrease in unemployment. The agency has produced this graph:



- What is your overall impression of this graph?
- How was the graph constructed to give this impression?
- Assume that you are a member of the political opposition party. You feel that the government's policies and practices have not caused a significant decrease in unemployment. As part of your statement to the press, you wish to include a graph. Using the data from the chart, construct a graph that will support your party's point of view.
- Using the data in the table, construct a line graph that gives a "more accurate" picture of Canadian unemployment statistics.
- Summarize how changing the vertical scale of each of these graphs affects the appearance of the graphed data.

SUGGESTED LEARNING RESOURCES

Print

Newspapers
Magazines

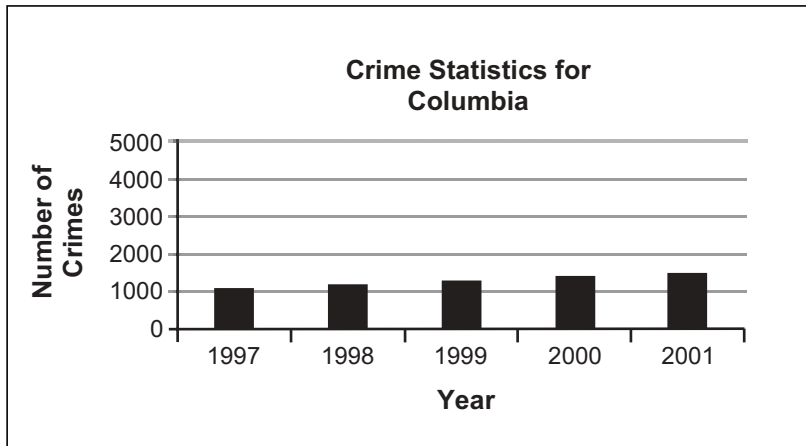
**PRESCRIBED LEARNING
OUTCOMES**

E-3 manipulate the presentation of data to represent a point of view
– *continued*

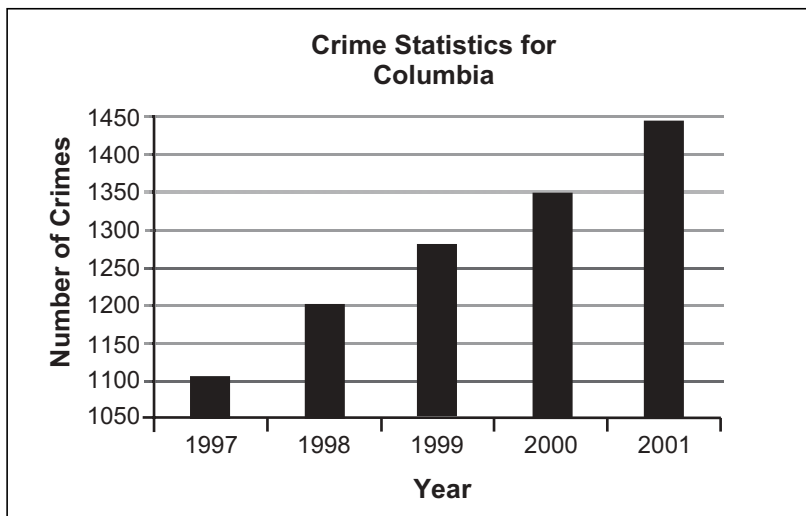
SUGGESTIONS FOR INSTRUCTION

Manipulating Data (continued)

b) Redraw your graph using a vertical scale of 0 to 5000 crimes per year with an interval of 1000.



c) Redraw your graph using a vertical scale of 1050 to 1450 crimes per year with an interval of 50.



Discussion Questions

1. Assume that you are the Chief of Police for the town of Columbia. When you were hired in 1993, you made a commitment to make sure crime did not “get out of control.” The town council has asked you to report on crime trends over the past five years. Which graph would you choose to use in your presentation? Why did you choose this one?

Possible Solution

I would most likely choose Graph #2 because it seems to minimize the increase in crime.

