## EXAMPLE: SETTING UP PERCENTAGE PROBLEMS

(a) What is 75% of 690?
(b) Forty is what percentage of 150?
(c) Eight is 62% of what?

## EXAMPLE: SETTING UP PERCENTAGE PROBLEMS

(a) What is 75% of 690?

## EXAMPLE: SETTING UP PERCENTAGE PROBLEMS

(b) Forty is what percentage of 150?

## EXAMPLE: SETTING UP PERCENTAGE PROBLEMS

(c) Eight is 62% of what?

## EXAMPLE: DISCOUNT

For months you have been wanting a 47" LCD flat screen television, but the price has been too high. The store is having a one-day sale on all televisions in the store. For one day only you can take 25% off any television. The regular price on the television you want is $1099.

(a) What is the sale price?

(b) What will the final price, including sales tax, be if the sales tax rate is 8%?

## EXAMPLE: USING THE TVM SOLVER

Use the TVM solver on your calculator to find the present value needed if we want a future value of \$5000 in 6 years, if we can earn 4.3% interest compounded monthly.

## EXAMPLE: PLANNING FOR RETIREMENT

Kevin is 30 years old, and he is preparing to begin saving for retirement. He expects to retire at age 67, and for planning purposes, he assumes he'll live to age 95. Based on cursory research, he expects that his investments can average a return of 7% annually, and after retirement, he will move his money into more conservative investments returning 5% annually. In order to be able to withdraw $3000 per month after retirement, how much should he plan to save each month?

## EXAMPLE: PLANNING FOR RETIREMENT

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## EXAMPLE: TVM SOLVER: SAVINGS ANNUITY

If you deposit \$250 each month into an IRA earning 7% interest, how much will you have in the account after 35 years? Use the TVM Solver on your graphing calculator.

## EXAMPLE: TVM SOLVER: PAYOUT ANNUITY

You expect to have \$500,000 in your IRA when you retire, and you want to be able to take monthly withdrawals for a total of 30 years. If your account earns 8% interest, how much will you be able to withdraw each month? Use the TVM Solver on your graphing calculator.

## EXAMPLE: BUYING A CONDO

The price of a condominium is $180,000, and your bank offers a 30-year fixed mortgage at 4% interest. You have $32,000 available right now.

(a) Your banker tells you to expect $5000 in closing costs. What percentage down payment can you afford? Will you need mortgage insurance?

## EXAMPLE: BUYING A CONDO

The price of a condominium is $180,000, and your bank offers a 30-year fixed mortgage at 4% interest. You have $32,000 available right now.

(a) Down payment: 15% (yes, you need mortgage insurance)

(b) What will the principal be on the mortgage?

## EXAMPLE: BUYING A CONDO

The price of a condominium is $180,000, and your bank offers a 30-year fixed mortgage at 4% interest. You have $32,000 available right now.

(a) Down payment: 15% (yes, you need mortgage insurance)
(b) Principal: $153,000
(c) What will your monthly P&I payment be?

## EXAMPLE: BUYING A CONDO

The price of a condominium is $180,000, and your bank offers a 30-year fixed mortgage at 4% interest. You have $32,000 available right now.

(a) Down payment: 15% (yes, you need mortgage insurance)

(b) Principal: $153,000

(c) Monthly P&I payment: $730.45

(d) In addition to principal and interest, your monthly payment will need to account for property taxes, homeowners insurance, and mortgage insurance, if necessary (find out in part (a)):

| | |
|---|---|
| **Property Taxes:** | 1.5% of the home value per year |
| **Homeowners Insurance:** | $900 per year |
| **Mortgage Insurance:** | $40 per month |

What will your total monthly payment amount be?

## EXAMPLE: BUYING A CONDO

The price of a condominium is $180,000, and your bank offers a 30-year fixed mortgage at 4% interest. You have $32,000 available right now.

(a) Down payment: 15% (yes, you need mortgage insurance)
(b) Principal: $153,000
(c) Monthly P&I payment: $730.45
(d) Total monthly payment: $1070.45
(e) How much will you pay in total over 30 years in principal and interest?

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The price of a condominium is \$180,000, and your bank offers a 30-year fixed mortgage at 4% interest. You have \$32,000 available right now.

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(b) Principal: \$153,000
(c) Monthly P&I payment: \$730.45
(d) Total monthly payment: \$1070.45
(e) Total principal and interest: \$262,962
(f) How much interest will you pay in total?

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(d) Total monthly payment: $1070.45

(e) Total principal and interest: $262,962

(f) Total interest: $109,962

## EXAMPLE: CHANGING THE INTEREST RATE

Compare a 30-year fixed-rate loan at 4% for \$200,000 to the same loan at 3.5% by finding the total amount paid in interest for both versions.

## EXAMPLE: CHANGING THE LOAN AMOUNT

Compare a 30-year fixed-rate loan at 4% for $200,000 to the same loan for $180,000 by finding the total amount paid in interest for both versions.

## EXAMPLE: CHANGING THE LENGTH OF THE LOAN

Compare a 30-year fixed-rate loan at 4% for $200,000 to the same loan for 20 years and for 15 years by finding the total amount paid in interest for all three versions.

## EXAMPLE: INCOME TAX

Using the tax table for 2020, how much would a married taxpayer who files separately from their spouse owe on a taxable income of $98,400?

| Tax Rate | Single or Married Filing Separately |
|---|---|
| 10% | up to $9,875 |
| 12% | $9,875 to $40,125 |
| 22% | $40,125 to $85,525 |
| 24% | $85,525 to $163,300 |
| 32% | $163,300 to $207,350 |
| 35% | $207,350 to $518,400 |
| 37% | more than $518,400 |
| Standard Deduction | $12,400 |

## EXAMPLE: TAX CALCULATION

Use the 2020 tax table in the textbook to calculate the final tax owed by a single taxpayer whose details are given below.

| | |
|---|---|
| Gross income: | \$65,000 |
| Deductions: | \$3000: charitable donations |
| | \$6000: contribution to traditional IRA |
| | \$1500: education expenses |
| | \$300: cost of tax preparation |
| Tax credit: | \$500: energy-efficient appliances |

| Tax Rate | Single or Married Filing Separately |
|---|---|
| 10% | up to \$9,875 |
| 12% | \$9,875 to \$40,125 |
| 22% | \$40,125 to \$85,525 |
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## EXAMPLE: PLOTTING POINTS ON A CALCULATOR

According to the U.S. Census Bureau, the number of Americans over the age of 100 is increasing. The Census Bureau reported the following data, where the number of people is measured in the thousands:

| **Year** | **Number (thousands)** |
|---|---|
| 1994 | 50 |
| 1996 | 56 |
| 1998 | 65 |
| 2000 | 75 |
| 2002 | 94 |
| 2004 | 110 |

Graph this data using a graphing calculator.

