

## *What is Diversification?*

### *Lesson Summary*

*What is Diversification?* will teach students how diversification of investments can help reduce risk.

### *Lesson Objectives*

- Create a diversified portfolio selecting stocks from at least six industries.
- Conduct Internet research on different investment options and write a summary of their findings and present to the class.
- Interpret company and industry charts to determine which investments to make with their SMG teams.
- Define diversification, risk tolerance, industry, and index.

### *NCTM Standards*

1A - Understand numbers, ways of representing numbers, relationships among numbers, and number systems.

1B - Understand meanings of operations and how they relate to one another.

5A - Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.

5B - Select and use appropriate statistical methods to analyze data.

5C - Develop and evaluate inferences and predictions that are based on data.

5D - Understand and apply basic concepts of probability.

6C - Apply and adapt a variety of appropriate strategies to solve problems.

7B - Make and investigate mathematical conjectures.

8A - Organize and consolidate mathematical thinking through communication.

8B - Communicate mathematical thinking coherently and clearly to peers, teachers, and others.

8C - Analyze and evaluate the mathematical thinking and strategies of others.

8D - Use the language of mathematics to express mathematical ideas precisely.

9C - Recognize and apply mathematics in contexts outside of mathematics.

### *Mathematical Strands*

	<b>Thinking Algebraically</b>	Students calculate percentages to determine sectors in a diverse portfolio.	
	<b>Interpreting Statistics</b>	Students are given profiles of investor portfolios, with investments disaggregated by industry sector. Students should be able to read the information presented to determine which sectors the investor is most and least invested in, and to identify which portfolios are diversified.	
	<b>Communicating Quantitative Information</b>	Students create bar charts, pie charts, or other graphical representations to present information on diversification.	
	<b>Tackling Complex Problems</b>	Students are given a sample SMG portfolio of stocks to analyze for diversification in terms of cap size.	

**Calculating Percentages**

To calculate percentages, take the amount of money in a category (for example, all the money invested in small cap firms), divide it by the total amount of money in the portfolio, and multiply by 100%.

$$\frac{\% \text{ of portfolio invested in small cap firms} = \text{money\_invested\_in\_all\_small\_cap\_firms}}{\text{total\_value\_of\_investment}} \cdot 100\%$$

Company	Size	Sector	Value
A	Mid	Industrial Materials	\$36,000
B	Small	Consumer Goods	\$7,000
C	Large	Media	\$11,000
D	Mid	Utilities	\$3,000
E	Mid	Consumer Goods	\$7,000
F	Large	Consumer Goods	\$21,000
G	Small	Telecommunications	\$1,500
H	Large	Industrial Goods	\$31,000
I	Small	Health	\$15,500
J	Mid	Energy	\$5,000
K	Large	Energy	\$27,000
L	Mid	Utilities	\$19,000

1. What is the total value of the investment above?
2. Using the portfolio above, calculate the percentage of the total investment in each sector.
3. Calculate the percentage of the investment in each size company.
4. Construct a bar chart to show how diversified this portfolio is in terms of sector.
5. Construct a pie chart to show how diversified this portfolio is in terms of cap size.

## INTERPRETING STATISTICS

Below is the profile of a portfolio's holdings (displayed within industry sectors).

Sector	% Holdings
Utilities	25.50
Business Services	9.06
Financials	0.00
Telecommunications	0.00
Media	0.00
Consumer Goods	0.00
Energy	6.86
Hardware	6.10
Health	0.00
Software	0.00
Consumer Services	0.00
Industrial Materials	52.49

1. How much more is this portfolio invested in Industrial Materials than in Utilities?
2. How much more is this portfolio invested in Energy than Hardware?
3. Would you say that this portfolio is well-diversified portfolio or not well-diversified? Why?

## INTERPRETING STATISTICS

Below is the profile of another portfolio's holdings (displayed within industry sectors).

Sector	% Holdings
Utilities	1.48
Business Services	10.46
Financials	4.02
Telecommunications	0.00
Media	8.54
Consumer Goods	20.72
Energy	3.91
Hardware	2.63
Health	2.15
Software	0.00
Consumer Services	25.32
Industrial Materials	20.77

4. What sector does the investor have the most money invested in?
5. What sector does the investor have the least money invested in?
6. Would you say that this is a well-diversified portfolio? Why?

## INTERPRETING STATISTICS

Below is the profile of a third portfolio's holdings (displayed within industry sectors).

Sector	% Holdings
Utilities	0.00
Business Services	0.00
Financials	0.00
Telecommunications	98.86
Media	0.00
Consumer Goods	0.00
Energy	0.00
Hardware	0.00
Health	0.00
Software	0.00
Consumer Services	0.00
Industrial Materials	1.14

7. What sector does the investor have the most money invested in?
8. What sector does the investor have the least money invested in?
9. Would you say that this is a well-diversified portfolio? Why?