(continued)

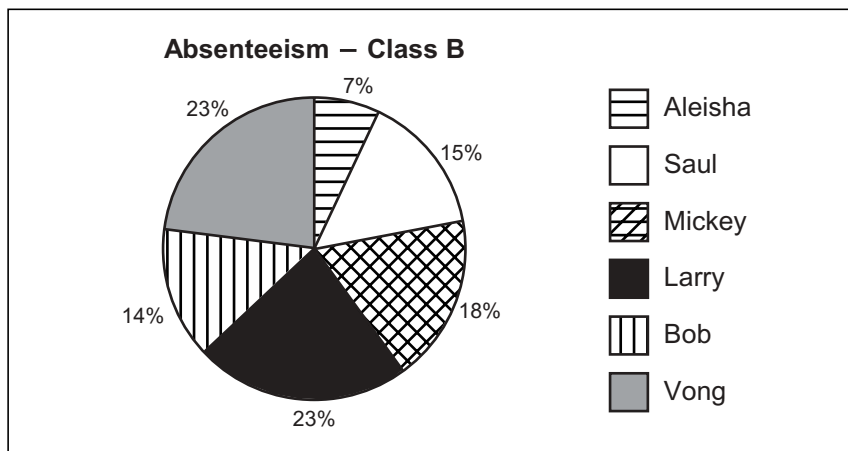
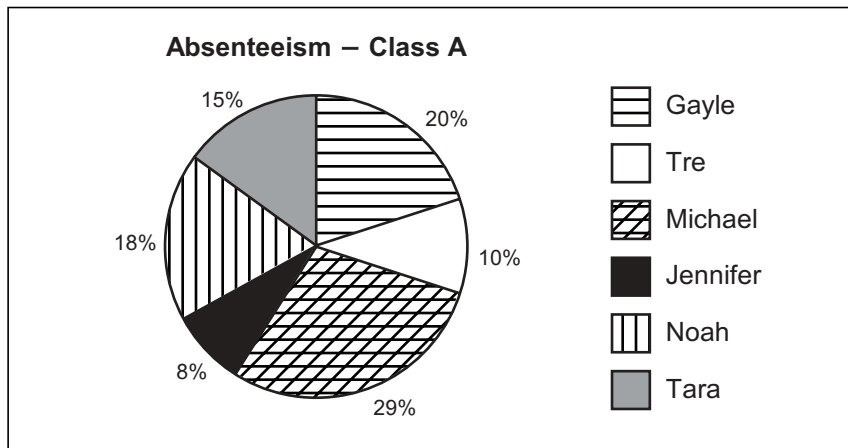
- ✓ Communications
- ✓ Connections
- ✓ Number Sense
- ✓ Organization and Structure
- Patterns
- Problem Solving
- ✓ Reasoning
- Technology
- ✓ Visualization

SUGGESTIONS FOR ASSESSMENT

SUGGESTED LEARNING RESOURCES

Manipulating Data

Two small groups of *Senior 3 Consumer Mathematics* students had their 2001 absenteeism statistics graphed.



- Name the students from Class A with the highest and lowest rates of absenteeism.
- Name the students from Class B with the highest and lowest rates of absenteeism.
- Of all the students, who had the highest rate of absenteeism? Was this person absent the most number of times?
- Of all the students, who had the lowest rate of absenteeism? Was this person absent the least number of times?

**PRESCRIBED LEARNING
OUTCOMES**

E-3 manipulate the presentation of data to represent a point of view
– *continued*

SUGGESTIONS FOR INSTRUCTION

Discussion Questions (continued)

2. Assume that you are a community activist. You feel that crime is “out of control” in Columbia and you want to communicate this opinion to the town council at the next council meeting. Which graph would you use in your presentation? Why did you choose this one?

Possible Solution

As a community activist, I would most likely choose graph #3 because it seems to show a dramatic increase in crime.

3. Assume that you are a town councillor. You want to get an accurate picture of the crime rate in Columbia.

- a) Which graph would you choose and why?

Possible Solution

As town councillor, I would most likely choose Graph #1 because it seems to represent the data more accurately.

- b) What other information about the town would you need to help you better understand the crime problem?

Possible Solution

Has the number of people in Columbia remained constant? Has the budget for policing remained constant? Have the types of crimes changed in the past five years? Has the percentage of crimes solved changed?

- | | |
|------------------------------|-----------------|
| ✓ Communications | Patterns |
| ✓ Connections | Problem Solving |
| ✓ Number Sense | ✓ Reasoning |
| ✓ Organization and Structure | Technology |
| | ✓ Visualization |

(continued)

SUGGESTIONS FOR ASSESSMENT

Student projects are intended to be a culmination of the Data Analysis unit. The project could be home- or school-based, depending on class time, learning resources, et cetera. Time permitting, the student project lends itself to class presentations.

Introduce the project early in the unit so that students have enough time to collect sample data. Collecting old newspapers and magazines prior to the unit would be helpful.

Project 1

In a newspaper, magazine, or Internet source, find an example of a graph that presents data in a misleading way. Along with your example, include a paragraph reporting on how the data are misleading. Redraw the misleading graph to represent the data in a more valid way.

