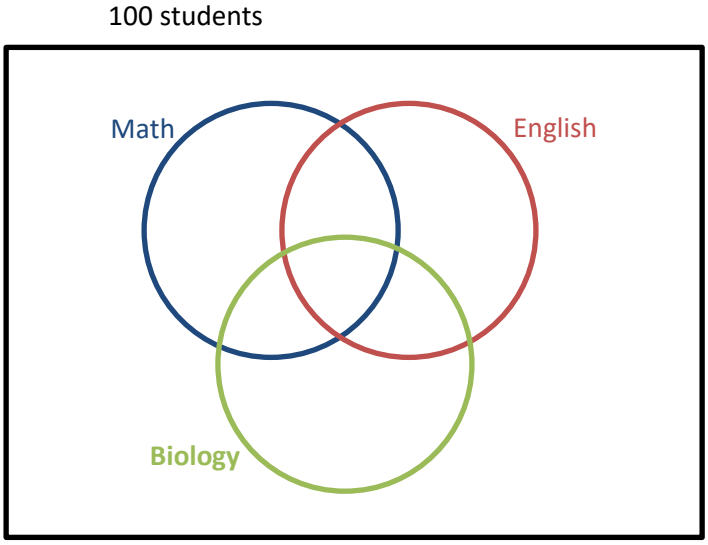
MAT 113 Final Review Exercises

Chapter 1: Critical Thinking (Also includes Section 9.1, Appendices, & Metric System)

1. Complete the following truth table.

p	q	NOT p	NOT q	p AND q	p OR q	If p, then q.	(NOT p) AND q	p OR (NOT q)	If (NOT p), then q.
T	T								
T	F								
F	T								
F	F								

2. The following data were obtained from a survey of 100 students at a certain college. Complete the Venn diagram by placing the appropriate number of students in each region. Then answer the following questions.
   - 40 were taking Math
   - 30 were taking English
   - 20 were taking Biology
   - 16 were taking Math and English
   - 10 were taking Math and Biology
   - 8 were taking English and Biology
   - 2 were taking all three courses (Math, English, and Biology)



   a. How many students surveyed were not taking English?
   b. How many students surveyed were only taking Math?
   c. How many students surveyed were taking Math or English?
   d. How many students surveyed were only taking one of these courses?
   e. How many students surveyed were not taking any of these courses?
   f. How many students surveyed were taking Math or Biology but not English?
   g. How many students surveyed were taking English and Biology but not Math.
   h. If a free calculator is to be given to the surveyed students at the college who are taking Math or Biology, then how many calculators will the college need?

3. Convert the following measurements.
   a. Convert 5.5 days to seconds.
   b. Convert 5.5 miles to kilometers.
   c. Convert 80 miles per hour to feet per second.

4. A rectangular room measuring 4 yards by 10 feet needs carpet.
   a. How many square **feet** of carpet are needed?
   b. If the cost of the carpet is $2.90 per square foot, find the total cost of the carpet.

5. Your car can travel 32 miles on one gallon and gas costs $3.80 per gallon. How much would it cost to fuel your car on a 2,048-mile-long trip?

6. A cylindrical soup can is 8 inches tall by 5 inches wide.
   a. How many **square feet** of paper are needed for the label (side of can only)?
   b. How many **square feet** of surface area are there all together (including side, top, & bottom)?
7. If $1\text{ L} \approx 61\text{ in}^3$, then how many liters of soup will fit in a cylindrical can that measures 8 inches tall by 5 inches wide?
8. A window is rectangular with a width of 3 feet and a height of 5 feet, but it has a half-circle window at the top.
   a. Find the perimeter of the entire window (around the outside of both windows together).
   b. Find the area of the entire window (including both windows).
   c. Ignoring the half-circle window, find the diagonal distance across the rectangular window (from one corner to the opposite corner).
9. Consider the following statement: "All movie stars own a beach house."
   a. Rewrite the statement as a conditional using the words "If . . ., then . . ."
   b. Write the statement's converse.
   c. Write the statement's inverse.
   d. Write the statement's contrapositive.
   e. Draw a Venn diagram that models the first premise and state whether or not the conclusion is valid.