If one sector of the economy falls precipitously, which portfolio may be at the greatest risk? Which portfolio has the greatest protection from dramatic fluctuations in one sector of the portfolio? Why?

## COMMUNICATING QUANTITATIVE INFORMATION

### Creating Charts to Represent Diversification

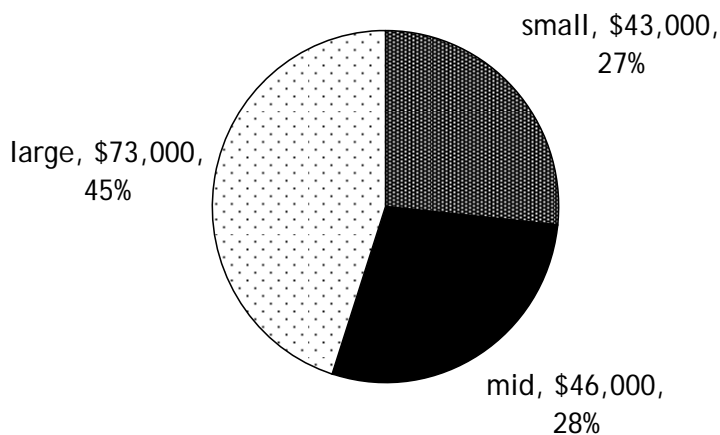
*There are many ways to represent a diversified portfolio and a few different ways to consider just what is considered a diversified investment portfolio.*

Company	Cap Size	Sector	Investment Value
A	Small	Media	\$6,000
B	Mid	Software	\$11,000
C	Mid	Consumer Goods	\$10,000
D	Small	Consumer Goods	\$7,500
E	Large	Utilities	\$36,000
F	Small	Business Services	\$12,000
G	Large	Utilities	\$10,000
H	Small	Consumer Goods	\$4,500
I	Mid	Energy	\$25,000
J	Large	Health	\$27,000
K	Small	Media	\$13,000

*The following graphs present the information above in different ways.*

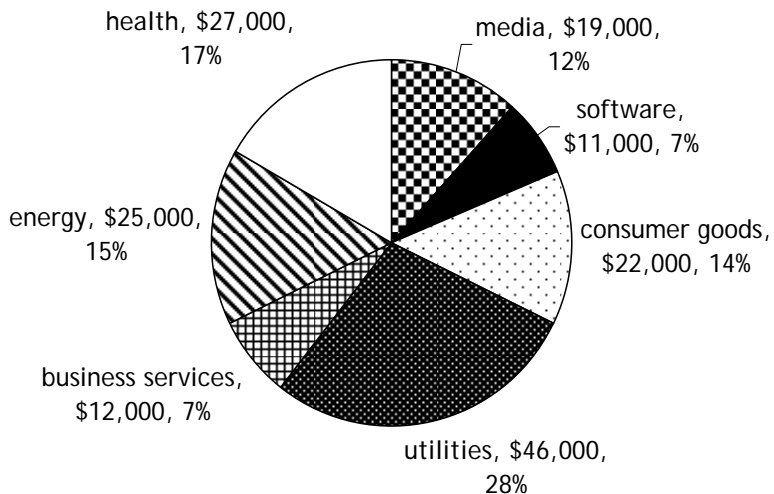
1. Next to each graph write a brief description of what information each graph presents.