## EXAMPLE: FITTING A QUADRATIC MODEL ON A CALCULATOR

According to the U.S. Census Bureau, the number of Americans over the age of 100 is increasing. The Census Bureau reported the following data, where the number of people is measured in the thousands:

| **Year** | **Number (thousands)** |
|---|---|
| 1994 | 50 |
| 1996 | 56 |
| 1998 | 65 |
| 2000 | 75 |
| 2002 | 94 |
| 2004 | 110 |

Use a graphing calculator to find a quadratic model that can be used to predict how many Americans will be over the age of 100 in a given year.

## EXAMPLE: MAKING PREDICTIONS WITH A QUADRATIC MODEL

A study designed to track the gas mileage of a car based on its speed found the following results.

| Speed (mph) | Mileage (mpg) |
|---|---|
| 15 | 22.3 |
| 20 | 25.5 |
| 25 | 27.5 |
| 30 | 29.0 |
| 35 | 28.8 |
| 40 | 30.0 |
| 45 | 29.9 |
| 50 | 30.2 |
| 55 | 30.4 |
| 60 | 28.8 |
| 65 | 27.4 |
| 70 | 25.3 |
| 75 | 23.3 |

(a) Use a graphing calculator to plot the data.
(b) Find a quadratic model that best fits the data.
(c) Based on this model, what gas mileage should be expected at 62 miles per hour? At 90 miles per hour? Which of these predictions is likely to be more reliable?
(d) Based on the model, what speeds are likely to produce a mileage of 28 miles per gallon?

## EXAMPLE: MAKING PREDICTIONS WITH A QUADRATIC MODEL

(a) Use a graphing calculator to plot the data. ✓

(b) Quadratic model: $P_t = -0.008t^2 + 0.746t + 13.469$

(c) Based on this model, what gas mileage should be expected at 62 miles per hour? At 90 miles per hour? Which of these predictions is likely to be more reliable?

(d) Based on the model, what speeds are likely to produce a mileage of 28 miles per gallon?

## EXAMPLE: SOLVING AN EXPONENTIAL MODEL FOR TIME

In a previous example, we modeled the population growth of Frederick County from 2013 onward using the following equation:

$$P_t = 241,409(1 + 0.008)^t$$

Use a graphing calculator to find when this model predicts that the population will reach 400,000 people.

## EXAMPLE: EXPONENTIAL REGRESSION

Use a graphing calculator to build an exponential population model for the U.S. using data from 2005 to 2019, shown in the table below.

| Year | Population (in millions) |
|---|---|
| 2005 | 295.5 |
| 2006 | 298.4 |
| 2007 | 301.2 |
| 2008 | 304.1 |
| 2009 | 306.8 |
| 2010 | 309.3 |
| 2011 | 311.6 |
| 2012 | 313.9 |
| 2013 | 316.1 |
| 2014 | 318.4 |
| 2015 | 320.7 |
| 2016 | 323.1 |
| 2017 | 325.1 |
| 2018 | 327.2 |
| 2019 | 328.2 |

## EXAMPLE: LOGISTIC REGRESSION

Use a graphing calculator to build a logistic population model for New York City using the population data below.

| Year | Population (millions) |
|---|---|
| 1900 | 3.44 |
| 1910 | 4.77 |
| 1920 | 5.62 |
| 1930 | 6.93 |
| 1940 | 7.45 |
| 1950 | 7.89 |
| 1960 | 7.78 |
| 1970 | 7.89 |

## EXAMPLE: REPRESENTATIVE SAMPLES

Decide whether each of the following sampling methods is likely to produce a representative sample.

(a) To find the average annual income of all adults in the United States, sample representatives in the US Congress.

(b) To find out the most popular cereal among children under the age of 10, stand outside a large supermarket one day and poll every twentieth child under the age of 10 who enters the supermarket.

## EXAMPLE: SAMPLING METHODS

Determine the type of sampling used in each of the following scenarios.

(a) A soccer coach selects six players from a group of boys aged eight to ten, seven players from a group of boys aged 11 to 12, and three players from a group of boys aged 13 to 14 to form a recreational soccer team.

(b) A pollster interviews all human resource personnel in five different high tech companies.

(c) A high school educational counselor interviews 50 female teachers and 50 male teachers.

## EXAMPLE: SAMPLING METHODS

Determine the type of sampling used in each of the following scenarios.

(d) A medical researcher interviews every third cancer patient from a list of cancer patients at a local hospital.

(e) A high school counselor uses a computer to generate 50 random numbers and then picks students whose names correspond to the numbers.

(f) A student interviews classmates in his algebra class to determine how many pairs of jeans a student at his school owns, on the average.

## EXAMPLE: QUIZ SCORE SAMPLES

Use the random number generator on your calculator to generate a simple random sample from the data below. Find the average score for this sample.
This table displays six sets of quiz scores (out of 10 points) for an elementary statistics class.

| A | B | C | D | E | F |
|---|---|---|---|---|---|
| 5 | 7 | 10 | 9 | 8 | 3 |
| 10 | 5 | 9 | 8 | 7 | 6 |
| 9 | 10 | 8 | 6 | 7 | 9 |
| 9 | 10 | 10 | 9 | 8 | 9 |
| 7 | 8 | 9 | 5 | 7 | 4 |
| 9 | 9 | 9 | 10 | 8 | 7 |
| 7 | 7 | 10 | 9 | 8 | 8 |
| 8 | 8 | 9 | 10 | 8 | 8 |
| 9 | 7 | 8 | 7 | 7 | 8 |
| 8 | 8 | 10 | 9 | 8 | 7 |

## EXAMPLE: DOT PLOT

Draw a dot plot to summarize the following data, the ages of 30 randomly chosen NBA players:

$$22, 28, 20, 24, 26, 21, 27, 28, 31, 29, 24, 22, 21, 25, 22,$$

$$25, 30, 29, 20, 22, 36, 24, 23, 36, 24, 29, 21, 21, 26, 23$$

## EXAMPLE: CATEGORICAL FREQUENCY DISTRIBUTION

Create a frequency table for the players' positions from the NBA dataset (shown below), including a relative frequency column.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PF | SF | SG | PG | SG | PF | C | SG | SF | SF |
| PF | PF | SF | SF | PF | SF | SG | PG | PG | C |
| PG | SF | SG | SG | C | SG | C | SG | C | SG |

## EXAMPLE: GROUPED FREQUENCY DISTRIBUTION

Build a grouped frequency table for points per game for the NBA players dataset (shown below), using a class width of 5.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 23.4 | 14.5 | 14.3 | 16.4 | 4.9 | 5.1 | 17.7 | 10.3 | 8.3 | 20.9 |
| 5.8 | 12.2 | 1.4 | 5.8 | 13.5 | 21.8 | 21.5 | 8.6 | 2.0 | 6.9 |
| 7.7 | 3.0 | 9.0 | 15.3 | 6.4 | 4.3 | 9.0 | 6.8 | 17.8 | 24.0 |

## EXAMPLE: HISTOGRAM

Build a histogram for points per game in the NBA dataset (shown below), using grouped classes with a class width of 5.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 23.4 | 14.5 | 14.3 | 16.4 | 4.9 | 5.1 | 17.7 | 10.3 | 8.3 | 20.9 |
| 5.8 | 12.2 | 1.4 | 5.8 | 13.5 | 21.8 | 21.5 | 8.6 | 2.0 | 6.9 |
| 7.7 | 3.0 | 9.0 | 15.3 | 6.4 | 4.3 | 9.0 | 6.8 | 17.8 | 24.0 |

## EXAMPLE: BAR CHART

Build a bar chart for the players' positions in the NBA dataset (shown below).