      Premise: All movie stars own a beach house.
      Premise: Carol owns a beach house.
      Conclusion: Carol is a movie star.
10. The average distance from the earth to the sun is about 150 million kilometers. If you were to try and drive your car 60 miles per hour along an imaginary road from the earth to the sun, how many years would it take you to get there?
11. The legs of a right triangle are 52 inches and 165 inches.
    a. Find the area of the triangle.
    b. Find the perimeter of the triangle.
12. The sides of a triangle are 2 inches, 3 inches, and 4 inches. Find the area of the triangle.
13. A circular pool is 24 feet wide.
    a. A cover is to be made for the pool. Find the amount of material needed to make the cover.
    b. A fence is to be placed around the pool. Find the amount of fence needed.
14. Match the following arguments with the informal fallacy being used. The fallacies are listed below.

A.	Appeal to Ignorance	i.	We must vote down the proposition to allow semi-automatic weapons because putting these lethal weapons into the hands of criminals will tear our society apart.
B.	Dismissal Based on Personal Attack	ii.	More people get their groceries at Wal-Mart than any other store. I guess Wal-Mart has the best groceries.
C.	False Authority	iii.	Anakin is too old to begin the training because he is not young enough.
D.	Straw Man	iv.	One night I forgot to leave my front porch light on. When I awoke the next morning, my jack-o-lantern was smashed. The porch light must have helped the carved pumpkin maintain its shape.
E.	Appeal to Common Practice	v.	The congressman, who built his own Fortune 500 company from the ground up, says that the new education standards will raise test scores.
F.	False Dilemma		
G.	False Cause		
H.	Circular Reasoning:		
I.	Hasty Generalization		

Chapter 2: Analysis of Growth

The following table gives the world population (in billions) over the years. Use this data to answer problems 1–4.

Year	1950	1960	1970	1980	1990	2000	2010
Population (in billions)	2.56	3.04	3.71	4.45	5.29	6.09	6.85

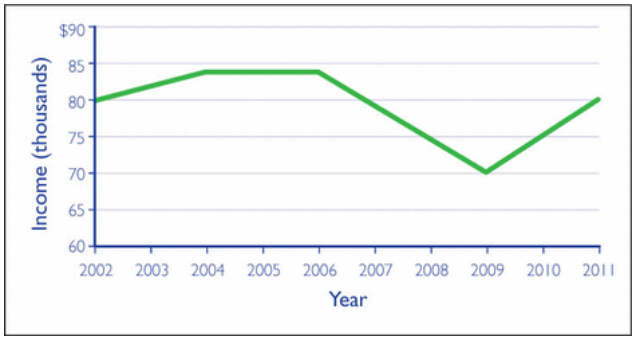
1. Approximate to nearest hundredth of a billion (2 places past decimal when in billions).
   a. Find the absolute change from 1950 to 1960.
   b. Find the absolute change from 2000 to 2010.
   c. Find the absolute change from 1950 to 2010.

2. Approximate to nearest tenth of a percent (0.1%).
   a. Find the percentage change or relative change from 1950 to 1960.
   b. Find the percentage change or relative change from 2000 to 2010.
   c. Find the percentage change or relative change from 1950 to 2010.

3. Approximate to nearest thousandth of a billion per year (3 places past decimal when in billions).
   a. Find the average growth rate in billions of people per year for 1950 to 1960.
   b. Find the average growth rate in billions of people per year for 2000 to 2010.

4. Use interpolation or extrapolation to predict the population of the world in the given years. Approximate to nearest hundredth of a billion (2 places past the decimal when in billions).
   a. Approximate the population of the world in 1953.
   b. Approximate the population of the world in 2018.