### Size of Companies

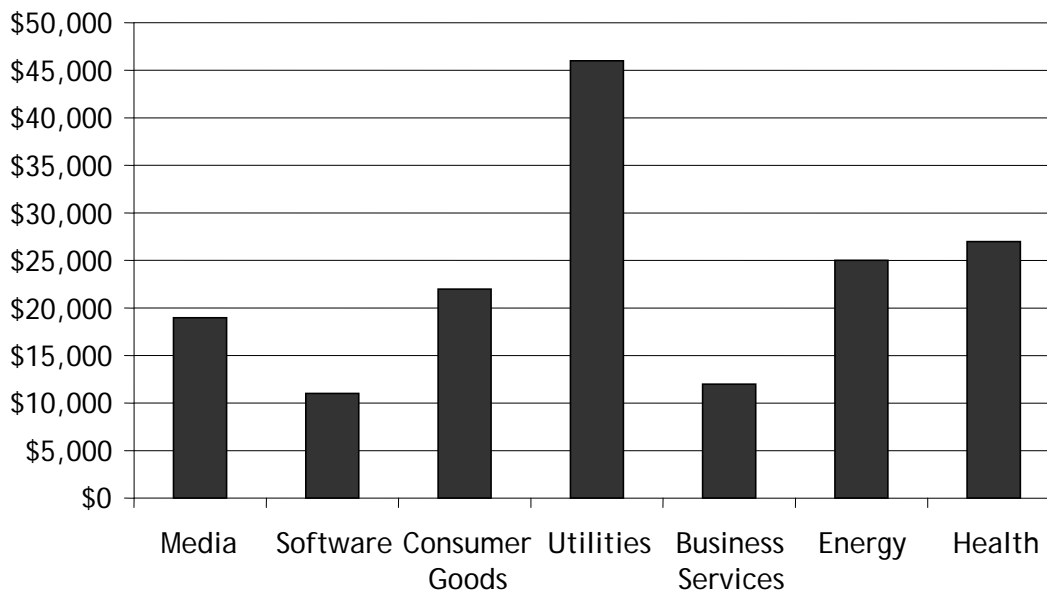


# COMMUNICATING QUANTITATIVE INFORMATION

## Investment by Sector

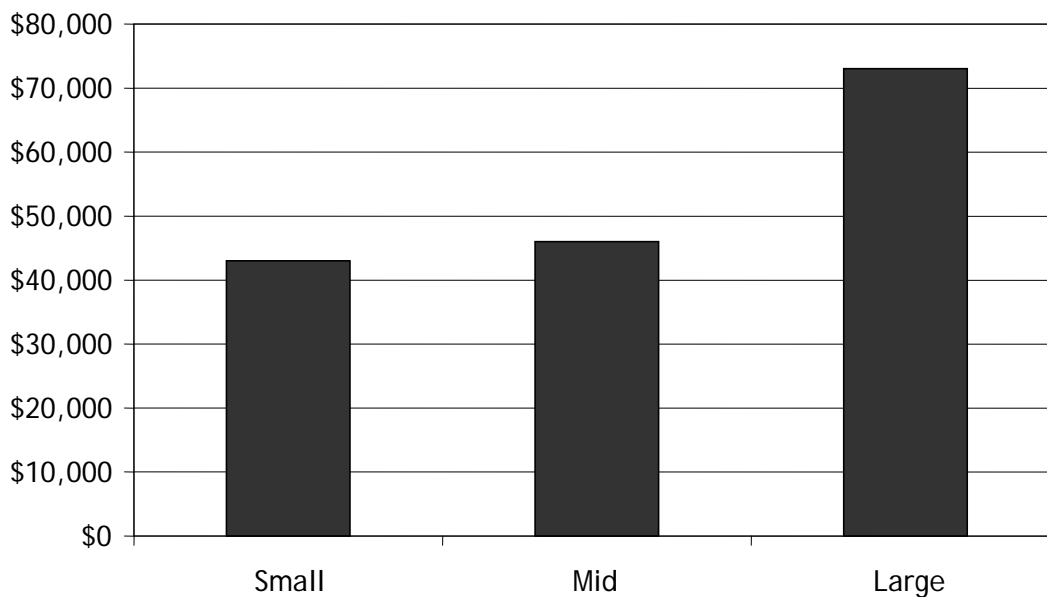


## Investment by Sector

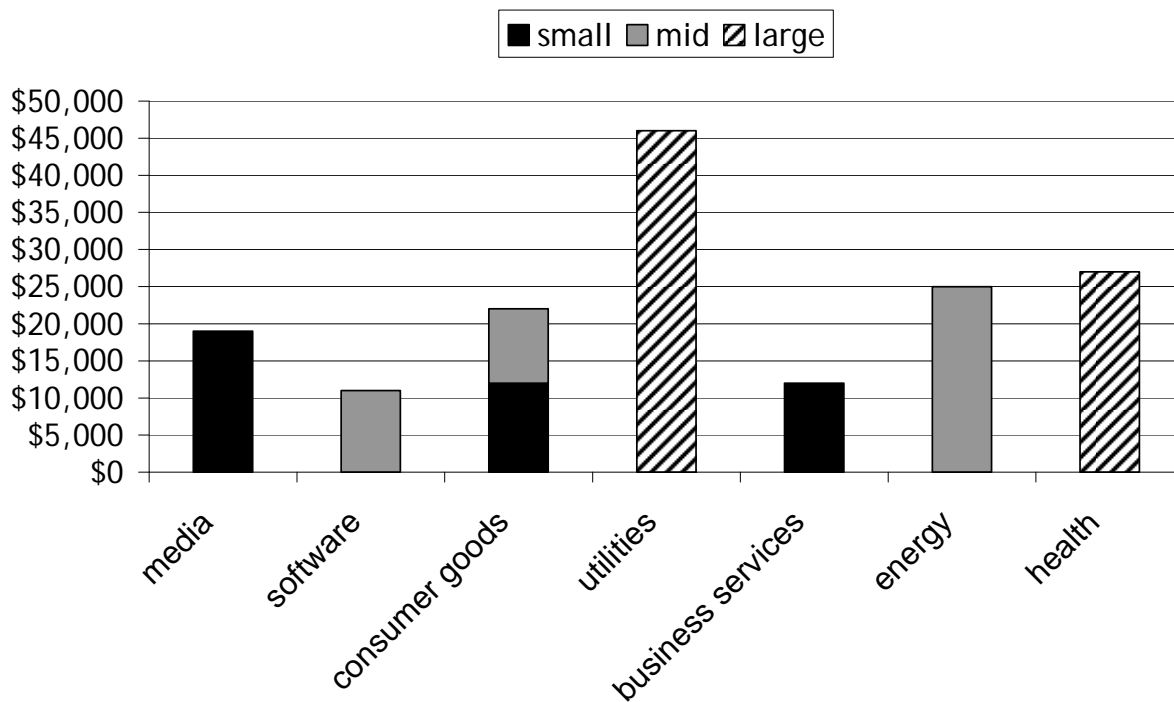


# COMMUNICATING QUANTITATIVE INFORMATION

## Company Cap Size



## Portfolio by Sector and Cap





## COMMUNICATING QUANTITATIVE INFORMATION

2. Below is one portfolio with which you can practice. The stocks listed include information on the size of the company, the industry it operates within, and the value of the investment. Use this information to create three graphical representations to show the diversification of this portfolio both in terms of sector and cap size.

Company	Cap size	Sector	Investment Value
A	Mid	Consumer Services	\$8,500
B	Mid	Software	\$9,000
C	Small	Software	\$13,500
D	Large	Media	\$20,000
E	Mid	Telecommunications	\$15,000
F	Large	Software	\$12,000
G	Mid	Energy	\$9,000
H	Small	Software	\$50,000
I	Small	Telecommunications	\$7,000
J	Mid	Financial	\$5,000
K	Small	Consumer Goods	\$9,000



## TACKLING COMPLEX PROBLEMS

### Evaluating Diversification

Below are the stocks a team has in their portfolio.

Stock	Price per Share	Number of Shares	Cap Size
Amerisafe Inc. (AMSF)	\$12.43	800	Small
Boeing Corporation (BA)	\$79.20	125	Large
Citigroup (C)	\$49.74	240	Large
Intel Corporation (INTC)	\$20.68	390	Large
Peerless Manufacturing Company (PMFG)	\$26.51	225	Small
Princeton Review (REVU)	\$5.21	2700	Small
Radio Shack Corp. (RSH)	\$17.53	950	Mid
U.S. Airways Group Inc. (LCC)	\$46.50	80	Mid
Verisign Inc. (VRSN)	\$21.14	450	Mid

1. What is the total value of their portfolio?
