

Yellow Version

Math 160 Test 1

Name: Key

1. (2 points) Determine whether the given value is a statistic or a parameter. All the employees of Burger World are asked their age. The average age is found to be 34 years old.

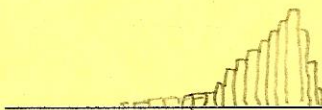
1. Parameter

2. (2 points) A Gallup poll asked Americans, "Which subject (Math, English, History,...), if any, has been the most valuable in your life?" What kind of variable did the Gallup organization measure?

2. Categorical

3. (2 points) Sketch a histogram below for which the median would be **greater** than the mean.

3. Skewed left



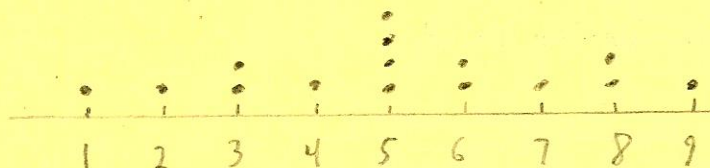
4. (3 points) List the original data from the stemplot in an ordered list sorted in a descending fashion.

Stem	Leaves
2	2 4
3	6 8 9 9
4	1 4 8
5	1 3

53, 51, 48, 44, 41, 39, 39, 38, 36, 24, 22

5. (3 points) **Construct the dotplot for the given data.** Attendance records for a preschool class with 15 students show the number of days each student was absent during the year. The days absent for each student were as follows.

3 5 9 5 5 6 2 1 8 4 3 5 6 7 8



Key

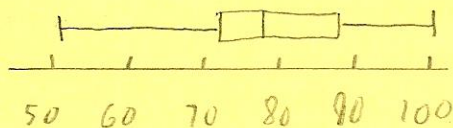
6. (3 points) *Use the data to create a stemplot.* The midterm test scores for the university's seventh-period graduate chemistry class are listed below.

92 73 82 95 77 84 65 67 78 88 56 75 86 72 92 79

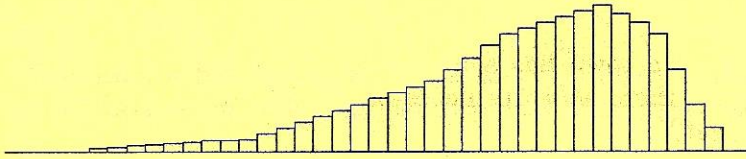
Stem	leaf
5	6
6	5 7
7	2 3 5 7 8 9
8	2 4 6 8
9	2 2 5

Use the data from question 6 to answer questions 7–13.

7. (1 point) What is the range? $95 - 56 = 39$ 7. 39
8. (1 point) What is the value of the median? 8. 78.5
9. (1 point) What is the value of quartile 1? 9. 72.5
10. (1 point) What is the value of quartile 3? 10. 87
11. (2 points) What two values provide the lower and upper fences for the data?
 $Q1 - 1.5(Q3 - Q1) = 72.5 - 1.5(14.5) = 50.75$ 11. _____
 $Q3 + 1.5(Q3 - Q1) = 87 + 1.5(14.5) = 108.75$
12. (1 point) Are there any outliers? Explain your reasoning to obtain full credit.
There are no outliers since all data values are between the fences.
13. (2 points) Construct a boxplot for the data.



Key



14. (1 point) Is the distribution in the histogram above skewed left, skewed right, or is normal?

14. Skewed left

15. (2 points) Andrew asked five of his friends how many cousins they had. The results are listed below. Find the mean number of cousins. Your answer should include writing down which formula you are using.

$$\bar{y} = \frac{\sum y}{n} = \frac{4+7+11+16+2}{5} = \frac{40}{5} = 8$$

15. 8

16. (1 point) What formula should be used to calculate the standard deviation?

$$s_x = \sqrt{\frac{\sum (y-\bar{y})^2}{n-1}}$$

16. _____

17. (2 points) What is the value of the standard deviation?

y	y - \bar{y}	(y - \bar{y}) ²
4	4 - 8	16
7	7 - 8	1
11	11 - 8	9
16	16 - 8	64
2	2 - 8	36

Then, $\sum (y-\bar{y})^2$

$$= 16 + 1 + 9 + 64 + 36 = 126$$

and $s_x = \sqrt{\frac{\sum (y-\bar{y})^2}{n-1}} = \sqrt{\frac{126}{4}} = 5.6$

17. 5.6

A survey of autos parked in student and staff lots at the college classified the brands by country of origin. The results from the survey are given in the table (right). Use these results to answer questions 18 - 20.

Origin	Driver	
	Student	Staff
American	120	117
European	12	33
Asian	85	95

18. (2 points) What percent of all the cars surveyed were American?

$$\frac{120+117}{462}$$

18. 51%

19. (2 points) What percent of Asian cars were owned by staff?

$$\frac{95}{85+95}$$

19. 53%

20. (2 points) What percent of the students owned Asian cars?

$$\frac{85}{120+12+85}$$

20. 39%

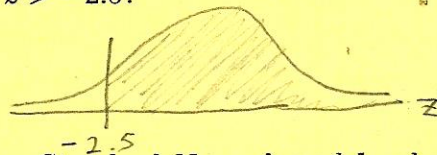
$$217 + 245 = 462$$

21. (2 points) The annual rainfall in a town has a mean of 13 inches and a standard deviation of 3 inches. Last year there were 10 inches of rain. How many standard deviations from the mean is that?