5. The line graph to the right shows the yearly gross income in thousands of dollars for a small business from 2002 through 2011. Choose the letter that best describes the growth rate for each given time period.
   a. Substantial positive growth rate
   b. Slight positive growth rate
   c. Zero growth rate
   d. Slight negative growth rate
   e. Substantial negative growth rate



2002–2004 _____ 2004–2006 _____ 2006–2009 _____ 2009–2011 _____

6. Andrea has an income of $4000 per month and has her monthly budget planned as given below. Find what percentage of her paycheck is used for each category.

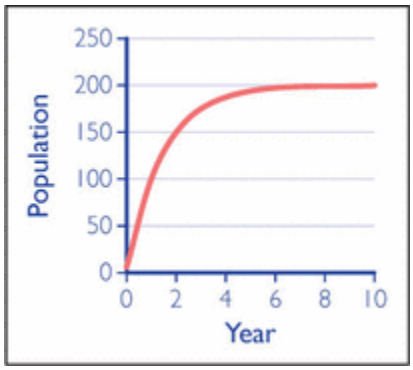
Category	Mortgage/Taxes	Insurance	Utilities	Food	Entertainment/Misc.	Saving/Giving
# Dollars	$1600	$600	$600	$300	$300	$600
Percentage						

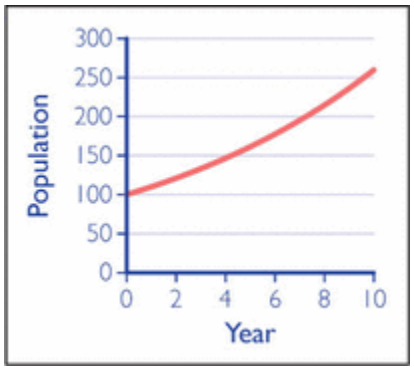
7. The first table below shows the rate of inflation for the given time periods. The second table below gives the annual salaries of Ben's father for the given years. Show what his salaries would be if they were given in constant 2010 dollars. Approximate answers to nearest dollar or whole number.

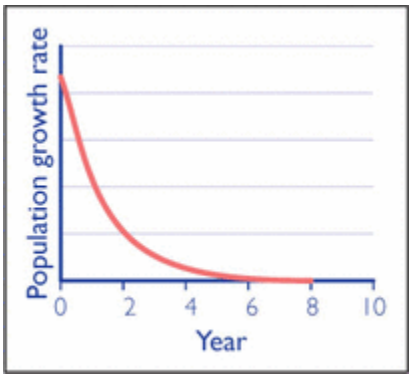
Time Span	1970–2010	1980–2010	1990–2010	2000–2010
Inflation	451%	154%	64%	26%

Year	1970	1980	1990	2000	2010
Salary	$22,100	$42,800	$65,700	$72,500	$92,200
2010 Dollars					

In what year did Ben's father make the most money, considering inflation?







8. For each line graph above, choose the letter from the descriptions below that best describes how the graph is changing.
   a. Graph is increasing at an increasing rate.
   b. Graph is increasing at a decreasing rate.
   c. Graph is increasing at a constant rate.
   d. Graph is decreasing at an increasing rate.
   e. Graph is decreasing at a decreasing rate.
   f. Graph is decreasing at a constant rate.

Chapter 3: Linear & Exponential Change

1. Determine whether the following examples describe linear change or exponential change.
   a. A Person gets an annual raise of 3% of his previous year's salary.
   b. A person receives an annual raise of $1,000.

2. Suppose that the cost of purchasing CDs from a music club is a flat membership fee of $30 plus $12 for each CD purchased. If *C* is the cost in dollars and *n* is the number of CDs bought and if the amount of money you pay is a linear function of the number of CDs you buy, find a linear formula for this relationship.

3. A store sells 40 pineapples per day when pricing them at $3 each and sells 20 pineapples per day when pricing them at $5 each.
   a. Write an equation that models this as a linear relationship between the number of pineapples sold, q, and their selling price, p. Let the quantity be a function of the price.
   b. If the price is $6.50, how many pineapples will the store sell per day?
   c. If the store is selling 55 pineapples per day, what price are they charging?
   d. Interpret the meaning of the slope with respect to this particular problem.