2. Determine what proportion of their investment is in small cap, mid cap and large cap stocks.
3. Would you advise them to diversify? Why or why not?

*Five months later, the stock prices have changed to the new values in the table below.*

4. Recalculate the proportions of their investment in small cap, mid cap, and large cap companies.

Stock	Price per Share	Number of Shares	Cap Size
Amerisafe Inc. (AMSF)	\$18.30	800	Small
Boeing Corporation (BA)	\$88.83	125	Large
Citigroup (C)	\$51.05	240	Large
Intel Corporation (INTC)	\$19.13	390	Large
Peerless Manufacturing Company (PMFG)	\$32.00	225	Small
Princeton Review (REVU)	\$5.53	2700	Small
Radio Shack Corp. (RSH)	\$27.74	950	Mid
U.S. Airways Group Inc. (LCC)	\$45.05	80	Mid
Verisign Inc. (VRSN)	\$25.16	450	Mid

5. Compare the portfolio's diversification now to its diversification five months ago.
6. What advice would you give the portfolio manager?

## What Is Diversification?

### ANSWER KEY

*Please Note: 1. Prices included in lesson are not representative of actual market data and are for instructional purposes only. 2. Discrepancies may occur between student responses and the answer keys as a result of how far calculations were taken past the decimal point. In most instances, numbers were rounded from the thousandth or ten thousandth place.*

#### Calculating Percentages

To calculate percentages, take the amount of money in a category (for example, all the money invested in small cap firms), divide it by the total amount of money in the portfolio, and multiply by 100%.

$$\frac{\% \text{ of portfolio invested in small cap firms} = \text{money\_invested\_in\_all\_small\_cap\_firms}}{\text{total\_value\_of\_investment}} \cdot 100\%$$