Given $y = 10$
 $\mu = 13, \sigma = 3$

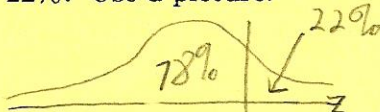
$$z = \frac{y - \mu}{\sigma} = \frac{10 - 13}{3} = -1$$

22. (2 points) What percent of a Standard Normal model is found in the region $z > -2.5$?



normalcdf(-2.5, 10) = 0.9938

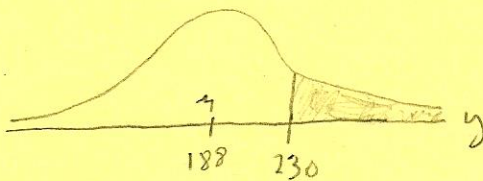
23. (2 points) In a Standard Normal model, what value(s) of z cut(s) off the highest 22%? Use a picture.



$$z = \text{invnorm}(0.78) = 0.77$$

24. Assume the cholesterol levels of adult American women can be described by a Normal model with a mean of 188 mg/dL and a standard deviation of 24 mg/dL.

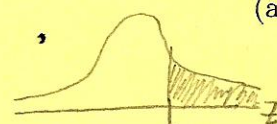
- (a) (2 points) What percent of adult women do you expect to have cholesterol levels over 230 mg/dL?



Transform to the Standard normal model

normalcdf

$$z = \frac{y - \mu}{\sigma} = \frac{230 - 188}{24} = 1.75$$

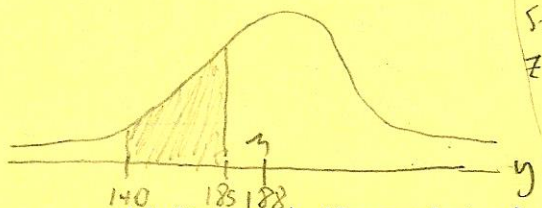


(a) 4%

$$z > 1.75$$

$$\text{normalcdf}(1.75, 10) = 0.0401$$

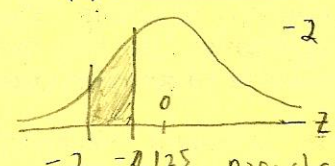
- (b) (2 points) What percent of adult women do you expect to have cholesterol levels between 140 and 185 mg/dL?



transform to the standard normal model

$$z = \frac{140 - 188}{24} = -2$$

$$z = \frac{185 - 188}{24} = -0.125$$

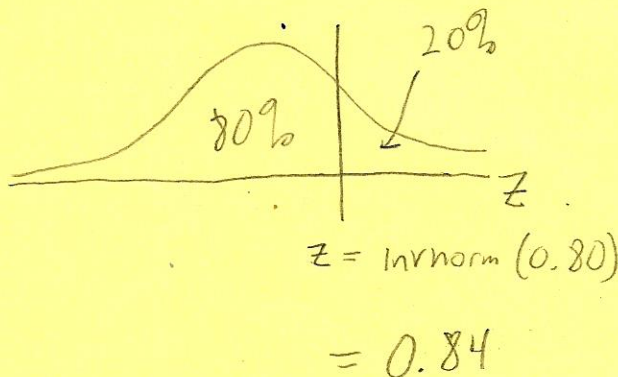


(b) 43%

$$-2 < z < -0.125$$

$$\text{normalcdf}(-2, -0.125) = 0.4275$$

- (c) (2 points) Above what value are the highest 20% of woman's cholesterol levels?



Then $z = \frac{y - \mu}{\sigma}$ is equivalent to

$$0.84 = \frac{y - 188}{24}, \text{ or}$$

$$(24)(0.84) = y - 188, \text{ or}$$

$$y = (24)(0.84) + 188 = 208.16 \text{ mg/dL}$$

(c) 208 mg/dL

Key

Math 160 Test 1

Name: Key

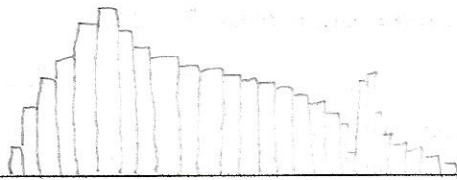
1. (2 points) Determine whether the given value is a statistic or a parameter. Some of the employees of Burger World are asked their age. Their average age is found to be 34 years old.

1. Statistic

2. (2 points) A Gallup poll asked Americans, "Which subject (Math, English, History,...), if any, has been the most valuable in your life?" What kind of variable did the Gallop organization measure?

2. Categorical

3. (2 points) Sketch a histogram below for which the median would be *less* than the mean.



3. _____

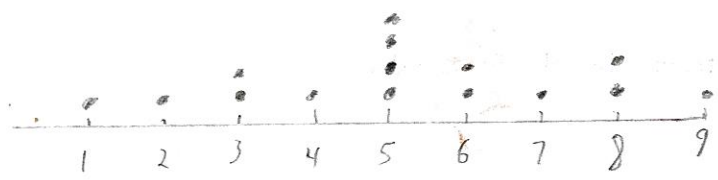
4. (3 points) List the original data from the stemplot in an ordered list sorted in a descending fashion.

Stem	Leaves
2	2 4
3	6 8 9 9
4	1 4 8
5	1 3

53, 51, 48, 44, 41, 39, 39, 38, 36, 24, 22

5. (3 points) **Construct the dotplot for the given data.** Attendance records for a preschool class with 15 students show the number of days each student was absent during the year. The days absent for each student were as follows.