4. A vehicle costs $35,000 when it was purchased and $25,000 four years later.
   a. What is the average rate of change of the value of the car? What does that mean?
   b. Write a linear equation that models the situation.
   c. Use the equation to predict the value of the automobile after 7 years.

5. Initially, a population is 1200, and it grows by 8% each year.
   a. Find a formula for the population, P, at any time, t.
   b. What will the population be 10 years from now?
   c. How many years will it take for the population to reach 2040?
   d. How many years will it take for the population to double?

6. A certain medication metabolizes at a rate of 28% per hour and is usually given as a 90 mg dose.
   a. Write a formula expressing the quantity in a person's system as a function of time.
   b. How much medication will the person have in their body after 4 hours?
   c. If a new injection must be given when there is only 10 mg left in their body, how long after the initial injection does that happen?
   d. What is the half-life of the medication?
   e. How much medication will the person have in their body after 1 day?

7. A substance has a half-life of 30 years and currently has a quantity of 100 lb. How much would be left after 50 years?

8. If a colony of bacteria doubles every 2 hours and begins with 8 cells, find the following:
   a. How many will there be in 12 hours?
   b. How many will there be in 3 days?

9. A certain radioactive material decays at a rate of 4.8% per month. What is its half-life? (Don't forget units.)

10. If a colony of bacteria grows at a rate of 22% per hour, what is the doubling time?

11. A man working in sales makes a base salary of $800 per week. His commission is 6% of his sales.
    a. Write an equation to model this scenario.
    b. Use the equation to calculate his total income if he sold $2,750 of merchandise during the week.
    c. How much would he need to sell in order to have a total income of $1,000.00?

12. What is the relative intensity of an earthquake that registers 5.3 on the Richter scale?

13. How many times more intense is a 6.0-magnitude earthquake compared to a 3.0-magnitude earthquake?

Chapter 4: Personal Finance

1. Imagine that on the day you were born your parents invested $1000 in an account with a simple interest rate of 5%. How much money will be in the account after 18 years?

2. A student has a credit card with an APR of 25% and a minimum payment that is 5%. The student has a balance of $3,200 on this credit card and has decided to stop charging and pay off the credit card by making only the minimum payment each month.
   a. Find the balance on the credit card after four years.
   b. How long will it take until the balance on the credit card drops below $31?

3. A new home was purchased for $398,000. A thirty-year mortgage was obtained at an APR of 4.8%.
   a. Find the monthly mortgage payment.
   b. How much total interest will be charge over the life of the loan?
   c. Complete the amortization table below.

Payment Number	Payment	Applied to Interest	Applied to Principal	Balance
—	—	—	—	$398,000.00
1				
2				
3				
4				

4. Lisa plans to send her daughter to a university in 15 years. Her goal is to create a college fund worth $150,000.
   a. How much must Lisa deposit monthly into an account with an APR of 5.4%, compounded monthly, to achieve her goal?
   b. How much interest would Lisa earn from this investment?

5. Tom invests $5,000 in an account that pays simple interest of 3%. Find the interest earned after 8 years.

6. At the time of retirement, a wise investor has $2.5 million in his retirement account that is paying interest at an APR of 7% compounded monthly. Find the monthly perpetuity yield of the investment.

7. At the time of retirement, a wise investor has $2.5 million in his retirement account that is paying interest at an APR of 7% compounded monthly. Find the monthly yield of a 20-year annuity.

8. Find the maximum amount I can borrow on an installment loan with an APR of 6% for 10 years to have a monthly payment below $300. (Round to nearest dollar.)

9. Find the APY of an account with an APR of 10% with interest…
   a. compounded quarterly and
   b. compounded monthly.

10. In six years, I need to have $5,000 in my savings account.
    a. If my savings account has an APR of 8% compounded monthly, how much must I deposit today to reach my goal? (Round to the nearest dollar.)
    b. How much interest would I earn from this investment?