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PF | SF | SG | PG | SG | PF | C | SG | SF | SF |
| PF | PF | SF | SF | PF | SF | SG | PG | PG | C |
| PG | SF | SG | SG | C | SG | C | SG | C | SG |

## EXAMPLE: STEM AND LEAF PLOT

Suppose you gathered data on how long it took you to get ready in the morning. For 40 days, you measured the amount of time between when your alarm went off and when you left the house. The results are below, rounded to the nearest minute:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 35 | 28 | 25 | 23 | 23 | 32 | 29 | 19 | 21 | 13 |
| 24 | 26 | 25 | 31 | 30 | 20 | 25 | 29 | 37 | 26 |
| 32 | 36 | 18 | 17 | 15 | 24 | 21 | 16 | 19 | 30 |
| 38 | 27 | 22 | 24 | 28 | 17 | 31 | 32 | 21 | 28 |

Build a stem-and-leaf plot for this data.

## EXAMPLE: SCATTERPLOT: TV PRICE

The following table shows, for a sample of Samsung LCD TVs, their size and their price. Construct a scatterplot for this data.

| Size (in.) | Price ($) | Size (in.) | Price ($) | Size (in.) | Price ($) |
|---|---|---|---|---|---|
| 43 | 500 | 60 | 1200 | 60 | 2800 |
| 55 | 900 | 45 | 1600 | 22 | 300 |
| 51 | 900 | 19 | 200 | 60 | 1100 |
| 32 | 400 | 55 | 2200 | 40 | 600 |
| 51 | 1200 | 60 | 1700 | 46 | 1600 |
| 37 | 500 | 55 | 2000 | 40 | 900 |

## EXAMPLE: MEDIAN NBA SALARY

Find the median of the salaries listed in the NBA dataset (shown below).

| | | | | |
|---|---|---|---|---|
| $155,647 | $384,541 | $898,310 | $898,310 | $898,310 |
| $898,310 | $898,310 | $1,618,420 | $1,620,564 | $1,845,301 |
| $2,338,847 | $2,578,800 | $3,625,760 | $3,831,840 | $4,469,160 |
| $4,767,000 | $4,767,000 | $5,500,000 | $7,059,480 | $7,333,333 |
| $7,666,667 | $7,830,000 | $7,839,960 | $8,113,930 | $13,125,000 |
| $13,486,300 | $27,093,019 | $27,504,630 | $30,560,700 | $30,603,448 |

## EXAMPLE: WEIGHTED AVERAGE

Find the final score of the student whose grades are listed below, using both the points system and the percentage system for defining weights.

| Assignment | Score | Weight | Points |
|---|---|---|---|
| Test 1 | 85% | 20% | 200 |
| Test 2 | 92% | 20% | 200 |
| Test 3 | 87% | 20% | 200 |
| Homework | 95% | 15% | 150 |
| Project | 92% | 10% | 100 |
| Final Exam | 91% | 15% | 150 |

## EXAMPLE: MODE

Find the mode of the dataset summarized below, the ages of players in the NBA dataset.

| Age | Frequency |
|---|---|
| 20 | 2 |
| 21 | 4 |
| 22 | 4 |
| 23 | 2 |
| 24 | 4 |
| 25 | 2 |
| 26 | 2 |
| 27 | 1 |
| 28 | 2 |
| 29 | 3 |
| 30 | 1 |
| 31 | 1 |
| 36 | 2 |

## EXAMPLE: RANGE OF NBA PLAYERS' HEIGHTS

Find the range of heights for the players listed in the NBA dataset (shown below).

| | | | | | |
|---|---|---|---|---|---|
| 2.03 m | 1.98 m | 1.98 m | 2.08 m | 1.93 m | 2.08 m |
| 2.08 m | 1.85 m | 1.98 m | 2.01 m | 2.08 m | 2.01 m |
| 2.03 m | 1.98 m | 2.03 m | 2.01 m | 2.03 m | 1.91 m |
| 1.93 m | 2.11 m | 1.78 m | 2.06 m | 2.03 m | 1.91 m |
| 2.06 m | 1.93 m | 2.06 m | 1.91 m | 2.13 m | 1.85 m |

## EXAMPLE: LINEAR REGRESSION WITH HOUSE PRICES

Construct the least-squares regression line for the house price data given below, knowing that $r = 0.9$.

| Size (sq. ft.) | Selling Price ($1000s) |
|---|---|
| 2521 | 400 |
| 2555 | 426 |
| 2735 | 428 |
| 2846 | 435 |
| 3028 | 469 |
| 3049 | 475 |
| 3198 | 488 |
| 3198 | 455 |

## EXAMPLE: LINEAR REGRESSION WITH HOUSE PRICES

(continued)

Construct the least-squares regression line for the house price data with the statistics below, knowing that $r = 0.9$.

$$\overline{x} = 2891, \overline{y} = 447$$

$$s_x = 269.5, s_y = 29.7$$

## EXAMPLE: REGRESSION LINE

A random sample of 11 statistics students produced the following data, where $x$ is the third exam score out of 80, and $y$ is the final exam score out of 200.

| $x$ | $y$ |
|---|---|
| 65 | 175 |
| 67 | 133 |
| 71 | 185 |
| 71 | 163 |
| 66 | 126 |
| 75 | 198 |
| 67 | 153 |
| 70 | 163 |
| 71 | 159 |
| 69 | 151 |
| 69 | 159 |

Use a graphing calculator to find the equation of the least-squares regression line that can be used to predict a student's performance on the final exam based on their third test score.

## EXAMPLE: PREDICTING HOUSE VALUES

Using a sample of houses on the market, we found the following regression equation to predict the price $y$ based on the square footage $x$:

$$\hat{y} = 0.099x + 160.8$$

Use this equation to predict the price of homes with the following square footage values:

(a) 2700 square feet
(b) 4500 square feet

Which prediction do you expect to be more reliable?

## EXAMPLE: LINEAR REGRESSION WITH NFL QUARTERBACKS

The following table lists the heights (in inches) and weights (in pounds) of 10 NFL quarterbacks in the 2019 season.

| Name | Height | Weight |
|---|---|---|
| Lamar Jackson | 75 | 200 |
| Patrick Mahomes | 74 | 225 |
| Dak Prescott | 74 | 226 |
| Kyler Murray | 70 | 207 |
| Russell Wilson | 71 | 206 |
| Deshaun Watson | 74 | 221 |
| Matt Ryan | 76 | 220 |
| Josh Allen | 77 | 233 |
| Drew Brees | 72 | 209 |
| Aaron Rodgers | 74 | 225 |

(a) Calculate the correlation coefficient for this data.

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| Matt Ryan | 76 | 220 |
| Josh Allen | 77 | 233 |
| Drew Brees | 72 | 209 |
| Aaron Rodgers | 74 | 225 |

(a) $r = 0.6$

(b) Is there are strong linear relationship?