3 5 9 5 5 6 2 1 8 4 3 5 6 7 8



KEY

6. (3 points) **Use the data to create a stemplot.** The midterm test scores for the university's seventh-period graduate chemistry class are listed below.

92 73 82 95 67 84 65 67 78 88 56 75 53 72 | 45 79

45 53 56 65 | 67 67 72 73 | 75 78 79

Q3
82 | 84 88
92 95

Stem	leaf
4	5
5	3 6
6	5 7 7
7	2 3 5 8 9
8	2 4 8
9	2 5

Q1 Q2

Use the data from question 6 to answer questions 7–13.

7. (1 point) What is the range?

$95 - 45 = 50$

7. 50

8. (1 point) What is the value of the median?

8. 74

9. (1 point) What is the value of quartile 1?

9. 66

10. (1 point) What is the value of quartile 3?

10. 83

11. (2 points) What two values provide the lower and upper fences for the data?

$Q1 - 1.5(Q3 - Q1) = 66 - 1.5(17) = 40.5$

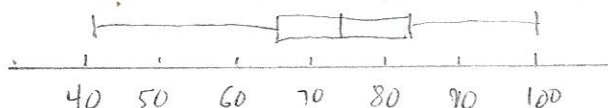
$Q3 + 1.5(Q3 - Q1) = 83 + 1.5(17) = 108.5$

11. _____

12. (1 point) Are there any outliers? Explain your reasoning to obtain full credit.

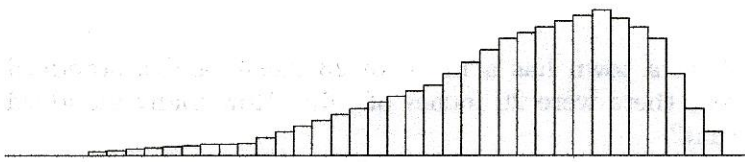
No, since there are no data values above/below the upper/lower fences.

13. (2 points) Construct a boxplot for the data.



The distribution is skewed left, but the middle 50% is nearly symmetric

Key



14. (1 point) Is the distribution in the histogram above skewed left, skewed right, or is normal?

14. Skewed left

15. (2 points) Andrew asked five of his friends how many cousins they had. The results are listed below. Find the mean number of cousins. Your answer should include writing down which formula you are using.

$$\bar{y} = \frac{\sum y}{n} = \frac{4+7+12+18+9}{5}$$

15. 10

16. (1 point) What formula should be used to calculate the standard deviation?

$$s_x = \sqrt{\frac{\sum (y - \bar{y})^2}{n-1}}$$

16. _____

17. (2 points) What is the value of the standard deviation?

y	(y - \bar{y})	(y - \bar{y}) ²
4	4 - 10	36
7	7 - 10	9
12	12 - 10	4
18	18 - 10	64
9	9 - 10	1

Then,

$$\sum (y - \bar{y})^2 = 36 + 9 + 4 + 64 + 1 = 114$$

and

$$s_x = \sqrt{\frac{\sum (y - \bar{y})^2}{n-1}} = \sqrt{\frac{114}{4}} \approx 5.3$$

17. 5.3

A survey of autos parked in student and staff lots at the college classified the brands by country of origin. The results from the survey are given in the table (right). Use these results to answer questions 18 - 20.

	Driver	
Origin	Student	Staff
American	120	117
European	12	33
Asian	85	95

18. (2 points) What percent of all the cars surveyed were Asian?

$$\frac{85+95}{462}$$

18. 39%

19. (2 points) What percent of American cars were owned by students?

$$\frac{120}{120+117}$$

19. 51%

20. (2 points) What percent of the students owned American cars?

$$\frac{120}{120+12+85}$$

20. 55%

Key

21. (2 points) The annual rainfall in a town has a mean of 23 inches and a standard deviation of 3 inches. Last year there were 20 inches of rain. How many standard deviations from the mean is that?

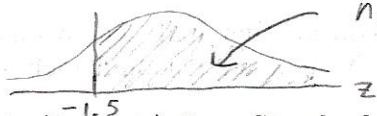
Given: $y = 20$

$\mu = 23, \sigma = 3$

$$Z = \frac{y - \mu}{\sigma} = \frac{20 - 23}{3}$$

21. -1

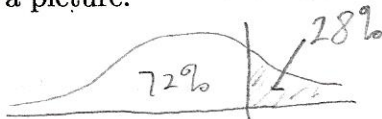
22. (2 points) What percent of a Standard Normal model is found in the region $z > -1.5$?



normalcdf(-1.5, 10) = 0.9332

22. 93%

23. (2 points) In a Standard Normal model, what value(s) of z cut(s) off the highest 28%? Use a picture.

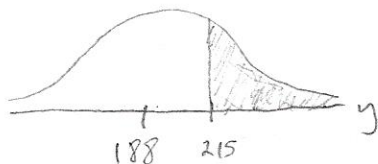


$z = \text{invnorm}(0.72)$

23. 0.58

24. Assume the cholesterol levels of adult American women can be described by a Normal model with a mean of 188 mg/dL and a standard deviation of 24 mg/dL.

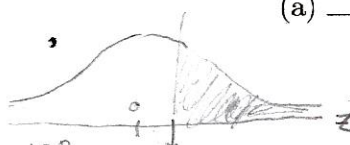
- (a) (2 points) What percent of adult women do you expect to have cholesterol levels over 215 mg/dL?