Company	Size	Sector	Value
A	Mid	Industrial Materials	\$36,000
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D	Mid	Utilities	\$3,000
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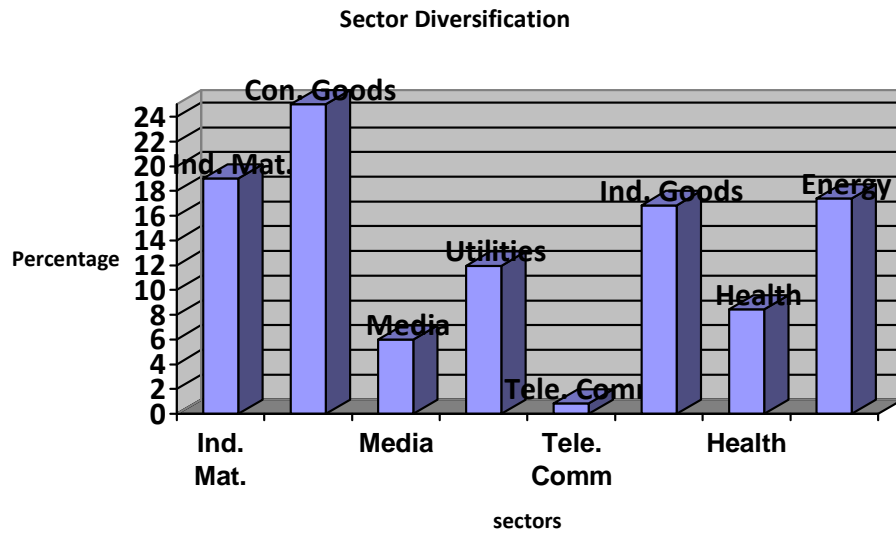
- What is the total value of the investment above?  
*Answer: The total value of the investment above is \$184,000.00.*
- Using the portfolio above, calculate the percentage of the total investment in each sector.  
*Answer: Industrial Materials:  $(\$36,000 \div \$184,000) (100\%) = 0.19562 \times 100 = 19.57\%$ ,  
Consumer Goods:  $(\$35,000 \div \$184,000) (100\%) = 19.02\%$ ,  
Media: 5.98%, Utilities: 11.96%, Telecommunications: 0.82%,  
Industrial Goods: 16.85%, Health: 8.42%, and Energy: 17.39%*
- Calculate the percentage of the investment in each size company.  
*Answer: Small cap:  $(\$24,000 \div \$184,000) (100\%) = 0.1304 \times 100 = 13.04\%$ ,  
Mid cap: 38.04%, Large cap: 48.91%*



## THINKING ALGEBRAICALLY

4. Construct a bar chart to show how diversified this portfolio is in terms of sector.

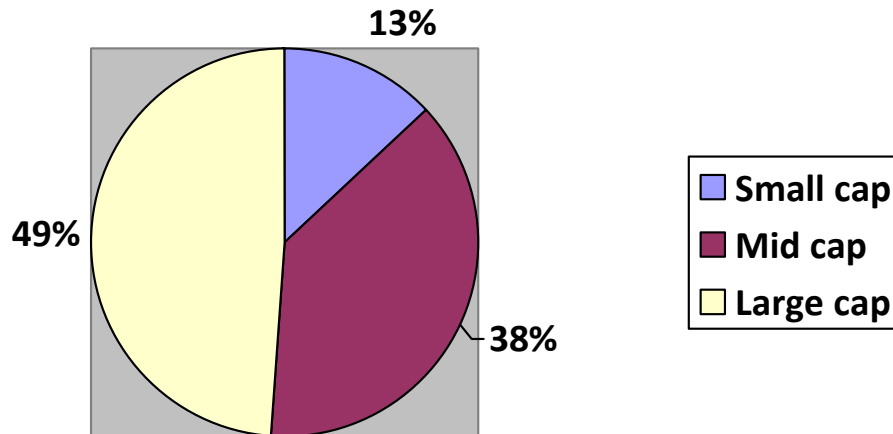
*Answer*



5. Construct a pie chart to show how diversified this portfolio is in terms of cap size.

*Answers*

### Diversification by Cap Size



## INTERPRETING STATISTICS

Below is the profile of a portfolio's holdings (displayed within industry sectors).

Sector	% Holdings
Utilities	25.50
Business Services	9.06
Financials	0.00
Telecommunications	0.00
Media	0.00
Consumer Goods	0.00
Energy	6.86
Hardware	6.10
Health	0.00
Software	0.00
Consumer Services	0.00
Industrial Materials	52.49

1. How much more is this portfolio invested in Industrial Materials than in Utilities?  
*Answer: There is 26.99% more invested in Industrial Materials than in Utilities.*
2. How much more is this portfolio invested in Energy than Hardware?  
*Answer: There is 0.76% more invested in Energy than in Hardware.*
3. Would you say that this portfolio is well-diversified portfolio or not well-diversified? Why?  
*Answers may vary: This portfolio is invested in 5 different industry sectors. From that viewpoint it might appear diversified. However, over 75% of this portfolio is in Utilities and Industrial Materials. That makes it one-sided. Utilities are considered low-risk.*



## INTERPRETING STATISTICS

Below is the profile of another portfolio's holdings (displayed within industry sectors).