11. Referring to Table 4.3 of index numbers on p. 289, find the 5-year inflation rate from 1969 to 1974.

12. If the inflation rate is 4.5%, what is the percentage decrease in the buying power of a dollar?

13. The average cost of a house in 1950 was $12,400. If the cost of the house changed only in accordance with inflation, how much was the average cost of a house in the year 2000?

14. Marcus invests $2000 annually into an IRA (individual retirement account) with an APR of 7.5%.
    a. After 42 years, what will be the value of this IRA?
    b. After 42 years, how much interest will he have earned on this investment?

15. You plan to work for 37 years and then retire using a 25-year annuity. You want to arrange a retirement income of $6,000 per month. The money will be invested in an account with an APR of 8% compounded monthly.
    a. What size of a nest egg do you need to achieve the desired monthly retirement income?
    b. What monthly deposits are required to achieve the desired monthly income at retirement?
    c. How much money will you withdraw from this account over the life of this 25-year annuity?

16. Your VISA card calculates finance charges using an APR of 21%. Your previous statement showed a balance of $250. In response to which, you made a payment of $75. You then bought $310 worth of Christmas presents, which you charged to your VISA card. Find the new balance on your VISA card.

17. Find the exact and approximate doubling time if an account earns an APR of 5% compounded monthly.

18. Suppose the buying power of a dollar decreases by 3.9% this year. What is the rate of inflation this year?

19. Ford Motor company is offering the following deals: 0% APR for 60 months or a $4,000 rebate. If the consumer takes the rebate, then they will finance their new car at the local credit union with an APR of 3.6% for five years. Find the monthly payment for each option if the purchase price of the car is $28,750. Which option should the consumer choose?

20. Suppose Jon has a total income of $100,000 in the year 2016 with his tax deductions totaling $21,000 and total tax credits of $6,500. What is Jon's taxable income (to look up in the table) for 2016?

21. Suppose you invest $125 each month for 12 years into an account that earns 6.5% APR compound monthly in order to save for a down payment on a house. How much will you have at the end to put down on a house?

22. How much interest will you earn if $1,100 is invested in a 5-year CD with an 8.3% APR compound quarterly?

23. Suppose the inflation rate this year is 1.5%. What is the percentage decrease in the buying power of the dollar?

Chapter 5: Introduction to Probability

1. Given a standard deck of 52 cards, find the probability of each of the following:
   a. On a single draw a face card will be drawn.
   b. On a single draw a ten or a red card will be drawn.
   c. A pair of fives will be drawn without replacement.
   d. A pair (any card) will be drawn without replacement.
   e. Three red cards will be drawn without replacement.
   f. A king, a queen, and a jack of the same suit will be drawn in that order without replacement.

2. Suppose you have a group of 20 people: 12 women and 8 men. Find the following:
   a. The number of different 4-person committees.
   b. The number of different ways to choose 4 officers (pres., vice pres., secretary, treasurer).
   c. The probability that the 4 officers from above will be all women.
   d. The probability that a committee of 4 will be all male.
   e. The probability that a committee of 4 will have a least one woman.
   f. The probability that a committee of 4 will be 3 women and 1 man.

3. A group of college students have been surveyed. The results have been summarized in the table to the right. One college student from the group will be selected. Find the following probabilities.
   a. P(Under classman)
   b. P(Upper-class commuter)
   c. P(Upper classman or commuter)
   d. P(Under classman or commuter)
   e. P(Commuter)

	Upper classmen	Under classmen
On campus	13	10
Commuters	18	9

4. What is the probability of rolling a prime number sum when rolling two dice?

5. What is the probability of rolling a sum of 6 or 9 when rolling two dice?

6. Suppose there are 15 jelly beans in a bowl: 3 green, 5 blue, and 7 red. A jelly bean is selected at random. What is the probability the jelly bean is not blue?

7. A betting game charges each participant $4 to roll two dice. If snake eyes (i.e., two 1's) are rolled, then $8 is won. If a sum of 7 is rolled, then $6 is won. For all other rolls, the player will win nothing. Find the player's expected value per game.

8. You purchase a flood insurance policy for $260. The policy will pay $32,000 if your home floods in the next 12 months, an event that has a probability of 1 in 250,000 according to the insurance company. What is the expected value of the policy for the insurance company?