Transform to Standard



Normal model

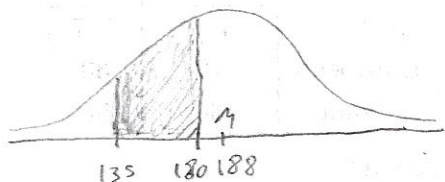


$$Z = \frac{y - \mu}{\sigma} = \frac{215 - 188}{24} = 1.13$$

(a) 13%

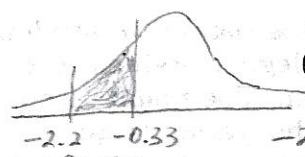
$z > 1.125$
normalcdf(1.125, 10) = 0.1292

- (b) (2 points) What percent of adult women do you expect to have cholesterol levels between 135 and 180 mg/dL?



Transform to Std. Normal Model

$$Z = \frac{135 - 188}{24} = -2.20$$

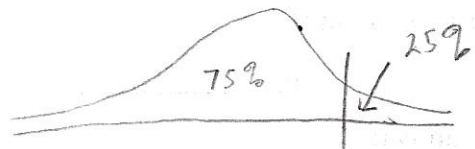


$$Z = \frac{180 - 188}{24} = -0.33$$

(b) 36%

$-2.20 < Z < -0.33$
normalcdf(-2.2, -0.33) = 0.3568

- (c) (2 points) Above what value are the highest 25% of woman's cholesterol levels?



$z = \text{invnorm}(0.75) = 0.67$

Then $Z = \frac{y - \mu}{\sigma}$ is equivalent to

$$0.67 = \frac{y - 188}{24}, \text{ or}$$

$(24)(0.67) = y - 188, \text{ or}$

$y = (24)(0.67) + 188 = \boxed{204 \text{ mg/dL}}$

Key

A
Math 119 Test 2

Name: Key

1. (4 points) Fill in the blanks below.

For each variable, the average is 50 and the standard deviation is 10.

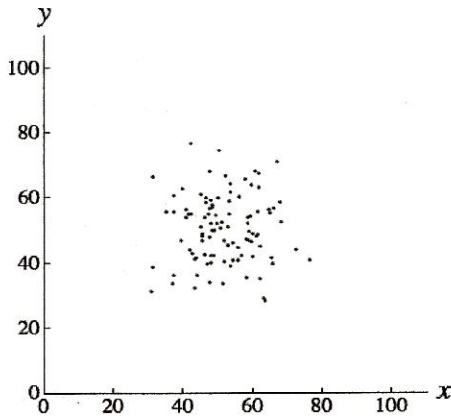
For one of the graphs below, $r = -0.90$.

For one of the graphs below, $r = 0.00$.

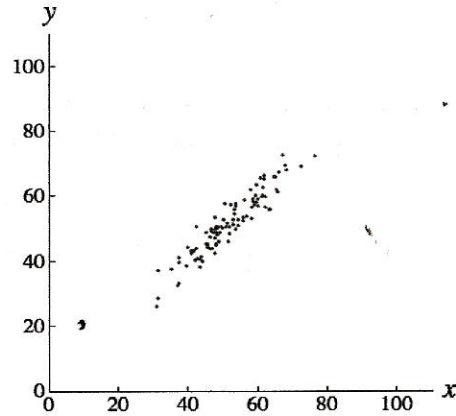
For one of the graphs below, $r = 0.80$.

For one of the graphs below, $r = 0.95$.

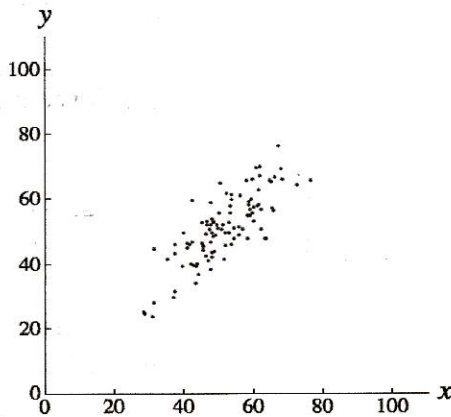
a) r for the graph below is 0



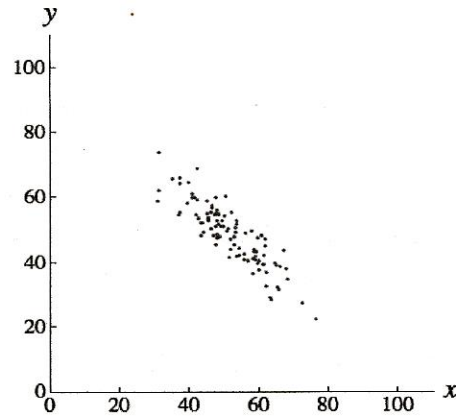
b) r for the graph below is 0.95



c) r for the graph below is 0.80



d) r for the graph below is -0.90



Key A

For questions 2 and 3, describe the error in the stated conclusion. (Worth 1 point each.)

2. **Given:** The linear correlation coefficient for the IQ test scores and head circumferences of test subjects is very close to 0.

Conclusion: IQ scores and head circumferences are not related in any way.

see other key

3. **Given:** There is a linear correlation between annual personal income and years of education.

Conclusion: More education causes a person's income to rise.

see other exam

4. Listed below are sizes (in thousands of square feet) and revenue (in millions of dollars) from casinos in Atlantic City.

Size	160	227	140	144	161	147	141
Revenue	189	157	140	127	123	106	101

- (a) (1 point) Which variable (Size or Revenue) should we take as the response variable?