Sector	% Holdings
Utilities	1.48
Business Services	10.46
Financials	4.02
Telecommunications	0.00
Media	8.54
Consumer Goods	20.72
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Hardware	2.63
Health	2.15
Software	0.00
Consumer Services	25.32
Industrial Materials	20.77

4. What sector does the investor have the most money invested in?  
*Answer: Consumer Services account for 25.32% of the value of the portfolio.*
5. What sector does the investor have the least money invested in?  
*Answer: Utilities make up 1.48% of the portfolio's value. Some sectors have no investment.*
6. Would you say that this is a well-diversified portfolio? Why?  
*Answers may vary: This portfolio is invested in 10 different sectors. The percentages of sectors are more diversified than in the last portfolio. The top three sectors represent about 65% of the total portfolio.*



## INTERPRETING STATISTICS

Below is the profile of a third portfolio's holdings (displayed within industry sectors).

Sector	% Holdings
Utilities	0.00
Business Services	0.00
Financials	0.00
Telecommunications	98.86
Media	0.00
Consumer Goods	0.00
Energy	0.00
Hardware	0.00
Health	0.00
Software	0.00
Consumer Services	0.00
Industrial Materials	1.14

7. What sector does the investor have the most money invested in?  
*Answer: Telecommunications amounts to 98.86% of the portfolio's value.*
8. What sector does the investor have the least money invested in?  
*Answer: Industrial Materials account for 1.14% of the portfolio.*
9. Would you say that this is a well-diversified portfolio? Why?  
*Answer: No. Only two sectors have investment in this portfolio. 98.86% of the portfolio is invested in Telecommunications.*

If one sector of the economy falls precipitously, which portfolio may be at the greatest risk? Which portfolio has the greatest protection from dramatic fluctuations in one sector of the portfolio? Why?

*Answer: The third portfolio has the greatest risk because 98.86% of the portfolio is invested in one company. The second portfolio has the greatest protection from dramatic fluctuation. It is invested in ten different sectors and has only one sector higher than 25%.*



## COMMUNICATING QUANTITATIVE INFORMATION

### Creating Charts to Represent Diversification

There are many ways to represent a diversified portfolio and a few different ways to consider just what is considered a diversified investment portfolio.

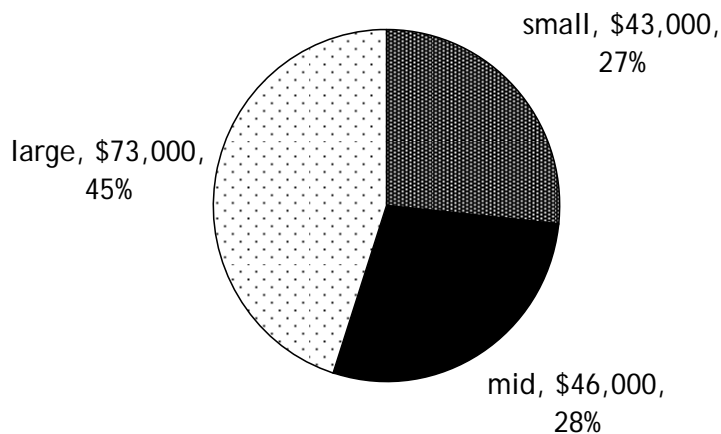
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I	Mid	Energy	\$25,000
J	Large	Health	\$27,000
K	Small	Media	\$13,000

The following graphs present the information above in different ways.