9. In a dice game, you win if the two dice come up with a sum of 5 or 6; otherwise, you lose $1. What should be the profit for winning to make this game fair?

10. Two cards are drawn in succession without replacement from a standard deck of playing cards. Find the probability both cards are black.

11. It is known that 2% of the population has green eyes.
    a. If two people are randomly selected, find the probability both have green eyes.
    b. If two people are randomly selected, find the probability neither have green eyes.
    c. If two people are randomly selected, find the probability at least one of them have green eyes.

12. A fair die is rolled 10 times. Find the probability of rolling a 5 at least once.

Chapter 6: Statistics

1. Which of the following is/are **not** true of a normal distribution?
    a. This distribution is common for measurements such as heights, weights, and standardized scores.
    b. The mean should be approximately equal to the median.
    c. Most of the data is clustered near the center or mean.
    d. The data is symmetrical with fewer occurrences of the data points that are further away the mean.
    e. Incomes and prices of houses often have this type of distribution.

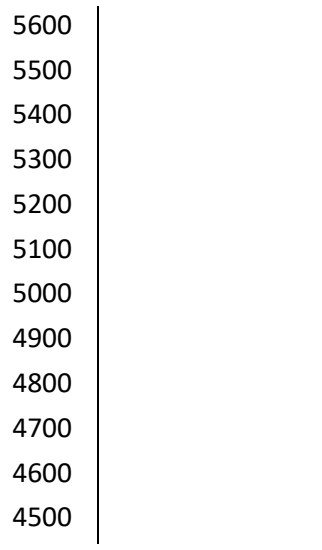
2. The life of a particular air-mattress is normally distributed with a mean of 36 months and a standard deviation of 5 months. The air mattress has a 24-month warranty for replacement.
    a. What percentage of the air mattresses will be eligible to be replaced under the warranty?
    b. What percentage of these mattresses will last at least 3 ½ years?
    c. What percentage of these mattresses will last between 3 and 4 years?

3. The data below shows the total number of home runs scored by major league baseball players in the given years. Find the mean, median, mode, range, and the five-number summary and draw a boxplot (using given scale).

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Home Runs	5458	5060	5207	5451	5017	5386	4957	4878	5042	4614

Mean: _____
Median: _____
Mode: _____

Five-Number Summary:
1. _____
2. _____
3. _____
4. _____
5. _____



4. Suppose that SAT scores are normally distributed with a mean of 507 and a standard deviation of 111. Use the 68-95-99.7 Rule to answer the following. (Give test scores as answers.)
   a. The middle 68% of SAT scores are between _____ and _____.
   b. The middle 95% of SAT scores are between _____ and _____.
   c. The middle 99.7% of SAT scores are between _____ and _____.

5. Suppose that SAT scores are normally distributed with a mean of 507 and a standard deviation of 111. Use the 68-95-99.7 Rule to answer the following.
   a. What percentage of the students score above 618?
   b. What percentage of the students score above 396?
   c. What percentage of the students score between 618 and 729?
   d. What percentage of the students score below 174?
   e. What percentage of the students score between 285 and 396?
   f. If 2000 students take the SAT, how many would score between 285 and 396?

6. Suppose that SAT scores were normally distributed with a mean of 507 and a standard deviation of 111. Use the Z-Table from your book (and given in class) to answer the following.
   a. What percentage of the students score above 450?
   b. What percentage of the students score below 350?
   c. What percentage of the students score between 550 and 650?
   d. If 2000 students take the SAT, how many would score between 550 and 650?