(a) Revenue

- (b) (1 point) Which variable (Size or Revenue) should we take as the explanatory variable?

(b) Size

- (c) (2 points) Find the correlation, r .

(c) 0.44

- (d) (2 points) What is the regression equation?

(d) $\hat{y} = 0.44x + 63.88$

- (e) (1 point) What is the value of r^2 ?

(e) 0.20 or 20%

- (f) (2 points) Interpret the meaning of r^2 in this context.

20% of the variation in revenues can be explained by the linear relationship between size & revenue

Key

A

5. Identify the type of sample survey.

- (a) (1 point) To determine her blood pressure, Charlotte divides up her day into three parts: morning, afternoon and evening. She then measures her blood pressure at 3 randomly selected times during each part of the day.

(a) Stratified

- (b) (1 point) To estimate the percentage of defects in a box of Krusty-O cereal, a quality control engineer selects every 120th box of Krusty-Os that is produced.

(b) Systematic

- (c) (1 point) To determine customer opinion of their inflight service, LeastWorst Airlines randomly selects 100 flights and surveys all the participants of each flight.

(c) Cluster

- (d) (1 point) A man experienced a tax audit. The tax department claimed that the man was audited because he was randomly selected from all men in his age group.

(d) Stratified

- (e) (1 point) A San Diego television station asks its viewers to call in their opinion regarding the weather programming.

(e) Convenience

- (f) (1 point) Each employee of Nerdstroms Department Store has a 7-digit employee number. The district manager wants to find out how happy the employees who work there are with their jobs. She randomly selects 30 employee numbers and surveys the corresponding employees.

(f) SRS

- (g) (1 point) A teacher wants to find out about the opinions of the class on a certain topic, so she surveys the entire class.

(g) Census

- (h) (1 point) A researcher interviews 19 work colleagues who work in his building.

(h) Convenience

Key A

6. For each pair of variables, indicate what association you expect: positive (+), negative (-) or none (N).

(a) (1 point) The linear relationship between the availability of doctors (measured as $\sqrt{\text{doctors per person}}$) for countries of the world and life expectancy (in years).

(a) +

(b) (1 point) The relationship between car weight and braking distance.

(b) +

7. (2 points) Which of the following statements concerning the linear correlation coefficient are true?

7. B and C

(a) If the linear correlation coefficient for two variables is zero, then there is no relationship between the variables.

(b) If the slope of the regression line is negative, then the linear correlation coefficient is negative.

(c) The value of the linear correlation coefficient always lies between -1 and 1.

(d) A linear correlation coefficient of 0.62 suggests a stronger linear relationship than a linear correlation coefficient of -0.82.

8. (2 points) A set of data consists of the number of years that applicants for foreign service jobs have studied German and the grades that they received on a proficiency test. The following regression equation is obtained: $\hat{y} = 31.6 + 10.9x$ where x represents the number of years of study and y represents the grade on the test. What does the slope of the regression line represent in terms of grade on the test?

9. (1 point) Six pairs of data yield $r = 0.089$ and the regression equation $\hat{y} = 5x + 2$. Also, $\bar{y} = 18.3$. What is the best predicted value of y for $x = 5$?

9. 18.3

10. (1 point) Six pairs of data yield $r = -0.82$ and the regression equation $\hat{y} = 4x - 2$. Also, $\bar{y} = 19$. What is the best predicted value of y for $x = 5$?

10. 18

$$\hat{y} = 4 \cdot 5 - 2 = 20 - 2 = 18$$

Key A

For questions 11, 12 and 13, read each brief report of statistical research, and identify whether it was an observational study or an experiment.

11. (1 point) A marketing firm does a survey to find out how many people regularly eat Krusty-O cereal. Of the one hundred people contacted, fifteen said they use the product.

11. Observational Study

12. (1 point) A clinic gives a drug to a group of ten patients and a placebo to another group of ten patients to find out if the drug has an effect on the patients' illness.

12. Experiment

13. (1 point) A quality control specialist at the Krusty-O factory compares the output from a machine with a new lubricant to the output of machines with the old lubricant.

13. Experiment

For questions 14, 15 and 16, a brief report of from an observational study is given. Identify whether the study was retrospective or prospective.

14. (1 point) A statistical analyst obtains data about ankle injuries by examining a hospital's records from the past 3 years.

14. retrospective

15. (1 point) Researchers collect data by interviewing athletes who have won olympic gold medals from 1992 to 2008.

15. retrospective

16. (1 point) A researcher plans to obtain data by following those in cancer remission since January of 2005.

16. prospective

17. (1 point) On Thursday, our class meets downstairs in room M-101 for another geogebra software lab. Write your name here if you agree to meet there.

17. _____

1. (4 points) Fill in the blanks below.

For each variable, the average is 50 and the standard deviation is 10.

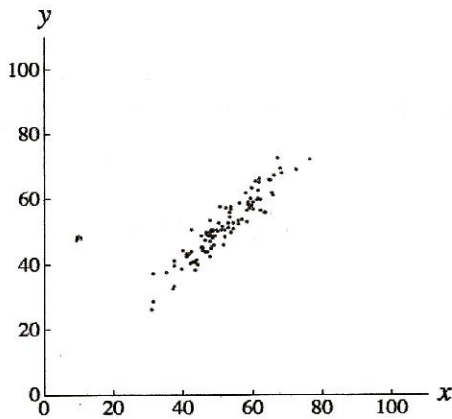
For one of the graphs below, $r = -0.90$.