1. Next to each graph write a brief description of what information each graph presents.

### Size of Companies

**Answer:** Company size- small, mid and large.  
Also, the percentage and dollar value of each cap size



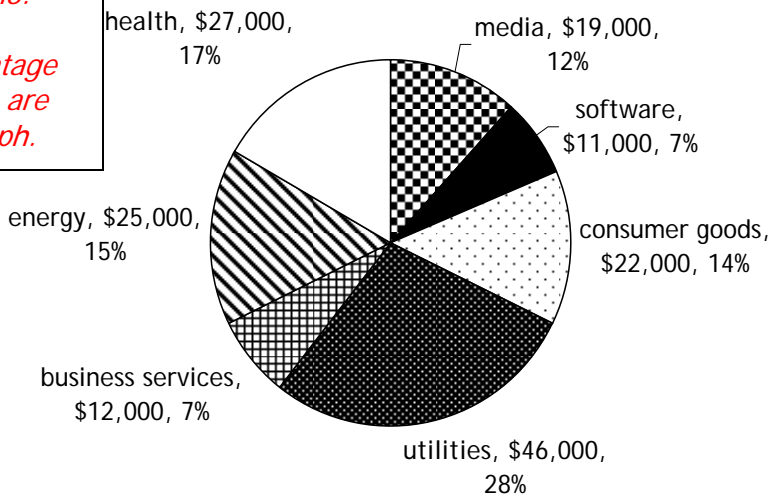


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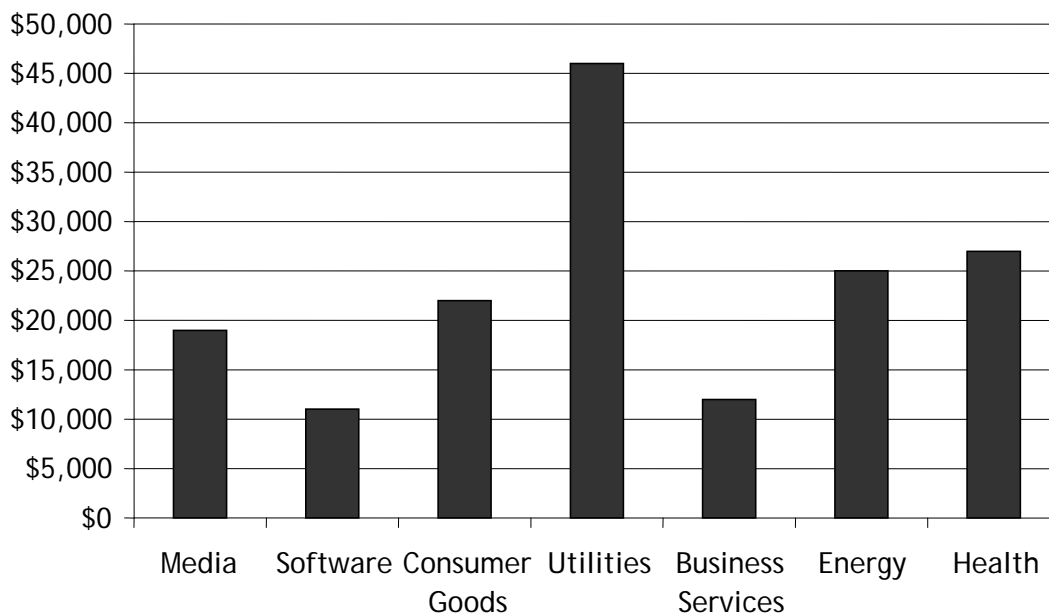
*Answer: In this pie graph, we know the percentage and dollar value of each sector in this portfolio.*