## EXAMPLE: LINEAR REGRESSION WITH NFL QUARTERBACKS

The following table lists the heights (in inches) and weights (in pounds) of 10 NFL quarterbacks in the 2019 season.

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| Matt Ryan | 76 | 220 |
| Josh Allen | 77 | 233 |
| Drew Brees | 72 | 209 |
| Aaron Rodgers | 74 | 225 |

(a) $r = 0.6$

(b) There is a moderate (positive) linear relationship.

(c) Compute the regression line for predicting weight from height.

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(a) $r = 0.6$
(b) There is a moderate (positive) linear relationship.
(c) Regression line: $\hat{y} = 3.01x - 4.43$
(d) Graph the data and the regression equation.

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(a) $r = 0.6$

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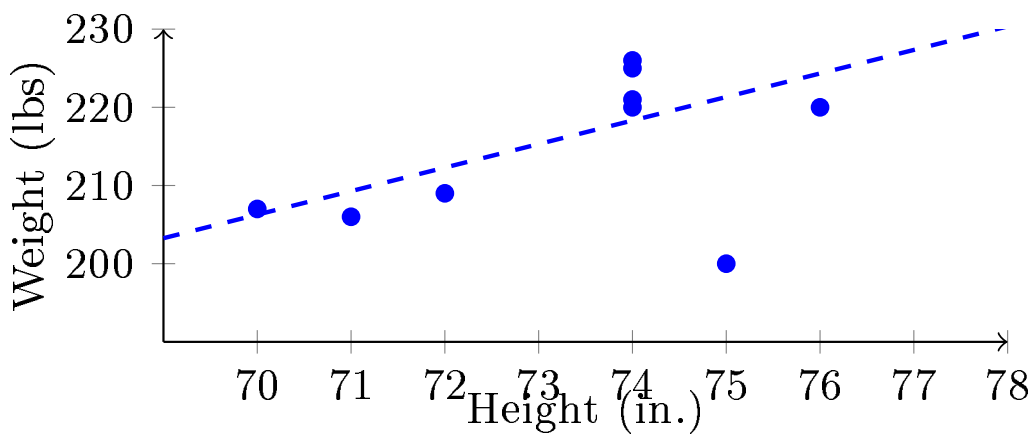
(c) Regression line: $\hat{y} = 3.01x - 4.43$

(d) Graph the data and the regression equation.



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(a) $r = 0.6$
(b) There is a moderate (positive) linear relationship.
(c) Regression line: $\hat{y} = 3.01x - 4.43$
(d) Graph the data and the regression equation. ✓
(e) Predict the weight of a quarterback who is 73 inches tall.

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| Aaron Rodgers | 74 | 225 |

(a) $r = 0.6$
(b) There is a moderate (positive) linear relationship.
(c) Regression line: $\hat{y} = 3.01x - 4.43$
(d) Graph the data and the regression equation. ✓
(e) Predict the weight of a quarterback who is 73 inches tall: 215.3 pounds
(f) Does Drew Brees weigh more or less than the weight predicted by the regression line, based on his height?

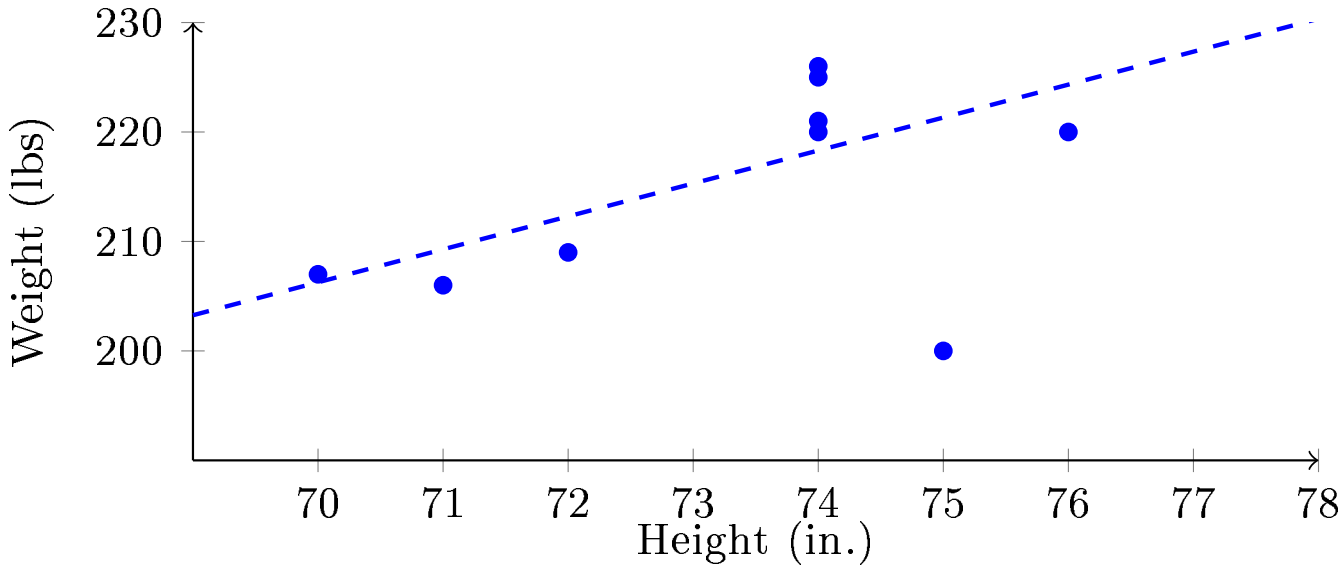
## EXAMPLE: LINEAR REGRESSION WITH NFL QUARTERBACKS

(a) $\boxed{r = 0.6}$

(b) There is a $\boxed{\text{moderate}}$ (positive) linear relationship.

(c) Regression line: $\boxed{\hat{y} = 3.01x - 4.43}$

(d) Graph the data and the regression equation.




(e) Predict the weight of a quarterback who is 73 inches tall: $\boxed{215.3 \text{ pounds}}$

(f) Does Drew Brees weigh more or less than the weight predicted by the regression line, based on his height? $\boxed{\text{Less}}$

## EXAMPLE: SAMPLE SIZE FOR POLL

If you want a poll to have a margin of error of 2% or less, what's the minimum sample size you should use?

## EXAMPLE: PROBABILITY WITH M&M'S

A bag of M&M's contains the following breakdown of colors:

| Red | Yellow | Brown | Blue | Orange | Green |
|---|---|---|---|---|---|
| 12 | 18 | 24 | 22 | 13 | 17 |

Suppose you pull two M&M's out of the bag (without replacing the candy after each pull).

(a) Find the probability of drawing two red candies

## EXAMPLE: PROBABILITY WITH M&M'S

A bag of M&M's contains the following breakdown of colors:

| Red | Yellow | Brown | Blue | Orange | Green |
|---|---|---|---|---|---|
| 12 | 18 | 24 | 22 | 13 | 17 |

Suppose you pull two M&M's out of the bag (without replacing the candy after each pull).