For one of the graphs below, $r = 0.00$.

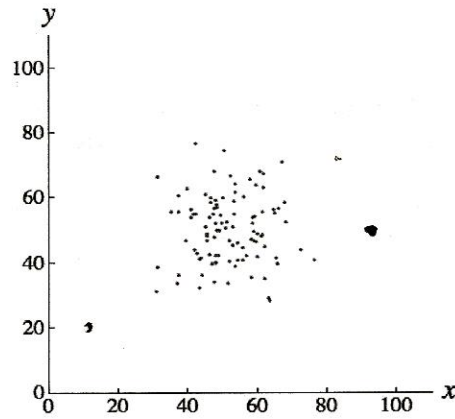
For one of the graphs below, $r = 0.80$.

For one of the graphs below, $r = 0.95$.

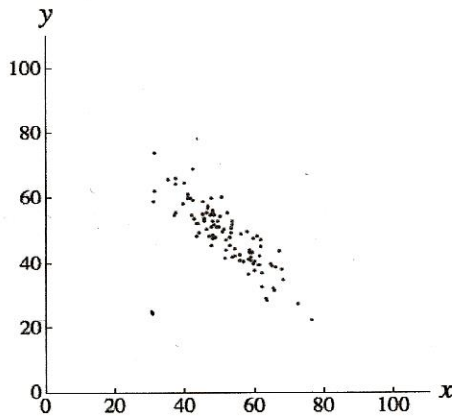
a) r for the graph below is 0.95



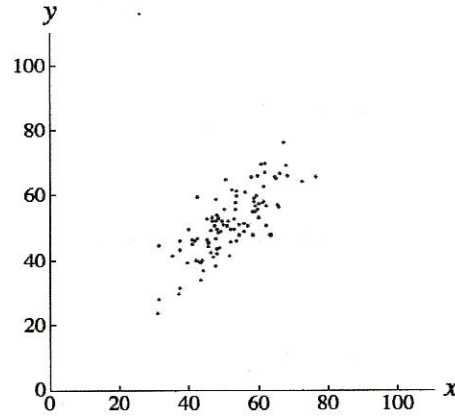
b) r for the graph below is 0



c) r for the graph below is -0.90



d) r for the graph below is 0.80



Key B

For questions 2 and 3, describe the error in the stated conclusion. (Worth 1 point each.)

2. **Given:** There is a linear correlation between annual personal income and years of education.

Conclusion: More education causes a person's income to rise.

The researcher concluded that the correlation implied a causal relation between the two variables.

3. **Given:** The linear correlation coefficient for the IQ test scores and head circumferences of test subjects is very close to 0.

Conclusion: IQ scores and head circumferences are not related in any way.

The researcher assumes that correlation is a measure of the relation between two variables, when in reality, it is a measure of the linear association between two variables. The scatterplot could indicate a curved relationship.

4. Listed below are sizes (in thousands of square feet) and revenue (in millions of dollars) from casinos in Atlantic City.

Size	160	227	140	144	161	147	141
Revenue	189	159	138	126	123	108	101

- (a) (1 point) Which variable (Size or Revenue) should we take as the response variable?

(a) Revenue

- (b) (1 point) Which variable (Size or Revenue) should we take as the explanatory variable?

(b) Size

- (c) (2 points) Find the correlation, r .

(c) 0.4744

- (d) (2 points) What is the regression equation?

(d) $\hat{y} = 0.47x + 59.4$

- (e) (1 point) What is the value of r^2 ?

(e) 0.225 or 23%

- (f) (2 points) Interpret the meaning or r^2 in this context.

23% of the variation in the revenue amounts can be explained by the linear relationship between size and revenue.

Key B

5. Identify the type of sample survey.

- (a) (1 point) A teacher wants to find out about the opinions of the class on a certain topic, so she surveys the entire class.

(a) Census

- (b) (1 point) To determine her blood pressure, Charlotte divides up her day into three parts: morning, afternoon and evening. She then measures her blood pressure at 3 randomly selected times during each part of the day.

(b) Stratified

- (c) (1 point) To estimate the percentage of defects in a box of Krusty-O cereal, a quality control engineer selects every 120th box of Krusty-Os that is produced.

(c) Systematic

- (d) (1 point) A man experienced a tax audit. The tax department claimed that the man was audited because he was randomly selected from all men in his age group.

(d) Stratified

- (e) (1 point) A San Diego television station asks its viewers to call in their opinion regarding the weather programming.

(e) Convenience

- (f) (1 point) Each employee of Nerdstroms Department Store has a 7-digit employee number. The district manager wants to find out how happy the employees who work there are with their jobs. She randomly selects 30 employee numbers and surveys the corresponding employees.

(f) SRS

- (g) (1 point) To determine customer opinion of their inflight service, LeastWorst Airlines randomly selects 100 flights and surveys all the participants of each flight.

(g) Cluster

- (h) (1 point) A researcher interviews 19 work colleagues who work in his building.

(h) Convenience

Key B

6. For each pair of variables, indicate what association you expect: positive (+), negative (-) or none (N).

(a) (1 point) a person's blood alcohol level; time it takes the person to solve a maze.

(a) +

(b) (1 point) The price of a box of Krusty-O cereal; the number of boxes of cereal sold.

(b) -

7. (2 points) Which of the following statements concerning the linear correlation coefficient are true?

7. C and D

(a) A linear correlation coefficient of 0.82 suggests a stronger linear relationship than a linear correlation coefficient of -0.82.