Project 2

Statements that distort the meaning of data may create news headlines. Find an example of such a headline and write a paragraph report on how it is misleading. Explain why a newspaper or other news medium might present a misleading report.

Project 3

Statistics are used to highlight the significance of events and to clarify their meaning. For example, the headline, **Flood of the Century**, which refers to the highest water level in southern Manitoba in 100 years, is more effective than **Manitoba Hit By Flood**. Find another example in the news in which actual statistics may or may not justify the use of a particular headline. In the paragraph report, address the following:

- a) How is the relationship between the headlines and the statistics made clear?
- b) Do the statistics justify the headlines? Explain why or why not.
- c) Are any important pieces of data missing from the story?
- d) How might the data have been collected?
- e) Rewrite the headline so that it becomes more misleading to your reader.

**SUGGESTED LEARNING
RESOURCES**

**PRESCRIBED LEARNING
OUTCOMES**

E-3 manipulate the presentation of data to represent a point of view
– *continued*

SUGGESTIONS FOR INSTRUCTION

Drawing Circle Charts

The following data were collected with a telephone poll of 1000 people. Each person was asked to name his or her favourite spectator sport.

Favourite Sport	Number
Hockey	450
Football	240
Baseball	120
Soccer	58
Volleyball	24
Other	108
Total	1000

In order to construct a circle chart of these data, follow these steps:

- a) Express each number as a percentage of the total number surveyed.

Example: Hockey (450 out of 1000)

$$450 \div 1000 \times 100 = 45\%$$

- b) Express each number as a portion of the circle.

Example: Hockey (45%)

$$45\% \times 360^\circ = 162^\circ$$

For the degree calculation, round each answer to the nearest degree. Sometimes, due to rounding, the total degrees will be greater than 360°.

- c) Using a protractor, draw an angle of 162° at the centre of the circle.
d) Repeat these steps with each of the sports in the table.
e) Include an appropriate title, shading, and legend.

- ✓ Communications
- ✓ Connections
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(continued)

SUGGESTIONS FOR ASSESSMENT

**SUGGESTED LEARNING
RESOURCES**

Project 4

Find a data set in the newspaper, the Internet, or elsewhere and create a misleading graph to present a point of view. Since this graph will be published in your local newspaper, write a newspaper article supporting the data in your graph.

**PRESCRIBED LEARNING
OUTCOMES**

E-3 manipulate the presentation of data to represent a point of view
– *continued*

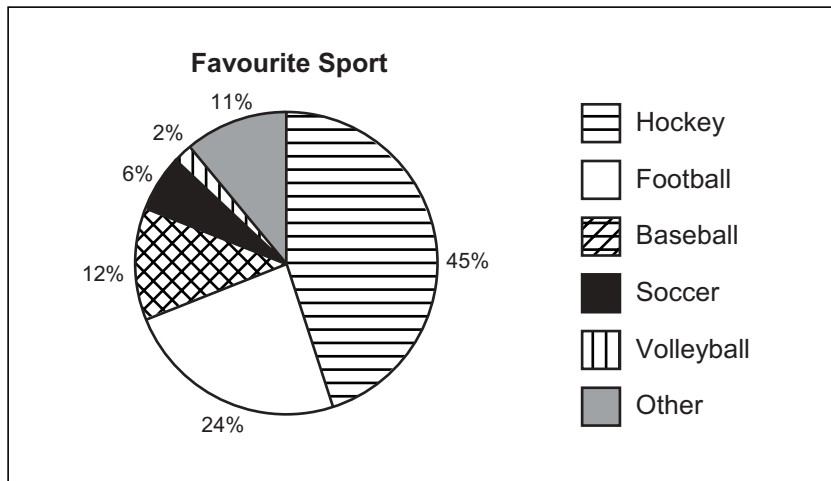
SUGGESTIONS FOR INSTRUCTION

Drawing Circle Charts (continued)

A chart could be completed before the students begin construction of the circle chart.

Favourite Sport	Number	As a Percent	Degrees
Hockey	450	45.0	162
Football	240	24.0	86.4
Baseball	120	12.0	43.2
Soccer	58	5.8	20.88
Volleyball	24	2.4	8.64
Other	108	10.8	38.88
Total	1000	100	360

Computer spreadsheet programs could also be used to construct circle charts.



- ✓ Communications
- ✓ Connections
- ✓ Number Sense
- ✓ Organization and Structure
- Patterns
- Problem Solving
- ✓ Reasoning
- Technology
- ✓ Visualization

SUGGESTIONS FOR ASSESSMENT

**SUGGESTED LEARNING
RESOURCES**