(b) Find the probability of drawing a blue candy and then a brown candy, in that order

## EXAMPLE: PROBABILITY WITH M&M'S

A bag of M&M's contains the following breakdown of colors:

| Red | Yellow | Brown | Blue | Orange | Green |
|---|---|---|---|---|---|
| 12 | 18 | 24 | 22 | 13 | 17 |

Suppose you pull two M&M's out of the bag (without replacing the candy after each pull).

(c) Find the probability of **not** drawing two green candies

## EXAMPLE: PROBABILITY WITH M&M'S

A bag of M&M's contains the following breakdown of colors:

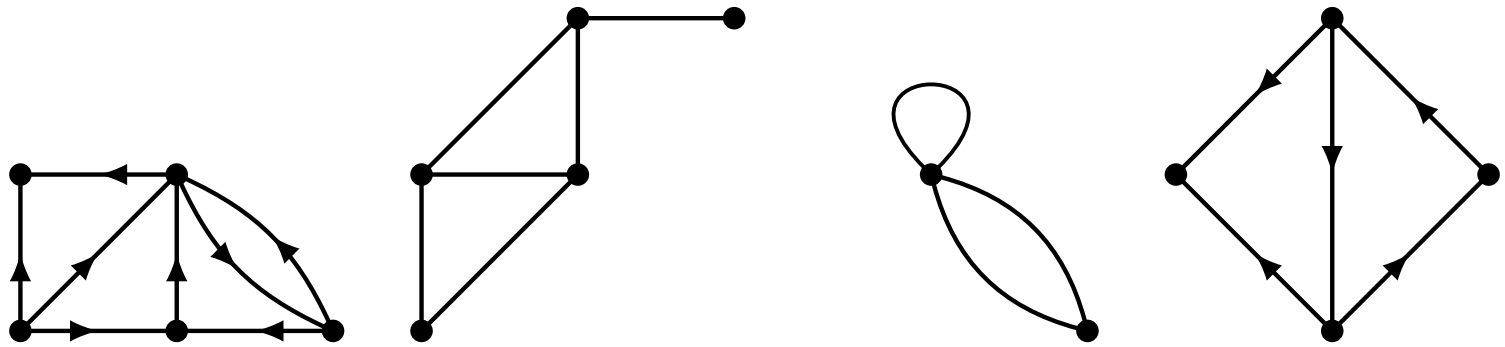
| Red | Yellow | Brown | Blue | Orange | Green |
|---|---|---|---|---|---|
| 12 | 18 | 24 | 22 | 13 | 17 |

Suppose you pull two M&M's out of the bag (without replacing the candy after each pull).

(d) Find the probability of drawing one orange candy and one yellow candy (note that order is not mentioned)

## EXAMPLE: CLASSIFYING GRAPHS

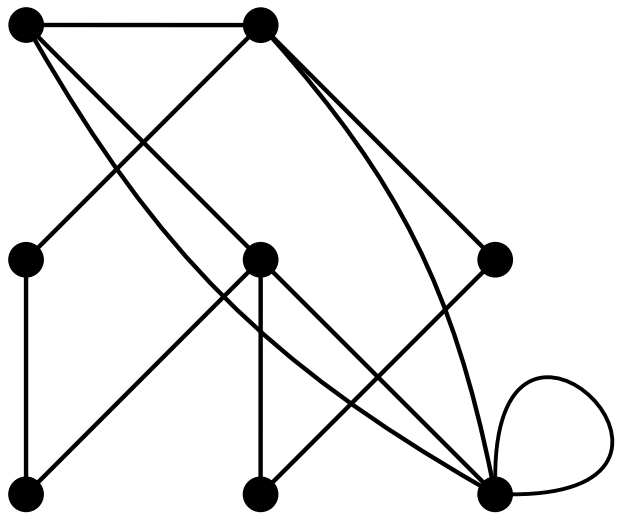
For each of the following graphs, determine whether it is a simple graph or multigraph, and whether it is directed or undirected.



(a) (b) (c) (d)

## EXAMPLE: DEGREES OF NODES

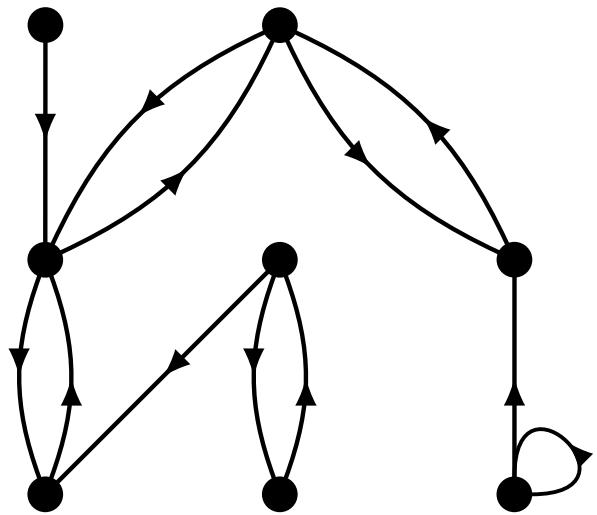
Find the degree of each node in the social network graph shown here.



(a)

## EXAMPLE: DEGREES OF NODES

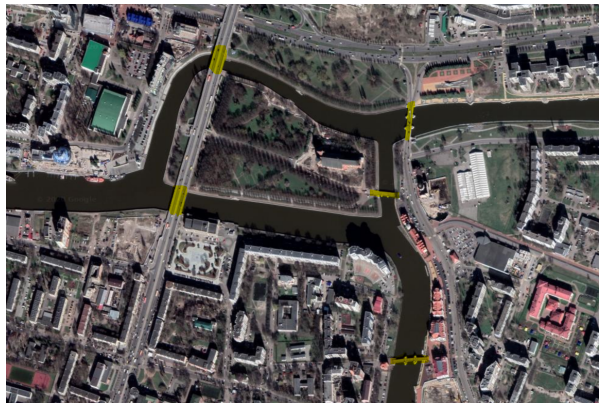
Find the degree of each node in the social network graph shown here.



(b)

## EXAMPLE: EULER PATHS IN MODERN KÖNIGSBERG

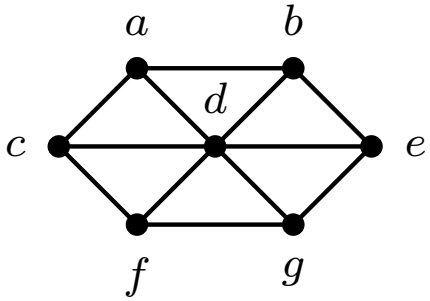
A modern image of part of Kaliningrad (which was once Königsberg) is shown below, with bridges highlighted.



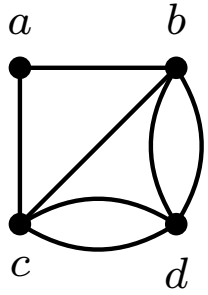
Is there an Euler path and/or circuit through this part of the city? If so, find one.