(b) If the linear correlation coefficient for two variables is zero, then there is no relationship between the variables.

(c) If the slope of the regression line is negative, then the linear correlation coefficient is negative.

(d) The value of the linear correlation coefficient always lies between -1 and 1.

8. (2 points) A set of data consists of the number of years that applicants for foreign service jobs have studied Spanish and the grades that they received on a proficiency test. The following regression equation is obtained: $\hat{y} = 31.6 + 10.9x$ where x represents the number of years of study and y represents the grade on the test. What does the slope of the regression line represent in terms of grade on the test?

For every increase in x (the number of years spent studying Spanish) there is an increase in test scores by 10.9.

9. (1 point) Six pairs of data yield $r = 0.89$ and the regression equation $\hat{y} = 5x + 2$. Also, $\bar{y} = 18.3$. What is the best predicted value of y for $x = 5$?

9. 27

$$\hat{y} = 5 \cdot 5 + 2 = 25 + 2 = 27$$

10. (1 point) Six pairs of data yield $r = -0.082$ and the regression equation $\hat{y} = 4x - 2$. Also, $\bar{y} = 19$. What is the best predicted value of y for $x = 5$?

10. 19

B

For questions 11, 12 and 13, read each brief report of statistical research, and identify whether it was an observational study or an experiment.

11. (1 point) A quality control specialist at the Krusty-O factory compares the output from a machine with a new lubricant to the output of machines with the old lubricant.

11. Experiment

12. (1 point) A clinic gives a drug to a group of ten patients and a placebo to another group of ten patients to find out if the drug has an effect on the patients' illness.

12. Experiment

13. (1 point) A marketing firm does a survey to find out how many people regularly eat Krusty-O cereal. Of the one hundred people contacted, fifteen said they use the product.

13. Observational Study

For questions 14, 15 and 16, a brief report of from an observational study is given. Identify whether the study was retrospective or perspective.

14. (1 point) A researcher obtains data about heart surgeries by examining a hospital's records from the past 3 years.

14. retrospective

15. (1 point) A statistical analyst collects data by interviewing athletes who have won olympic gold medals from 1992 to 2008.

15. retrospective

16. (1 point) A researcher plans to obtain data by following those in cancer remission since January of 2012.

16. perspective

17. (1 point) On Thursday, our class meets downstairs in room M-101 for another geogebra software lab. Write your name here if you agree to meet there.

17. Derp

Key

Key

Round all probabilities to four decimal places. Round z-scores to two decimal places. There are two versions of this exam.

1. A candy dish contains ⁴four red candies, ⁷seven yellow candies and four-¹⁴teen blue candies. You close your eyes, choose two candies one at a time (without replacement) from the dish, and record their colors.

(a) (2 points) Find the probability that both candies are red.

$\frac{4}{25} \cdot \frac{3}{24} = \frac{4}{25} \cdot \frac{1}{8} = \frac{1}{50}$ (a) 0.02

(b) (2 points) Find the probability that the first candy is red and the second candy is blue.

$\frac{4}{25} \cdot \frac{14}{24} = \frac{7}{75}$ (b) 0.0933

2. Suppose that $P(A) = 0.2$ and $P(B) = 0.3$. If events A and B are independent, find these probabilities:

(a) (2 points) $P(A \text{ and } B) = P(A) \cdot P(B)$ (a) 0.06

(b) (2 points) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ (b) 0.44
 $= 0.3 + 0.2 - 0.06$

3. (2 points) Toss a single, six-sided die three times. Find the probability that all three rolls are fives.

3. 0.00463

$(\frac{1}{6})^3$

SF
SD
HC
9B
13A

Key

4. The human resources division at the Krusty-O cereal factory reports a breakdown of employees by job type and sex, summarized in the table below.

Job Type	Sex		total
	Male	Female	
Management	7	6	13
Supervision	8	12	20
Production	45	72	117
	60	90	150

One of these workers is randomly selected.

- (a) (2 points) Find the probability that the worker is a female.

$$\frac{90}{150}$$

(a) $\boxed{0.60}$

- (b) (2 points) Find the probability that the worker is a female or a supervisor.

$$P(F \text{ or } S) = P(F) + P(S) - P(F \text{ and } S) \quad (b) \quad \boxed{0.6533}$$

$$= \frac{90}{150} + \frac{20}{150} - \frac{12}{150} = \frac{98}{150}$$

- (c) (2 points) Find the probability that the worker is female, given that the person works in production.

$$P(F|P) = \frac{P(F \text{ and } P)}{P(P)} = \frac{\frac{72}{150}}{\frac{117}{150}} = \frac{72}{117} \quad (c) \quad \boxed{0.6154}$$

- (d) (2 points) Find the probability that the worker works in production and is a female.

$$P(P \text{ and } F) = \frac{72}{150} = 0.48$$

(d) $\boxed{0.48}$

Key

5. Voter Support for political term limits is strong in many parts of the U.S. A poll conducted by the Field Institute in California showed support for term limits by a 2-1 margin. The results of this poll of $n = 347$ registered voters are given in the table.