*Answer: The percentage and monetary value are given in this pie graph.*

Investment by Sector



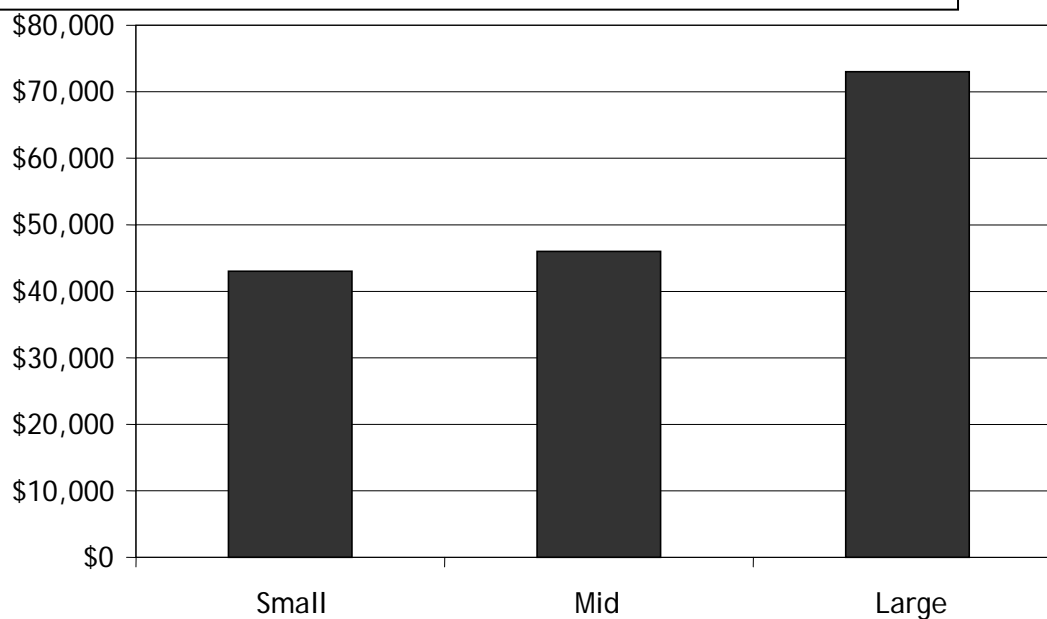
Investment by Sector



## COMMUNICATING QUANTITATIVE INFORMATION

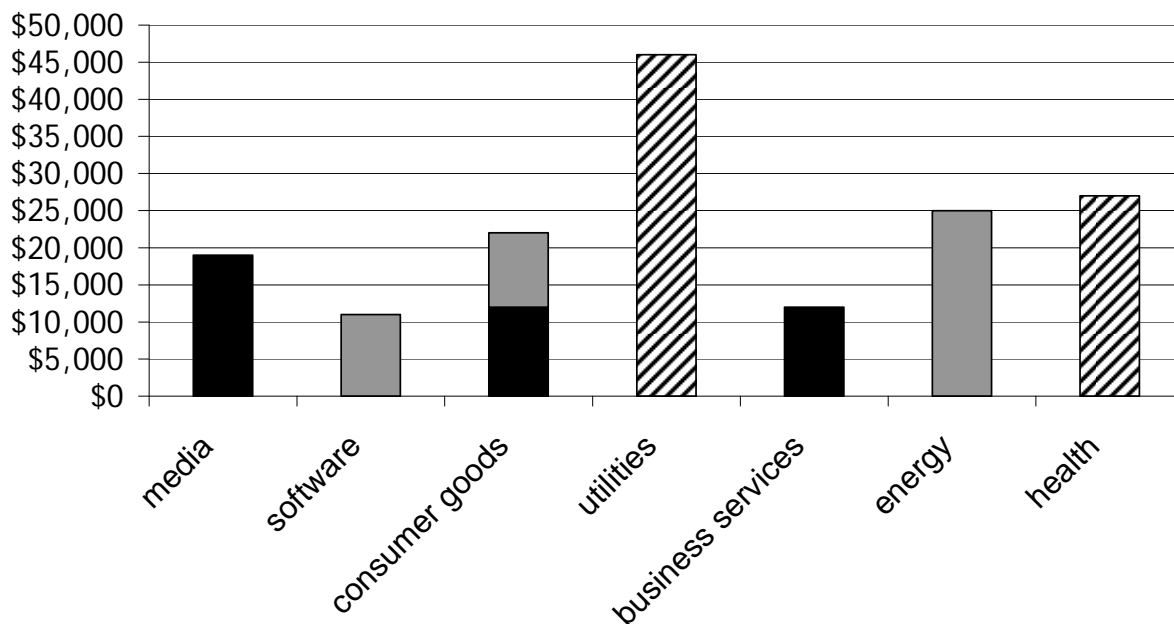
### Company Cap Size

*Answer: Company cap size and monetary value are given.*



### Portfolio by Sector and Cap

■ small ■ mid ▨ large



*Answer: Sector, cap size, and monetary value are given.*



## COMMUNICATING QUANTITATIVE INFORMATION

2. Below is one portfolio with which you can practice. The stocks listed include information on the size of the company, the industry it operates within, and the value of the investment. Use this information to create three graphical representations to show the diversification of this portfolio both in terms of sector and cap size.

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D	Large	Media	\$20,000
E	Mid	Telecommunications	\$15,000
F	Large	Software	\$12,000
G	Mid	Energy	\$9,000
H	Small	Software	\$50,000
I	Small	Telecommunications	\$7,000
J	Mid	Financial	\$5,000
K	Small	Consumer Goods	\$9,000

*Answer: Students can use the five previous graphs as examples. Remember to include a graph for cap size and sector. The total value of this portfolio is \$158,000. Here are the percentages of the portfolio accounted for by the different cap categories: small cap 50.32%, mid cap 29.43%, and large cap 20.25%. The breakdown of the portfolio by percentages is: Consumer Services 5.38%, Software 53.48%, Media 12.66%, Telecommunications 13.92%, Energy 5.70%, Financial 3.16%, and Consumer Goods 5.70%.*



## TACKLING COMPLEX PROBLEMS

### Evaluating Diversification

Below are the stocks a team has in their portfolio.

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Princeton Review (REVU)	\$5.21	2700	Small
Radio Shack Corp. (RSH)	\$17.53	950	Mid
U.S. Airways Group Inc. (LCC)	\$46.50	80	Mid
Verisign Inc. (VRSN)	\$21.14	450	Mid

- What is the total value of their portfolio?  
*Answer: The total value of portfolio is \$89,765.05.*
- Determine what proportion of their investment is in small cap, mid cap and large cap stocks.  
*Answer: small cap 33.39%, mid cap 33.29%, large cap 33.31%*
- Would you advise them to diversify? Why or why not?  
*Answer: Their portfolio already is diversified with one-third of the portfolio's value in each of the three cap categories.*

Five months later, the stock prices have changed to the new values in the table below.

- Recalculate the proportions of their investment in small cap, mid cap, and large cap companies.

Stock	Price per Share	Number of Shares	Cap Size
Amerisafe Inc. (AMSF)	\$18.30	800	Small
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Verisign Inc. (VRSN)	\$25.16	450	Mid

- Compare the portfolio's diversification now to its diversification five months ago.  
*Answer: The portfolio now has a total value of \$108,866.45 in portfolio. Small cap 33.78%, mid cap 37.92%, large cap 28.31%.*
- What advice would you give the portfolio manager?  
*Answers may vary: I would tell him that his portfolio is still diversified and that it would be difficult to keep it at 33% for all cap sizes.*