## EXAMPLE: EXISTENCE OF EULER PATHS

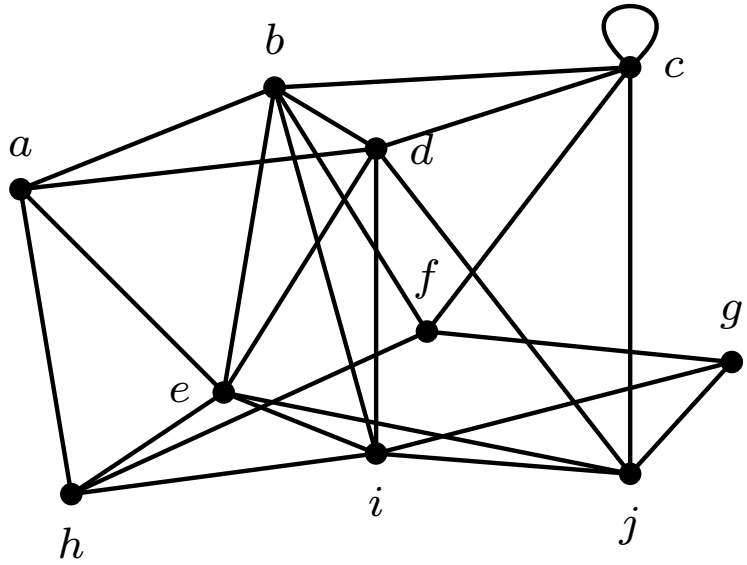
For each of the following graphs, determine if an Euler circuit exists. If not, determine whether there is an Euler path.




(a)



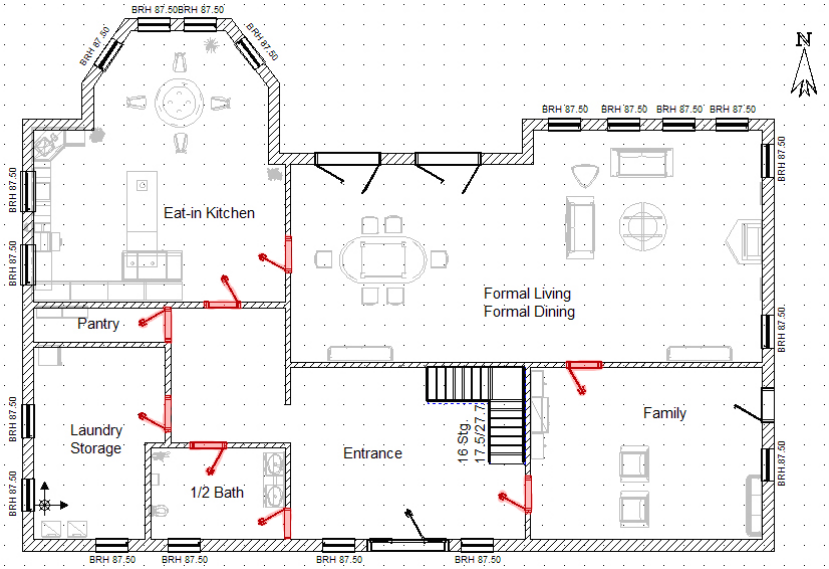

(b)




(c)

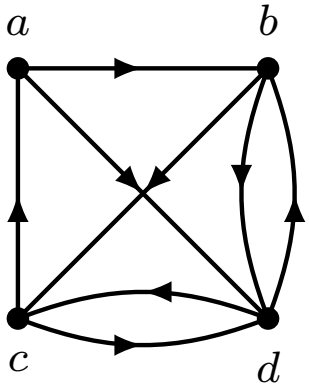
## EXAMPLE: EULER PATH THROUGH HOUSE

The floor plan below shows the first floor of a single-family home. Is there an Euler circuit/path through the interior of this level, using the highlighted doors (in other words, ignoring external doors and stairs)?

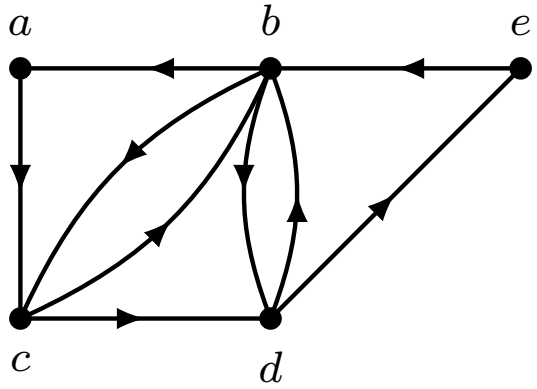


## EXAMPLE: EULER PATHS IN DIRECTED GRAPHS

For each of the following graphs, determine if an Euler circuit exists. If not, determine whether there is an Euler path.



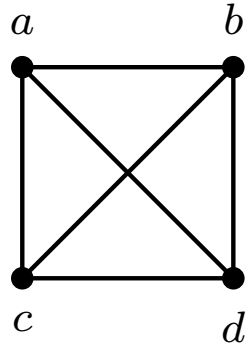

(a)



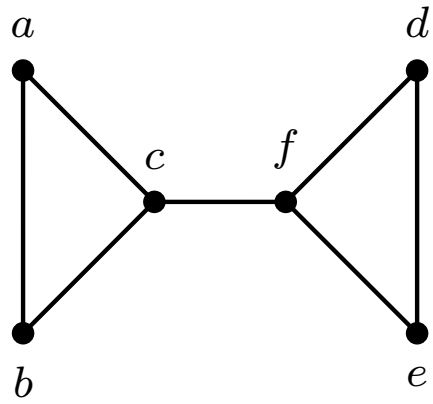

(b)

## EXAMPLE: HAMILTON PATHS

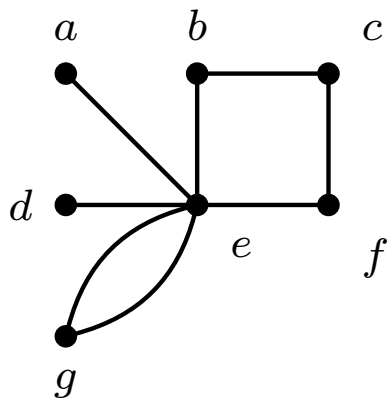
For each of the following graphs, determine whether a Hamilton circuit exists; if so, describe the circuit. If there is no Hamilton circuit, see if there is a Hamilton path.