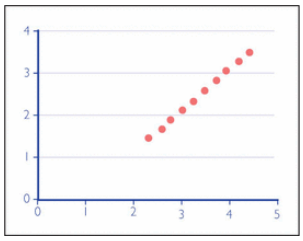
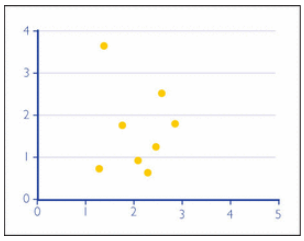
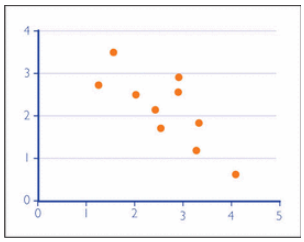
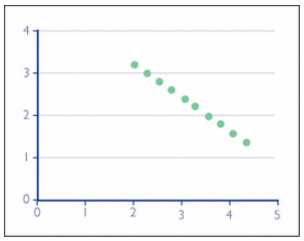
7. Find the margin of error for a 95% confidence interval, given the following sample sizes. Give answers as percentages rounded to nearest tenth of a percent (i.e., to the nearest 0.1%).
   a. If the sample size is 8000, the margin of error is _____.
   b. If the sample size is 800, the margin of error is _____.

8. Find the sample size that will give the following margin of error for a 95% confidence interval. Estimate to nearest whole number.
   a. If the margin of error is 4.5%, the sample size is _____.
   b. If the margin of error is 1.5%, the sample size is _____.

9. Suppose that 1150 randomly chosen ISU students were surveyed to try to determine the approval rating of ISU students regarding the job performance of the University President. Of the students questioned, 874 said that they approved. Find the 95% confidence interval for the percentage of all students that approve of the University President's job performance. Round margin of error to the nearest tenth of a percent.

10. A randomly selected sample of 4750 adults in Illinois were questioned to see if adults in Illinois approved of increasing the speed limit on interstates to 75 mph. Of those questioned, 4180 said that they approved. Find the 95% confidence interval for the percentage of all adults in Illinois that approve of increasing the speed limit to 75 mph on the interstate. Round margin of error to the nearest tenth of a percent.

11. Identify whether the following pairs of variables are positively correlated (P), negatively correlated (N), or uncorrelated (U).
    a. Monthly payment for a mortgage versus Interest rate
    b. Strength of gravity versus Number of miles away from earth
    c. Running speed of a dog versus Length of legs of the dog
    d. Number of flu cases in Illinois versus Number of HIV cases in South Africa
    e. Percentage of students with good attendance versus Percentage of students with passing scores
    f. Margin of error versus Sample size
    g. Price of item versus Number of consumers buying item
    h. Number of mph of hurricane wind speed versus Number of dollars of damage
    i. Monthly cost of groceries versus Temperature outdoors

12. For each scatterplot above, choose the letter from the descriptions below that best describes the value of the correlation coefficient.
    a. Correlation coefficient is 1 or very close to 1 (i.e., a very strong positive correlation).
    b. Correlation coefficient is positive but somewhat moderate.
    c. Correlation coefficient is 0 or is very close to 0 (i.e., a very weak correlation).
    d. Correlation coefficient is negative but somewhat moderate.
    e. Correlation coefficient is –1 or very close to –1 (i.e., a very strong negative correlation).

13. The greatest possible value for the correlation coefficient is _____, and the least possible value for the correlation coefficient is _____.

14. Suzy has the following exam scores: 76, 84, 62, and 91. To receive a B in the course, Suzy must have an exam average of at least 80. If all exams are of equal weight, what score must Suzy achieve on the last exam of the semester to receive a B for the course?

15. A room contains 10 nurses and 7 doctors. The average age of the nurses is 28.9 years, and the average age of the doctors is 45.7 years. Find the average age of all of the people in the room.

16. A room contains 10 nurses and 7 doctors. The average age of the nurses is 28.9 years. If the average age of all of the people in the room is 40.0 years, find the average age of the doctors.

17. A group of students were asked how much money they had spent on a cup of coffee. The responses have been summarized in the table below.

Cost of Coffee	$4.50	$5.86	$6.89	$7.91
# of Students	10	15	8	2

a. Find the mean amount of money spent on a cup of coffee among those students.
b. Find the median amount of money spent on a cup of coffee among those students.
c. Find the mode amount of money spent on a cup of coffee among those students.