	For (F)	Against (A)	No Opinion (N)	Total
Republican (R)	0.28	0.10	0.02	0.40
Democrat (D)	0.31	0.16	0.03	0.50
Other (O)	0.06	0.04	0.00	0.10
Total	0.65	0.30	0.05	1.00

If one individual is drawn at random from this group of 347 people, calculate the following probabilities:

(a) (2 points) $P(N)$

(a) $\boxed{0.05}$

(b) (2 points) $P(R|N) = \frac{P(R \text{ and } N)}{P(N)} = \frac{0.02}{0.05}$ (b) $\boxed{0.4}$

(c) (2 points) $P(A|D) = \frac{P(A \text{ and } D)}{P(D)} = \frac{0.16}{0.50}$ (c) $\boxed{0.32}$

(d) (2 points) $P(A) =$

(d) $\boxed{0.30}$

(e) (2 points) $P(A \text{ or } O) = P(A) + P(O) - P(A \text{ and } O)$ (e) $\boxed{0.36}$
 $= 0.30 + 0.10 - 0.04$

(f) (2 points) $P(D \text{ and } A) = 0.16$

(f) $\boxed{0.16}$

Key

6. (2 points) You bought a new set of four tires from a manufacturer who just announced a recall because 8% of those tires are defective. What is the probability that at least one of yours is defective?

$$P(\text{at least one}) = 1 - P(\text{none defective}) \quad 6. \boxed{0.2836}$$

$$= 1 - (0.92)^4$$

In the following problem, round off your final answers to three decimal places (or give an exact answer as a decimal). Before you give your final answers, give exact numbers in your calculations OR round them off to at least five significant digits.

7. (5 points) Find the expected value and standard deviation of the following probability model.

X	5	10	15
P(X)	0.412	0.579	0.009

$$\mu = 7.985$$

$$\sigma = 2.543$$

X	P(x)	X · P(x)
5	0.412	2.06
10	0.579	5.79
15	0.009	0.135

$$\mu = \sum x \cdot p(x)$$

$$= 7.985$$

x	P(x)	(x - μ) ²	(x - μ) ² · P(x)
5	0.412	8.910225	3.6710127
10	0.579	4.060225	2.350870275
15	0.009	49.210225	0.442892025

$$\sigma^2 = \sum (x - \mu)^2 \cdot p(x)$$

$$= 6.464775$$

key

$$\Rightarrow \sigma = \sqrt{6.464775}$$

Key

8. People with type O-negative blood are said to be "universal donors." About 7% of the U.S. population has this blood type. Suppose that 11 people show up at a blood drive. Find the probability of each outcome described below.

Geometric model

(a) (2 points) The first universal donor is the fourth person chosen.

$X =$ the trial on which the 1st success occurs, (a) $\boxed{0.0563}$
with success defined as "getting a donor who is a universal donor."

$$\text{Find } P(X=4) = (0.93)^3 \cdot (0.07) \doteq 0.0563$$

Binomial model

(b) (2 points) There are some universal donors in the group of 11 people.

$X =$ the number of successes in 11 trials

(b) $\boxed{0.5499}$

$$\text{Find } P(X \geq 1) = 1 - P(X=0)$$

$$= 1 - \binom{11}{0} \cdot (0.07)^0 \cdot (0.93)^{11} = 1 - (0.93)^{11}$$

Geometric model

(c) (2 points) The first universal donor is the third or fourth person chosen.

$$\text{Find } P(X=3 \text{ OR } X=4)$$

(c) $\boxed{0.1168}$

$$= (0.93)^2 \cdot (0.07) + (0.93)^3 \cdot (0.07)$$

Binomial model

(d) (2 points) There are two universal donors in the group.

$$\text{Find } P(X=2) = \binom{11}{2} \cdot (0.07)^2 \cdot (0.93)^9 \quad \text{(d) } \boxed{0.1403}$$

$$= 55 \cdot (0.07)^2 \cdot (0.93)^9$$

$$= \text{binompdf}(11, 0.07, 2)$$

Binomial model

(e) (2 points) There are no more than two universal donors in the group.

$$P(X \leq 2) = P(X \leq 2) \quad \text{(e) } \boxed{0.9630}$$

$$= P(X=0) + P(X=1) + P(X=2)$$

Key

9. Suppose now that 160 people show up to the blood drive.

(a) (2 points) What is the expected number of universal donors?

$$E(x) = n \cdot p = (160)(0.07)$$

(a) 11.2 or 11 donors

$$\sigma = \sqrt{npq} = \sqrt{(11.2)(0.93)} = 3.22738$$

(b) (2 points) Verify that you can use a Normal model to approximate the distribution of the number of universal donors.

$$\left[\begin{array}{l} n \cdot p = 11.2 \geq 10 \\ \text{and} \\ n \cdot q = (160)(0.93) = 148.8 \geq 10 \end{array} \right] \Rightarrow \left[\begin{array}{l} \text{The normal model approximates the} \\ \text{binomial model} \end{array} \right]$$

$$\begin{array}{l} np = 11.2 \\ nq = 148.8 \end{array}$$

(c) (2 points) Using the Normal Model, what's the probability there are at least 20 universal donors?

$$P(X \geq 20) = P\left(Z \geq \frac{20 - 11.2}{3.22738}\right)$$

(c) 0.00317

$$\approx P(Z \geq 2.73) = \text{normalcdf}(2.73, 10)$$

10. (3 points) A cooties insurance policy costs \$50 for this year. If you catch cooties this year, you will receive a check for \$1000. If you do not catch cooties you will receive nothing. There is a 4% chance that you catch cooties this year. If you decide to purchase this policy, what is the expected value of your change in wealth this year?

Outcome	x	P(x)	x · P(x)
cooties	\$950	0.04	\$38
no cooties	-50	0.96	-48

10. \$-10

$$\sum x \cdot p(x) = \$38 + (-\$48) = -\$10$$