(a)



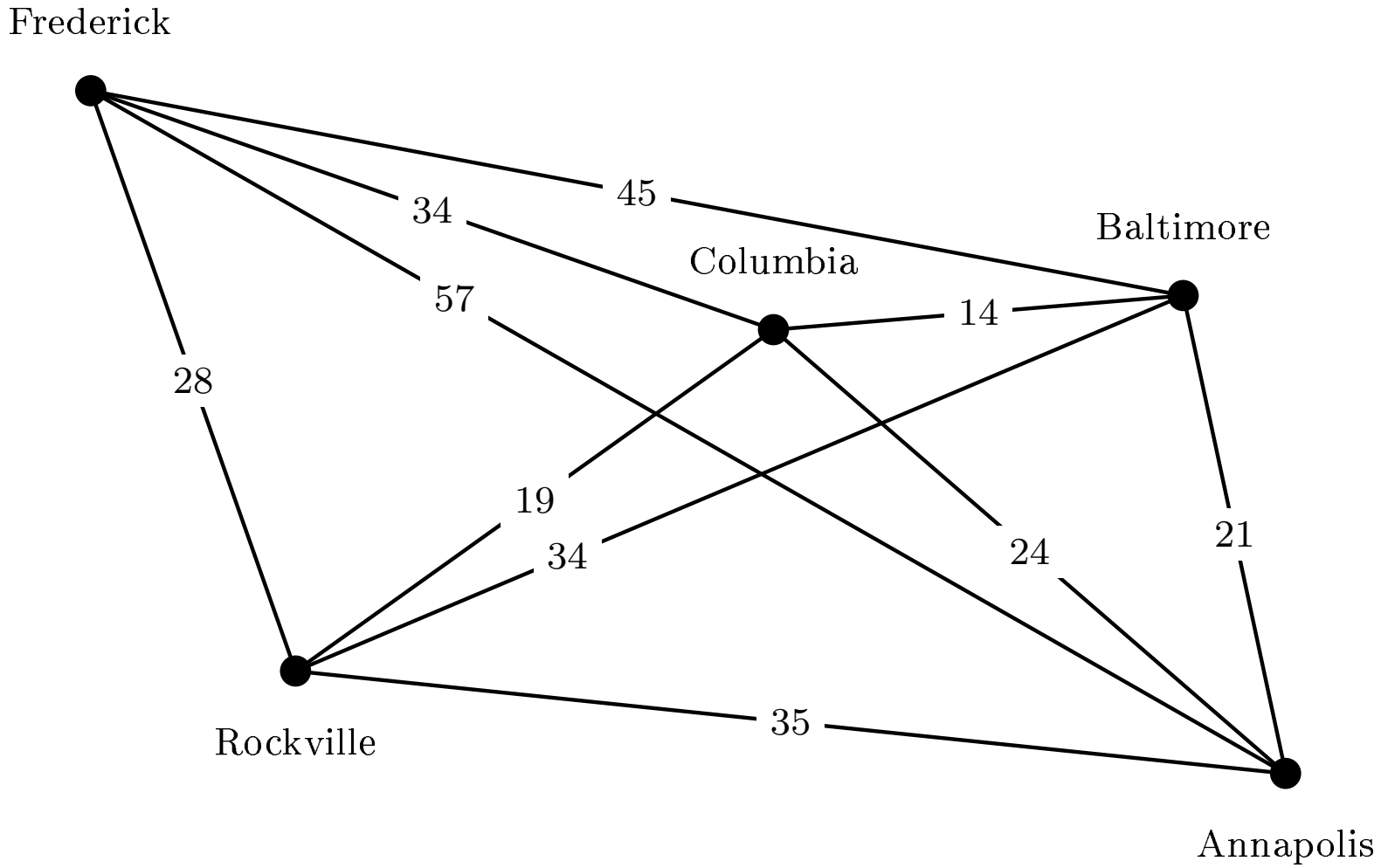

(b)




(c)

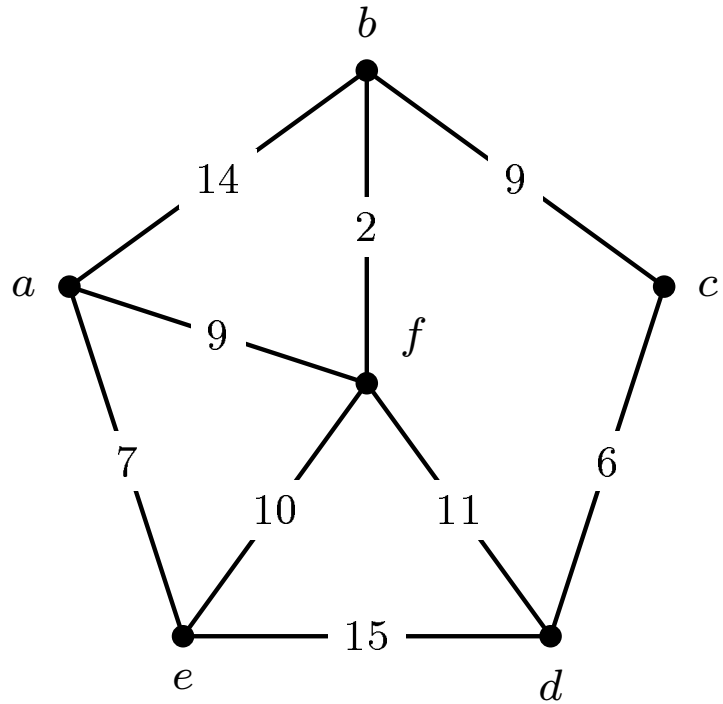
## EXAMPLE: NEAREST NEIGHBOR ALGORITHM

Use the nearest neighbor algorithm to find a possible minimum circuit through the Maryland cities shown below, starting and ending at Frederick.



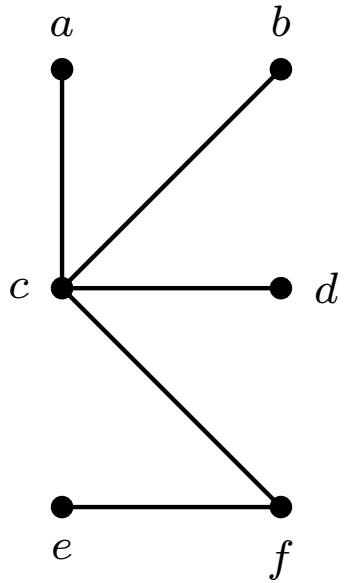
## EXAMPLE: DIJKSTRA'S ALGORITHM

Use Dijkstra's algorithm to find the shortest path between $a$ and $c$ in the graph shown below.

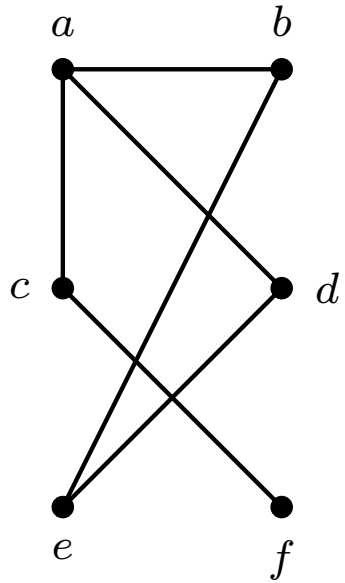


## EXAMPLE: IDENTIFYING TREES

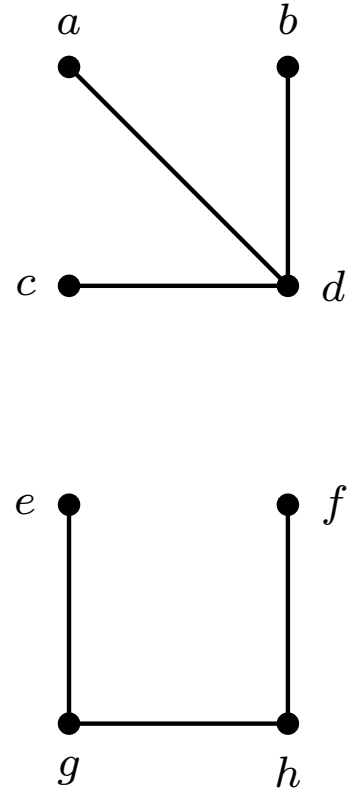
Which of the following are trees?




(a)




(b)




(c)

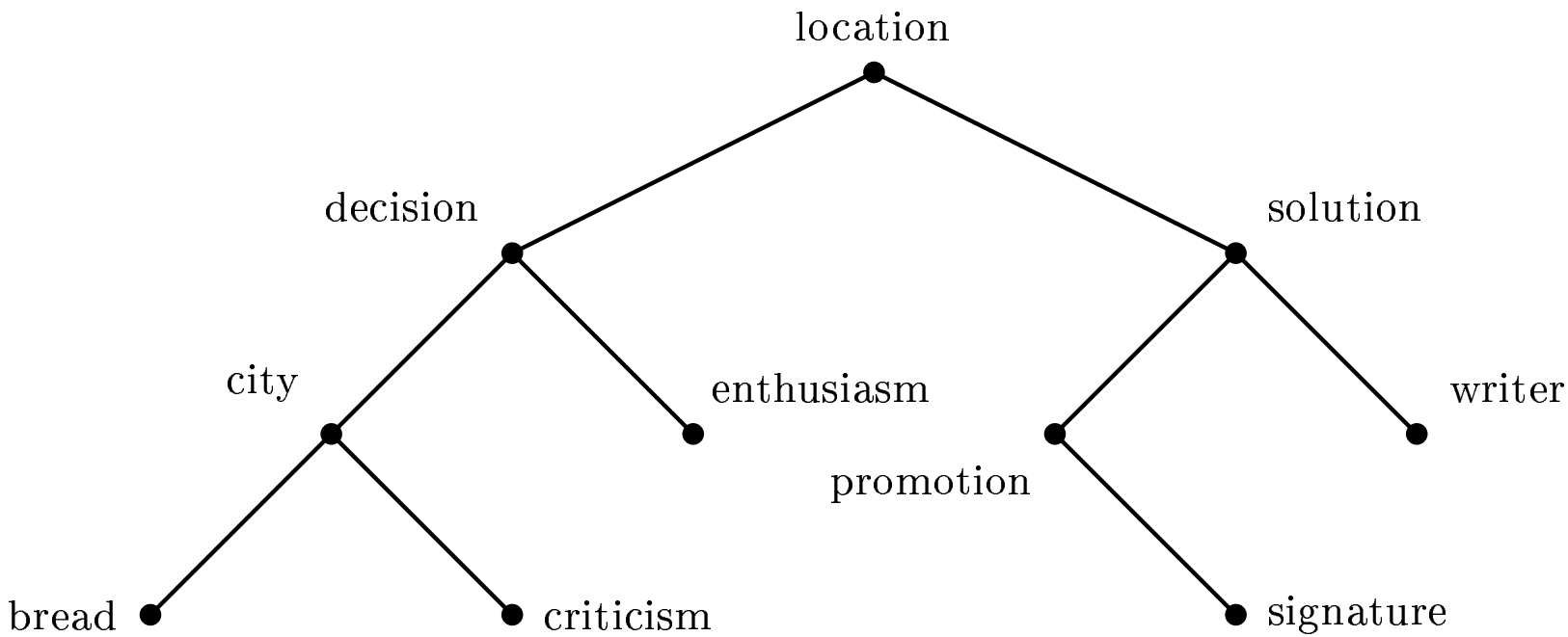
## EXAMPLE: BUILDING A BINARY SEARCH TREE

Build a binary search tree for the following list of words, starting with the first word at the top of the tree:

*location, solution, promotion, decision, city, bread, enthusiasm, writer, signature, criticism*

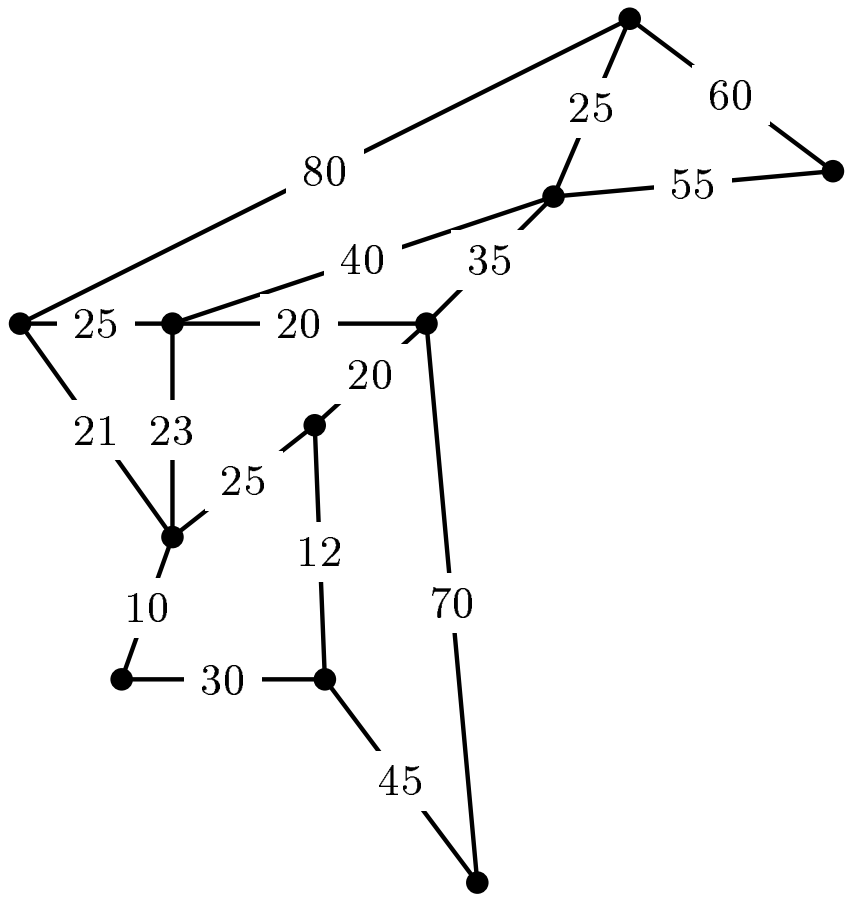
## EXAMPLE: SEARCHING WITH A BINARY SEARCH TREE

Using the binary tree shown below, search for the word *criticism*. How many steps (comparisons) are needed to find it?



## EXAMPLE: FINDING A MINIMAL SPANNING TREE

The graph below shows a network of roads between towns in Nevada. The roads shown on the graph are unpaved, and the weights represent the length of each road. Which roads should be paved so that there is a path of paved roads between every pair of towns, and the total length of paved road is as short as possible? In other words, find a minimal spanning tree for this graph.



## EXAMPLE: FINDING A MINIMAL SPANNING TREE

Minimal spanning tree: