PSY 233 Homework Packet

Spring 2007

PSY 233 Formulas

sample mean $\bar{x} = \frac{\sum X}{n}$ population mean $\mu = \frac{\sum X}{N}$

sums of squares $SS = \sum X^2 - \frac{\left(\sum X\right)^2}{n}$

sample variance $s^2 = \frac{\sum \left(X - \bar{X}\right)^2}{n-1}$ population variance $\sigma^2 = \frac{\sum \left(X - \mu\right)^2}{\mathrm{N}}$

-OR-

$s^2 = \frac{\sum X^2 - \frac{\left(\sum X\right)^2}{n}}{n-1}$ $\sigma^2 = \frac{\sum X^2 - \frac{\left(\sum X\right)^2}{N}}{N}$

sample standard deviation $\mathrm{s} = \sqrt{\mathrm{s}^2}$ population standard deviation $\sigma = \sqrt{\sigma^2}$

z-score formula $\mathrm{z} = \frac{\mathrm{X} - \mu}{\sigma}$

z-test formula $\mathrm{z} = \frac{\bar{\mathrm{X}} - \mu}{\sigma_{\bar{\mathrm{x}}}}$, where $\sigma_{\bar{\mathrm{x}}} = \frac{\sigma}{\sqrt{\mathrm{n}}}$

single sample t-test formula $\mathrm{t} = \frac{\bar{\mathrm{X}} - \mu}{\mathrm{s}_{\bar{\mathrm{x}}}}$, where $s_{\bar{x}} = \frac{s}{\sqrt{n}}$ $\mathrm{df} = \mathrm{n} - 1$ $CI = \bar{X} \pm t_{crit}(S_{\bar{X}})$

independent measures t-test formulas (equal sample sizes only)

$t = \frac{(\bar{X}_1 - \bar{X}_2)}{s_{\bar{X}_1 - \bar{X}_2}}$ where $\mathrm{s}_{\bar{\mathrm{X}}_1 - \bar{\mathrm{X}}_2} = \sqrt{\frac{\mathrm{s}_1^2}{\mathrm{n}_1} + \frac{\mathrm{s}_2^2}{\mathrm{n}_2}}$ $\mathrm{df} = \mathrm{n}_1 + \mathrm{n}_2 - 2$

-for pooled variances (equal or unequal sample sizes or n's)

$t = \frac{(\bar{X}_1 - \bar{X}_2)}{s_{\bar{X}_1 - \bar{X}_2}}$ where $\mathrm{s}_{\bar{\mathrm{X}}_1 - \bar{\mathrm{X}}_2} = \sqrt{\frac{\mathrm{s}_\mathrm{p}^2}{\mathrm{n}_1} + \frac{\mathrm{s}_\mathrm{p}^2}{\mathrm{n}_2}}$, where $s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$

ANOVA (analysis of variance) formulas

$$SS_{TOT} = \Sigma X_{TOT}^2 - \frac{\left(\Sigma X_{TOT}\right)^2}{N_{TOT}}$$

$$SS_{BETWEEN} = \frac{\left(\sum X_1\right)^2}{n_1} + \frac{\left(\sum X_2\right)^2}{n_2} + \ldots + \frac{\left(\sum X_k\right)^2}{n_k} - \frac{\left(\sum X_{TOT}\right)^2}{N_{TOT}}$$

$$SS_{WITHIN} = \left(\sum X_1^2 - \frac{\left(\sum X_1\right)^2}{n_1}\right) + \left(\sum X_2^2 - \frac{\left(\sum X_2\right)^2}{n_2}\right) + \ldots + \left(\sum X_k^2 - \frac{\left(\sum X_k\right)^2}{n_k}\right)$$

$$df_{tot} = N - 1 \qquad df_{Between} = K - 1 \qquad df_{within} = N - K$$

$$MS_{Beteween} = \frac{SS_{Between}}{df_{Between}} \quad MS_{WITHIN} = \frac{SS_{Within}}{df_{Within}} \qquad F = \frac{MS_{Between}}{MS_{Within}}$$

$$\eta^2 = \frac{SS_{Between}}{SS_{total}} \qquad \omega^2 = \frac{SS_{Between} - (k-1)MS_{Within}}{SS_{total} + MS_{Within}}$$

$$HSD = q_{\alpha}\sqrt{\frac{MS_{Within}}{n}}$$

correlation formulas

$df = n - 2$

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{n}}{\sqrt{\left[\sum X^2 - \frac{\left(\sum X\right)^2}{n}\right]\left[\sum Y^2 - \frac{\left(\sum Y\right)^2}{n}\right]}}$$

-OR-

$$r = \frac{SP_{XY}}{\sqrt{SS_X SS_Y}} \text{ where } SP_{xy} = \Sigma XY - \frac{\Sigma X \Sigma Y}{n}$$

regression formulas

$\hat{Y} = bX + a$

$$b = \frac{\sum XY - \frac{\sum X \sum Y}{n}}{\sum X^2 - \frac{\left(\sum X\right)^2}{n}} \quad \text{-OR-} \quad b = \frac{SP_{XY}}{SS_X}$$

$$a = \frac{\sum Y - b\sum X}{n} \quad \text{-OR-} \quad a = \overline{Y} - b\overline{X}$$

$$s_{Y-\hat{Y}} = s_Y\sqrt{\left(1 - r^2\right)\frac{n-1}{n-2}} \quad = \sqrt{\frac{\sum\left(Y - \hat{Y}\right)^2}{n-2}}$$

goodness of fit chi-square formulas

$$\chi^2 = \sum \frac{\left(f_o - f_e\right)^2}{f_e} \quad df = C - 1$$

Test of independence chi-square formulas

$$f_e = \frac{f_c f_r}{n} \quad \chi^2 = \sum \frac{\left(f_o - f_e\right)^2}{f_e} \quad df = (R - 1)(C - 1)$$

Exam 1

Exam 1 will cover chapters 1-3 in the text, and Lesson 1-4 online.

In Chapter 2 we will not be covering frequency distribution polygons on pages 38-39 of your text.

Worksheet Chapters 1 and 2

1. The relation between a sample and a statistic is the same as the relation between
   a. a population and a parameter
   b. a dependent variable and an independent variable
   c. descriptive statistics and inferential statistics
   d. measurement data and categorical data

2. Which scale of measurement are the following examples (nominal, ordinal, interval, or ratio)? Select the best answer.

   2A. numbers used to identify political affiliation: republican, democrat, independent _____

   2B. freshman, sophomore, junior, senior, graduate, faculty member

   _____

   2C. social security number (hint: the number is just a label).

   _____

   2D. amount of time it takes a pain reliever to work _____

   2E. length or width of a room _____

3. Are the following examples discrete or continuous variables?

   Amount of verbal material learned in 30 minutes _____

   Number of children in a family _____

4. A recent report concludes that participants on an exercise regimen of running two miles each day had a lower percentage of body fat than participants on no exercise program.

   4A. What is the independent variable?_____

   4B. What is the dependent variable? _____

5. A study is conducted to determine whether listening to different types of music impairs memory. Participants are given 10 minutes to memorize as many words as they can. During this 10 minute period, one group listens to hard rock, a second group listens to classical music, and a third group listens to no music at all. Each group is then given a list of 50 words to memorize. They are then given a blank piece of paper and told to write down as many words as they can remember.

5A. What is the independent variable? _____

5B. What is the dependent variable? _____

5C. Is the independent variable discrete or continuous? _____

6. A study was conducted to determine whether physically fit persons sleep more hours than those who are not physically fit. Two groups of people were selected. One group consisted of people who work out at least 3 times a week. The other group consisted of people that do not work out at all. For one week, subjects slept in a sleep lab and an experimenter recorded the number of hours each person slept.

6A. What is the independent variable? _____

6B. What is the dependent variable? _____

6C. Is the dependent variable discrete or continuous? _____

6D. Is the data collected measurement data or categorical data? _____

6E. What scale of measurement is the data (nominal, ordinal, interval, or ratio)?

_____

7. Use the following data set for 7A through 7G:

X	Y
3	-2
4	6
5	7
2	1

7A. ΣX_____

7B. $\Sigma Y + 2$_____

7C. ΣXY_____

7D. ΣX^2_____

7E. $(\Sigma Y)^2$_____

7F. $(\Sigma X)(\Sigma Y)$_____

7G. $\Sigma (X-Y)$_____

8. Draw a positively skewed distribution.

9. Twenty FSU students were asked, "How many phone calls did you receive last night?" The numbers below are their answers.

10	7	4	6	5	2	3	0	1	11
7	6	4	4	5	3	2	2	0	3

Complete the grouped frequency distribution.

Interval	Real Limits	Mid-point	Fre-quency	Cumulative Frequency	Relative Percentage	Cumulative Percentage
0-1						
2-3						
4-5						
6-7						
8-9						
10-11						

10. What percentage of FSU students received between 2 and 3 phone calls? _____

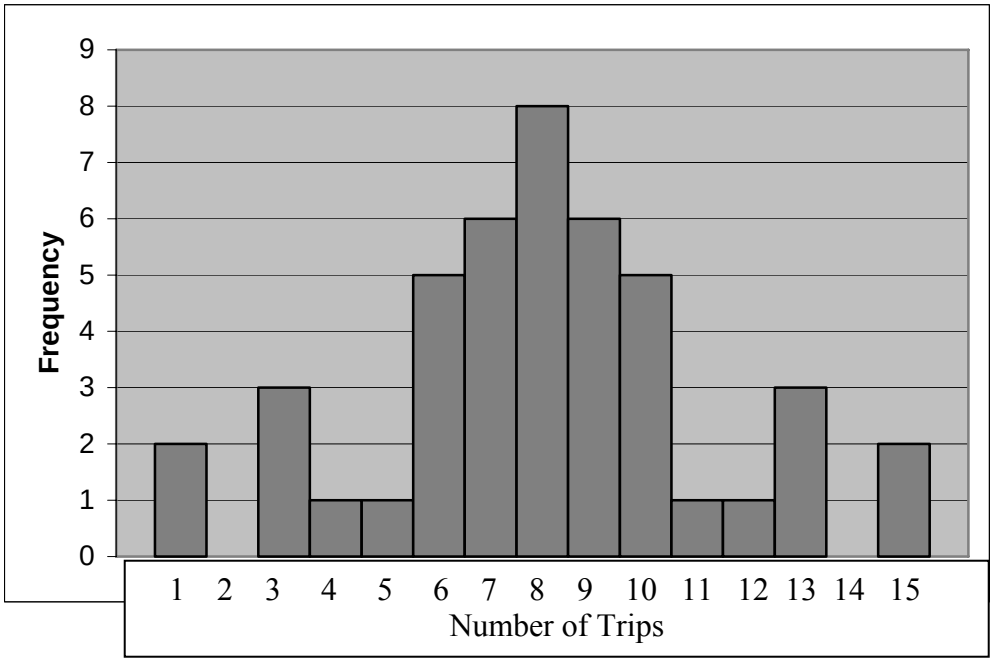
11. How many people received less than 9 phone calls? _____

12. What score falls at the 70th percentile? Interpret.

13. What percentile is associated with a score of 3.5? Interpret.

Worksheet Chapters 2 and 3

1. A sample of 44 drivers in South Carolina reported the number of trips they took outside the county of where they lived. The data is reproduced below.



1A. Compute the mean of the distribution.

1B. Compute the median of the distribution

1C. Compute the mode of the distribution

2. A retailer created a grouped frequency distribution for the number of weeks individuals spent paying for lay-away items. The data are reproduced below:

Real Limits	*f*
2.5-6.5	5
6.5-10.5	1
10.5-14.5	5
14.5-18.5	5
18.5-22.5	0
22.5-26.5	3
26.5-30.5	5
30.5-34.5	1
34.5-38.5	5

Create a histogram for the above data

3. A distribution of scores has a mean = 30, Median = 20, and a Mode = 10. The distribution:

a. has a positive skew
b. has a negative skew
c. is normal
d. is bimodal

4. Use the following distribution to answer the next three questions

Score	*f*
5	1
6	0
7	0
8	0
9	4
10	6
11	7
12	7

4A. The above distribution:

a. has a positive skew
b. has a negative skew
c. is normal
d. is bimodal

4B. The mode for the above distribution is:

a. 7
b. 0 and 7
c. 11 and 12
d. 6, 7, and 8

4C. Which of the following numbers would be considered an outlier in the above distribution?

a. 0 b. 1
c. 5 d. 7

5. The median is equivalent to:

a. the 25th percentile
b. the 50th percentile
c. the 75th percentile
d. none of the above

6. The only measure of central tendency we are certain to actually observe as a value in our data set is:

a. the mean
b. the median
c. the mode
d. all measure of central tendency must be actual values in the distribution

Worksheet: Chapters 3

1. A sample of twenty FSU students were randomly selected and asked, "How many phone calls did you receive last night?" The numbers below are their responses.

0	1	2	0	2	4	2	3	4	5	3
4	5	6	3	10	7	6	7	11		

1A. What is the mode? _____

1B. What is the median? _____

1C. What is the mean? _____

2. A survey asks whether participants think O. J. Simpson is innocent or guilty. Which would be the best measure of central tendency to describe this data set?

a. the mean
b. the median
c. the mode

3. Which is the most commonly used measure of central tendency?

a. the mean
b. the median
c. the mode

4. A survey asked Ohio University students which pizza place they preferred. The results are as follows.

Pizza Place	Frequency
Late Night Pizza	5
Papa John's	6
Pizza Hut	3
Little Caesers	5

4A. What is the best measure of central tendency for this data?

a. the mean b. the median c. the mode

4B. Find the mode of this distribution.

4C. Which pizza place is most popular among the students surveyed?

5. How does it affect the mean when you add a constant to every score? That is, if an instructor adds 5 points to everyone's test score, how will the mean change?

a. the new mean and the old mean will be the same
b. the new mean will be 5 points higher than the old mean
c. the new mean will be 5 points less than the old mean
d. not enough information to answer this question

6. There are five brothers. Their mean income is $200 per week, and their median income is $170 per week. Bruce, the lowest paid, gets fired from his $100 a week job and now has an income of $0 per week.

What is the median weekly income of the five brothers after Bruce lost his job?

Two samples are as follows

Sample A:	7	9	10	8	9	12
Sample B:	13	5	9	1	17	9

7. What is the mode for sample A?_____

8. What is the mean for sample B?_____

9. What is the range for sample A? _____

10.What is the median for sample B? _____

11 If a distribution has a positive skew, which of the following is true... (circle one)

a. the median, the mean, and the mode will all be the same
b. the median will greater than the mode
c. the median will be less than the mode

12 A geography exam was given to samples of high school seniors and college students. The lowest possible score on the exam is 0 and the highest possible score is 75. The data showing the test scores is below:

high school seniors

Sample A:	28	30	33	35	40	40	45	50	50	55

college students

Sample B:	35	38	40	40	40	40	40	41	42	45

12A. What is the mean for Sample A? _____

12B. What is the mean for Sample B? _____

12C. Based on the two means, does it appear that one group is more accurate than the other?

_____

Exam 1: Sample Test

Multiple Choice (2 points each)

A researcher wants to measure the number of pounds of tin the population recycles on average every year. He randomly samples data from 100 recycling plants around the country. Since the researcher knows 70% of the recycling plants are in urban areas, 70% of the sample was specifically taken from urban areas.

1. What type of scale would be used to measure the tin?
    a. nominal
    b. ordinal
    c. interval
    d. ratio

2. The scale used to measure the tin is:
    a. continuous
    b. discreet
    c. qualitative
    d. parabolic

In order to determine whether a new gene therapy will benefit colon cancer patients, a random sample of patients is given either the new gene therapy, conventional therapy, or a placebo. The number of months of survival was measured to determine therapy success.

3. The independent variable was:
    a. the type of therapy
    b. the number of months survival
    c. gene therapy
    d. colon cancer

4. The dependent variable was:
    a. the type of therapy
    b. the number of months survival
    c. gene therapy
    d. colon cancer

5. When constructing histograms from a grouped frequency distribution, what should be used to denote the points on the scale of measure?
    a. apparent limits
    b. real limits
    c. upper real limits
    d. mid-point

6. Not everything naturally follows a normal distribution, such as salaries in the U.S. The distribution of salaries in the U.S. is:

a. negatively skewed because poor people represent outliers who earn significantly less than everyone else

b. positively skewed because poor people represent outliers who earn significantly less than everyone else

c. negatively skewed because rich people represent outliers who earn significantly more than everyone else

d. positively skewed because rich people represent outliers who earn significantly more than everyone else

7. Measuring the number of times an individual eats during the day is an example of a _____ variable.

a. nominal
b. qualitative
c. continuous
d. discreet

8. Which of the following is <u>not</u> a discrete variable?

a. number of bars a shuffle group visited
b. number of tables available
c. amount of time they stayed in a bar
d. number of people who passed out

9. In a positively skewed distribution, Alice scored the mean, Betty scored the median, and Claire scored the mode. Who had the highest score?

a. Alice
b. Betty
c. Claire
d. They all scored approximately the same

10. What scale of measurement is used if you know that one variable is larger than another, but you do not know how much larger?

a. nominal
b. ordinal
c. interval
d. ratio

11. If the 40th percentile on an examination is 75.5, then

a. 40% of the people got a score of 75.5
b. less than 40% of the people got a score higher than 75.5
c. 40% of the people got a score of 75.5 or less
d. 60% of the people got a score lower than 75.5

12. The value of one score in a distribution is changed form X = 20 to X = 30. Which measure(s) of central tendency is/are certain to be changed?

a. the mean
b. the median
c. the mean and the median
d. the mode

13. The concept of generalizing from a few observations to an entire group is central to the area of:

a. descriptive statistics
b. nominal scaling
c. ratio scaling
d. inferential statistics

14. When a distribution has two separate and distinct medians, then

a. it is positively skewed
b. it is negatively skewed
c. it is bimodal
d. a distribution can never have more than one median

15. An example of a quantitative variable is:

a. religious affiliation
b. number of children in a family
c. being a registered voter
d. college major

16. Students voted for their preferred professors by ranking them. This is an example of measurement on a _____ scale.

a. nominal
b. ordinal
c. interval
d. ratio

Use the following data set for the next three problems: (Show your work!) (1 point each)

X	Y	C=3
-3	-2	
0	1	
-4	1	
1	0	

17. Compute $(\sum XY)$ _____

18. Compute $\sum CX$ _____

19. Compute $\sum(X-Y)$_____

Use the following population data set for the next few problems

5 10 10 12 15 15 18 18 18 20 20 25

20. Compute the mean _____ Show Work! (2 points)

21. Compute the median _____ (1 point)

22. Compute the mode _____ (1 point)

23. A sample of construction workers was asked to report the number of times they experienced back pain on the job in the past month. Twenty workers reported their incidents of back pain every day for a month. The data from these 20 workers are found below:

14	16	6	23	27	4	8	15	17	29
15	22	12	19	3	2	16	0	14	5

With the data above, complete the grouped frequency distribution. (6 points)

Class Intervals Apparent Limits	Real Limits	Midpoint	Frequency	Cum f	Relative Percent	Cum Relative Percent
0-4						
5-9						
10-14						
15-19						
20-24						
25-29						

23A. What percentage of workers experienced back pain 14.5 or fewer times?(1 point)

23B. How many times did the 80^{th} percentile experience back pain? (1 point)

23C. How many workers experienced back pain between 5 and 9 times? (1 point)

23D. What percentile is associated with 14.5 incidents of back pain? (1 point)

23E. Create a frequency histogram of the above data (from the grouped frequency distribution). (2 points)

Exam 2

Exam 2 will cover Chapters 4-6 in the text, and Lesson 5-8.

In chapter 4 we will compute the interquartile range differently than your text pp 79-80.

Also, the online lessons and homework packet contain information about conditional probabilities not covered by your text.

Worksheet Chapter 4

A sample of twenty FSU students were randomly selected and asked, "How many phone calls did you receive last night?" The numbers below are their responses.

0	1	2	0	2	4	2	3	4	5	3
4	5	6	3	10	7	6	7	11		

1A. What is the variance? _____

1B. What is the standard deviation?_____

1C. What is the interquartile range? _____

2. How does it affect the standard deviation when you divide a constant into every score? That is, if an instructor divides everyone's score by two, how will the standard deviation change?

a. the new standard deviation and the old standard deviation will be the same
b. the new standard deviation will be twice as large as the old standard deviation
c. the new standard deviation will half the size (twice as small) as the old standard deviation
d. not enough information to answer this question

. Two samples are as follows

Sample A:	7	9	10	8	9	12
Sample B:	13	5	9	1	17	9

3A. Just by looking at these data, which sample has more variability? _____

3B. What is the standard deviation for sample A? _____

3C. What is the variance for sample B? _____

4. A geography exam was given to samples of high school seniors and college students. The lowest possible score on the exam is 0 and the highest possible score is 75. The data showing the test scores is below:

high school seniors

Sample A:	28	30	33	35	40	40	45	50	50	55

college students

Sample B:	35	38	40	40	40	40	40	41	42	45

4A. Based on the two means, does it appear that one group is more accurate than the other?

_____

4B. What is the standard deviation for Sample A? _____

4C. What is the standard deviation for Sample B? _____

4D. Which group is more consistent (i.e., has less variability)? _____

5. An instructor gives his class a 10-point quiz. The next day he tells his students that the average score on the quiz was $\overline{X}$ = 7.5 with a standard deviation of s = 13.5. It should be obvious that the instructor made a mistake in his calculations. Explain why.

Worksheet Chapter 5 and 6

1. What is the percentage area between a z-score of .43 and a z-score of 1.33?

2. What is the percentage area between a z-score of -1.25 and a z-score of .36?

3. In a normal distribution of test scores with a mean equal to 57 and a standard deviation equal to 6.5, what is the percentile rank is associated with a score of 65?

4. The scores on a personality test are normally distributed with $\mu = 250$ and $\sigma = 30$. What percentage of people taking the test can be expected to score between 229 and 325?

The average man in an industrialized country lives $\mu = 70$ and $\sigma = 6.3$. Use this information to answer problems 5-8.

5. What percentage of men live 75 years or longer? _____

6. What percentage of men live between 65 and 75 years? _____

7. What percentage of men live 65 years or less? _____

8. What percentage of men live between 55 and 60 years?_____

9. 95% of the men will live between the ages of _____ and _____ years (i.e. find the raw values that mark the middle 95% of the distribution of ages)

10. In a distribution of scores with a mean of 1500 and a standard deviation of 250, what raw score corresponds with the 67th percentile?

Questions 11 - 13 refer to a distribution with $\mu = 60$ and $\sigma = 4.3$

11. The raw score corresponding to a z-score of 0.00 is _____.

12. The raw score corresponding to a z-score of -1.51 is _____.

13. The z-score corresponding to a raw score of 68.7 is _____.

14. Men in third-world countries have a life expectancy of $\mu = 60$ and $\sigma = 4.3$. Men in industrialized countries have a life expectancy of $\mu = 70$ and $\sigma = 6.3$. If a man in a third-world country lives to be 65 and a man in an industrialized country lives 72, who lived longer relative to their age distribution?

In a distribution with a mean of 50 and a standard deviation of 5:

15. What raw score corresponds with the 14th percentile?

16. What z-score cuts off the top 10% of this (or any) distribution?

17. What raw score cuts off the top 10% of this distribution?

18. What raw scores mark the middle 60% of this distribution?

Worksheet: Chapter 6

1. When flipping a coin, heads and tails are mutually exclusive because _____.
    a. if the coin comes up heads, it cannot also come up tails.
    b. if the coin comes up heads on one toss, it has no influence on whether the coin comes up heads or tails on the next toss.
    c. sampling is with replacement
    d. sampling is without replacement

2. Jake is having a party for all of his friends in his apartment complex. He knows they all have very different tastes, so he stocks his refrigerator with a large selection. Jake has 12 bottles of Coors beer, 24 bottles of Molson beer, 24 bottles of Heinekin beer, 8 bottles of wine coolers, and 12 bottles of Coke.

    2A. Billy wants any beer. What is the probability that the first beverage Jake randomly grabs is a beer?

    2B. Allison wants a Coke. Given that the first bottle grabbed was a Coors, what is the probability that the second beverage Jake randomly grabs is a Coke?

3. What is the probability of drawing an ace out of a standard deck of 52 cards?

4. What is the probability of drawing a red card out of a standard deck of 52 cards?

5. What is the probability of drawing a red ace out of a standard deck of 52 cards?

6. What is the probability of drawing three cards out of a standard deck of 52 cards, without replacement, and have all 3 cards turn up red?

7. A letter of the English alphabet is chosen at random. Find the probability that the letter selected...

7A. is a vowel (consider y a consonant)

7B. is any letter which follows p in the alphabet

8. If I flip a coin 5 times which set of heads (H) and tails (T) outcomes is more likely:

a. HHHHH
b. TTTTT
c. HTHTH
d. all are equally likely

9. There are 105 applicants for a job with a new coffee shop. Some of the applicants have worked at coffee shops before and some have not served coffee before. Some of the applicants can work full-time, and some can only work part-time. The exact breakdown of applicants is as follows...

		Coffee Shop Experience (E)	No Coffee Shop Experience (not E)
Available Full-Time	(F)	20	12
Available Part-Time	(not F)	42	31

Find each of the following probabilities.

9A. P(E): The probability someone has coffee shop experience

9B. P(F): The probability someone is available full-time

9C. P(not E): The probability someone has no coffee shop experience

9D. P(E & F): The probability someone has coffee shop experience and is available full-time.

9E. P(F | E): The probability someone is available full-time given that they have coffee shop experience.

9F. P (not F | not E): The probability someone is available part-time given they have no coffee shop experience.

Exam 2: Sample Test

Multiple Choice (2 points each)

1. If an event can occur once out of 20 times, its probability value is
   a. .20
   b. .80
   c. .95
   d. .05

2. Dr. Hipke calculates the standard error for a selected sample to be 2. If the number of subjects for Dr. Hipke's sample was n = 16, what was the standard deviation?
   a. 64
   b. 128
   c. 8
   d. it is impossible to determine from the information provided

3. When the variance is equal to zero...
   a. the standard deviation is equal to 1
   b. the raw scores are negative
   c. all of the raw scores are the same
   d. the variance can never be equal to zero

4. How is the standard deviation affected when you divided a constant into every score? That is, if everyone's score is divided by 2, how will the standard deviation change?
   a. the new standard deviation and the old standard deviation will be the same
   b. the new standard deviation will be twice as large as the old standard deviation
   c. the new standard deviation will be half the size (twice as small) as the old standard deviation
   d. not enough information to answer this question

5. When flipping a coin, heads and tails are independent because _____.
   a. if the coin comes up heads, it cannot also come up tails.
   b. if the coin comes up heads on one toss, it has no influence on whether the coin comes up heads or tails on the next toss.

6. The interquartile range is not the best measure of dispersion because it eliminates 50% of the distribution. The 50% of the distribution that is eliminated is:
   a. the middle 50%
   b. the upper 50%
   c. the lower 50%
   d. the lower 25% and the upper 25%

7. Which of the following is a conditional probability
   a. the probability of being struck by lightning
   b. the probability of it raining
   c. the probability of having being struck by lightning if it is raining
   d. the probability of getting heart disease

8. To calculate the probability of the joint occurrence of two independent events, the probabilities for the separate events occurring
   a. are added together
   b. are first multiplied together, and then subtracted from 1.0
   c. are multiplied together
   d. are subtracted from each other

9. Which of the following is a conditional probability?
   a. the probability that the wind will blow tomorrow
   b. the probability that the wind will blow tomorrow given that it rains
   c. the probability that it will rain or the wind will blow tomorrow
   d. the probability that it will rain and the wind will blow tomorrow

10. If there are only 10 red, 5 green, and 10 yellow M & Ms left in the package, what is the probability of drawing a red M & M (which you eat) and then another red one?
   a. .35
   b. .80
   c. .16
   d. .15

The average score on a test of hand steadiness is 20 **($\mu = 20$).** The standard deviation is 5 **($\sigma=5$).**

11. What proportion of individuals can be expected to score higher than 28?
Show your work! (2 points)

12. What proportion can be expected to score between 19 and 21?
Show your work! (3 points)

13. Use the following population data set to answer the next problem: (Show Work!)
54 29 35 10 28 36 32 45 48 60

Compute the interquartile range _____ (2 points)

14. The mean of the Stanford Binet IQ is 100 with a standard deviation of 16.

A. Mensa is an organization that only allows people to join if their IQs are in the top 2% of the population. What is the lowest Stanford-Binet IQ you could have and still be eligible to join Mensa? **Show your work.**

_____ (3 points)

B. What percentage of the population has a Stanford-Binet IQ score between 84 and 95? **Show your work.**

_____ (3 points)

C. What score falls at the 80th percentile. **Show your work**

_____ (2 points)

D. What is the probability of obtaining an IQ score lower than 80?

_____ (2 points)

Use the following population data set for the next few problems

5 10 10 12 15 15 18 18 18 20 20 25

15. Compute the variance _____ Show Work! (3 points)

16. Compute standard deviation _____ (1 point)

17. A company hired a psychologist to assist their employees in their personal problems. The psychologist met with 50 employees. The psychologist kept 1 file for each person she helped. That is, she had 50 files. Ten people sought out help for drug related problems. Twenty people needed help for family crisis problems. And the remaining twenty people needed help for miscellaneous reasons. The numbers are summarized below.

(3 points each)

Problem	Frequency
Drug	10
Family crisis	20
Other	20

A. If one of the files were selected at random, what is the probability that it would involve a drug case?
Leave your answer in decimal form.

_____

B. If one of the files were selected at random, what is the probability that it would involves a drug case or a family crisis case?
Leave your answer in decimal form.

_____

C. If two of the files were randomly selected one at a time, what is the probability that they would involve a drug case and a family crisis case. (Sampling is one at a time with replacement.)
Leave your answer in decimal form.

_____

D. If two of the files were randomly selected one at a time, what is the probability that they would both involve drug cases. (Sampling is one at a time with replacement.)
Leave your answer in decimal form.

Exam 3

Exam three will cover Chapter 7 and 8 in the text, and Lesson 9-12 online.

Worksheet: Chapter 7 and 8

1. A researcher predicts that someone who exercises regularly should have a different percentage of body fat than people who do not exercise at all. The researcher finds that a person who exercises regularly has a body fat percentage of 13%. Does this percentage differ significantly from the population of people who do not exercise and have a body fat percentage of 20%?

1A. Was this a one-tailed or a two-tailed test?

1B. What was the null hypothesis in words and symbols?

1B. What was the alternative hypothesis in words and symbols?

2. A study is conducted to determine whether a new drug will improve memory. A person taking the new drug is able to recall 35 words from a list of 50 after studying the list for 10 minutes. Do they recall more words than the general population that can recall only 25 words?

2A. Is this a one-tailed or a two-tailed test?

2B. What is the null hypothesis in words and symbols?

2C. What is the alternative hypothesis in words and symbols?

3. The basketball coach likes to recruit tall students. The height of the students are normally distributed. The mean height of the basketball team is 79 inches high with a standard deviation of 1.76 inches. Someone claims to be a member of the team who is 74 inches tall. What is the probability that someone 74 inches or shorter really is on that basketball team?

4. What is the critical value for each of the following?

4A. α=.05, one-tailed test

4B. α =.01, two-tailed test

4C. α =.01, one-tailed test

5. One tail-tests:

a. predict the direction of the effect and are more likely to result in rejection of H_o
b. do not predict the direction of the effect and are more likely to result in rejection of H_o
c. predict the direction of the effect, and are less likely to result in rejection of H_o
d. do not predict the direction of the effect, and are less likely to result in rejection of H_o

6. If we repeatedly sample from a population and form a distribution of sample means it is:

a. a sampling distribution
b. a sampling distribution of the mean
c. the standard error
d. the standard deviation

7. The probability of a Type II error is:

a. β b. $1 - \beta$
c. α d. $1 - \alpha$

8. The larger the standard error:

a. the more variability there is in the set of sample means
b. the less variability there is in the set of sample means
c. standard error does not indicate variability
d. the more variability there is in a population distribution

9. The probability of correctly rejecting the null is:

a. the probability of a Type II error
b. alpha
c. power
d. none of the above

10. What is the probability of committing a Type II error given that the null hypothesis is actually false?

11. What is the probability of committing a Type II error given that the null hypothesis is actually true?

12. Fill in the blanks with correct decision, Type I error, and Type II error. Also include the probability of each cell. Which cell is power?

	True state of the world	
Decision	Null is true	Null is false
Reject null	_____	_____
Fail to reject null	_____	_____

STEP 4: Evaluate the Null Hypothesis (Reject or Fail to reject?)

What is your conclusion?

15. Telling someone that he has a disease when he does not is an example of ...
    a. Type I error
    b. Type II error
    c. Type III error
    d. Type IV error

16. Telling someone to go home and take an aspirin when in fact he needs immediate treatment is an example of ...
    a. Type I error
    b. Type II error
    c. correct decision

17. Convicting an innocent woman of a crime is an example of ...
    a. Type I error
    b. Type II error
    c. correct decision

18. Letting a guilty woman go free is an example of...
    a. Type I error
    b. Type II error
    c. correct decision

Worksheet: Chapter 7 and 8 (Part 2)

1. Patients recovering from an appendix operation normally spend an average of 6.3 days in the hospital. The distribution of recovery times is normal with a σ = 1.2 days. The hospital is trying a new recovery program that is designed to lessen the time patients spend in the hospital. The first 10 appendix patients in this new program were released from the hospital in an average of 5.5 days. On the basis of these data, can the hospital conclude that the new program has a significant reduction of recovery time. Test at the .05 level of significance with a one-tailed test.

STEP 1: State your hypotheses (include both H_0 and H_1).

STEP 2: Set up the criteria for making a decision. That is, find the critical value.

STEP 3: Summarize the data into the appropriate test-statistic.

STEP 4: Evaluate the Null Hypothesis (Reject or Fail to reject?)

What is your conclusion?

2. What is the Central Limit Theorem? Why is it so important?

3. From the central limit theorem, we know which of the following characteristics of the sampling distribution...

A. its shape
B. its mean
C. its standard deviation
D. all of the above

4. In earlier chapters $z = \frac{X - \mu}{\sigma}$. In this chapter the z formula used is $z = \frac{\overline{X} - \mu}{\frac{\sigma}{\sqrt{n}}}$.

What are the differences between the two formulas? Why are the formulas not the same?

5A. From the text, what are some of the factors that affect the likelihood of rejecting H_0?

5B. Which of these factors does the experimenter have control over before he/she collects data?

6. Name the factors that affect the z-score, and subsequently your decision about the null.

Exam 3: Sample Test

1. What is the standard error?
   a. the standard deviation of the sampling distribution of the sample means
   b. Type I error
   c. Type II error
   d. both b and c

2. Professional athletes are now commonly tested for steroid use following competition. It is known that there is some risk of sampling error, but this risk is believed to be minimal. What would constitute a Type II error on the part of the testing agency, if their null hypothesis is that the athlete is drug-free?
   a. an athlete who is using steroids tests negative (drug-free)
   b. an athlete who is using steroids tests positive (not drug-free)
   c. an athlete who is not using steroids tests negative (drug-free)
   d. an athlete who is not using steroids tests positive (not drug-free).

3. A researcher is very worried about making a Type I error. What is the alpha level she should choose to minimize the risk of a Type I error?
   a. $\alpha = .01$
   b. $\alpha = .05$
   c. $\alpha = .025$
   d. α does not have a direct effect on Type I errors

4. A psychology student was getting ready to propose her thesis, but she was very worried about making a Type I error. She asked her advisor what alpha level she should choose to minimize the risk of Type I error. Which of the following gives the least chance of making a Type I error?
   a. .01
   b. .025
   c. .05
   d. Alpha does not have a direct effect on Type I errors.

5. When the null hypothesis is rejected, then
   a. Type II error is committed
   b. a significant difference has been established
   c. the sample means are assumed to be equal
   d. the population means are assumed to be equal

6. According to the Central Limit Theorem, the _____ the size of the samples selected from the population, the _____ likely the sampling distribution of means _____.
   a. fewer; more; will approximate the normal curve
   b. fewer; less; will approximate the standard deviation
   c. larger; less; will approximate the normal curve
   d. None of the above is correct

7. Which of the following would constitute a Type II error?
    a. you test positive for a disease but you really do not have it
    b. you test negative for a disease and you really do not have it
    c. you test positive for a disease and you really do have it
    d. you test negative for a disease but you really do have it

8. A directional test means the same as:
    a. a test of alpha
    b. a two-tailed test
    c. a test of power
    d. a one-tailed test

9. According to your text, sampling error means the same as:
    a. the Central Limit Theorem
    b. the failure to accept the research hypothesis
    c. a biased sample
    d. variability due to chance

10. The research (alternative) hypothesis is:
    a. the hypothesis that states 'no difference, or no relationship is expected'
    b. the hypothesis that states 'the error variability is expected to be less than 1'
    c. the hypothesis that states what the experiment was designed to investigate
    d. the hypothesis that states the number of subjects to be used in the experiment

11. If all other factors are held constant, *decreases* in the sample variance will _____ the value of the t-statistic.
    a. increase
    b. decrease
    c. have no effect on
    d. can't answer: Not enough information

12. What is the critical value for a one tailed-test, $Z_{.05}$, alpha = .05?
    a. 1.96
    b. 1.64
    c. 2.33
    d. 2.58

13. In a large corporation the mean entry level salary is $27,000 with a standard deviation of 6,000. The entry level salaries for a random sample of 15 employees with only high school degrees is $24,100. Do people with only high school degrees earn less than the rest of the company?
13A. Conduct a <u>one-tailed</u> hypothesis test with $\alpha = .05$.

STEP 1 State your hypotheses in both words and symbols. Be sure to clearly label your null and alternative hypotheses. (4 points).
In words:

In symbols:

STEP 2: Find the critical value. (1 point)
STEP 3: Compute the appropriate test-statistic. (4 points)

STEP 4: Evaluate the null hypothesis (based on <u>your</u> answers to the above steps). (1 point)

REJECT or **FAIL TO REJECT** (circle one)

What is the best conclusion, according to <u>your</u> decision in STEP 4? (1 point)

14. Years of population counts have shown African leopards have an average number of spots equal to $\mu = 25$ with a standard deviation of 7 spots. A biologist claims that Snow leopards have a different number of spots than African leopards. He gets a representative sample of 15 Snow leopards. You notice that these leopards have an average of 30 spots. You want to know, with a 95% level of certainty, whether Snow leopards have a different number of spots compared to those from Africa. **Conduct a TWO-TAILED test**

STEP 1 State your hypotheses in both words and symbols. Be sure to clearly label your null and alternative hypotheses. (4 points).
In words:

In symbols:

STEP 2 Find the critical value. (1 point)

STEP 3 Compute the appropriate test-statistic. **Show your work** (4 points)

STEP 4 Evaluate the null hypothesis (based on your answers to this point)

REJECT or **FAIL TO REJECT** (circle one) (1 point)

Exam 4

Exam 4 will cover Chapters 9, 10, and 13 in the text, and Lesson 13-16 online.

The formulas for ANOVA (Chapter 13) will vary slightly from the text. We will not do the Scheffe test on pp 330-332.

Worksheet: Chapter 9

1. Conduct a t-test to see if a sample of 65 participants with a mean of 83 and a standard deviation of 5.4 is significantly greater than a population mean of 80. Set $\alpha = .05$, 1-tail.

2. A psychobiologist hypothesizes that the diastolic blood pressure of Type A persons differs from the average person. In the population, the mean diastolic blood pressure is $\mu = 80$. The psychobiologist takes the blood pressure of 22 Type A men whose ages range from 21 and 29. The sample mean diastolic pressure is $\overline{X} = 93$, with the standard deviation of $S = 18.76$. Using $\alpha = .05$, two-tailed, conduct a t-test.

STEP 1: State your hypotheses (include both H_0 and H_1).Set $\alpha = .05$, two-tailed.

STEP 2: Set up the criteria for making a decision. That is, find the critical value.

STEP 3: Summarize the data into the appropriate test-statistic. That is, compute the t statistic.

STEP 4: Evaluate the Null Hypothesis (Reject or Fail to reject?)

What is your conclusion?

Compute 95% confidence limits on μ. Interpret.

3. A population has $\mu = 100$ and $\sigma = 50$. Find the t-score for each of the following sample means:

a. a sample of n = 25 with $\overline{X} = 220$, s = 50
b. a sample of n = 4 with $\overline{X} = 230$, s = 50
c. a sample of n = 100 with $\overline{X} = 190$, s = 50

4. A particular state knows that its officers can run a mile in $\mu = 7$ minutes, and they want to improve this overall running performance of the force. You are the chief statistician for the state-attorney's general office, and you have been asked to check to see if new recruits hired under a new standard can run faster than the uniformed officers. You plan to compare the mean-mile run time of ten recruits to the average of 7 minutes to determine if it takes them less time to run a mile. The run times (in minutes) are:

5.2 5.0 6.8 9.3 11.1 7.0 8.4 8.0 9.9 8.4

(hint: you must compute the mean and standard deviation from the sample)

4A. Should you do a one-tailed or a two-tailed hypothesis test?

4B. Conduct the appropriate hypothesis test.

STEP 1: State your hypotheses (include both H_0 and H_1). Set $\alpha = .05$.

STEP 2: Set up the criteria for making a decision. That is, find the critical value.

STEP 3: Summarize the data into the appropriate test-statistic.

STEP 4: Evaluate the Null Hypothesis (Reject or Fail to reject?)

What is your conclusion?
11C. Compute 95% confidence limits. Interpret.

5. A manufacturer of flashlight batteries claims that its batteries will last an average of

$\mu = 34$ hours of continuous use. After receiving several complaints about the batteries, a consumer protection group predicts that the batteries run less than 34 hours. During consumer testing, a sample of n=30 batteries lasted an average of only $\overline{X} = 32.5$ hours with a standard deviation of 3. Conduct a one-tailed hypothesis test with $\alpha = .05$.

STEP 1: State your hypotheses (include both H_0 and H_1).

STEP 2: Set up the criteria for making a decision. That is, find the critical value.

STEP 3: Summarize the data into the appropriate test-statistic.

STEP 4: Evaluate the Null Hypothesis (Reject or Fail to reject?)

What is your conclusion?

6. In a single-sample t-test, what are the respective critical values for:
   A. $\alpha = .05$, n=10, two-tailed test
   B. $\alpha = .01$, n=31, one-tailed test
   C. $\alpha = .05$, n=40, one-tailed test
   D. $\alpha = .01$, n=107, two-tailed test

Worksheet: Chapter 10

1. The standard error of the difference (for the independent measures t-test) is an estimate of
   a. centrality
   b. normality
   c. variability
   d. none of the above

2. If other factors are held constant, increasing the level of confidence from 95% to 99% will cause the width of the confidence interval to:
   a. increase
   b. decrease
   c. not change
   d. there is no consistent relation between interval width and level of confidence

3. In an experiment, the experimental group has 13 participants with $s^2 = 3.24$ and the second group has 15 participants with $s^2 = 2.56$. Compute the <u>pooled variance</u>

4. Suppose a teaching methods study was designed to test a hypothesis of equal means on the final examination scores for an experimental teaching method and the traditional lecture method. Subjects were randomly assigned to one of the two methods, classes were taught, and final examination scores were recorded. A summary of the data is as follows

Experimental:	n = 16	$\overline{X} = 87.5$	$s^2 = 38.13$
Traditional:	n = 16	$\overline{X} = 82.0$	$s^2 = 42.53$

Which type of hypothesis testing should be conducted in order to assess whether there is a difference in the final exam scores of the two teaching techniques?
   a. single sample t-test
   b. dependent samples t-test
   c. independent samples t-test

Conduct the appropriate hypothesis test.

<u>STEP 1</u>: State your hypotheses (include both H_0 and H_1). Set $\alpha = .05$, two-tailed.

STEP 2: Set up the criteria for making a decision. That is, find the critical value.

STEP 3: Summarize the data into the appropriate test-statistic.

STEP 4: Evaluate the Null Hypothesis (Reject or Fail to reject?)

What is your conclusion?

5. Rapee and Lim (1992) asked 28 persons with social phobias and 33 nonclinical subjects to rate themselves on a public speaking performance that they gave. The participants rated themselves on a 1 to 15 scale with higher numbers indicating worse performance. The sample of phobic patients gave themselves a mean rating of 12.5 with a variance of 9.61, whereas the nonclinical sample had a mean self-rating of 9.4 with a variance of 10.24.

Which type of hypothesis test should be conducted in order to assess whether there is a difference in the self report ratings of the two groups?

a. single sample t-test
b. dependent samples t-test
c. independent samples t-test

Conduct the appropriate hypothesis test.

STEP 1: State your hypotheses (include both H_0 and H_1). Set $\alpha = .01$, two-tailed.

STEP 2: Set up the criteria for making a decision. That is, find the critical value.

STEP 3: Summarize the data into the appropriate test-statistic. That is, compute the t statistic.

STEP 4: Evaluate the Null Hypothesis (Reject or Fail to reject?)

What is your conclusion?

6. A researcher is studying whether diet pills really work. The researcher gets two groups of people. The first group of 20 people is given the diet pill to help suppress their appetite. The second group of 15 people is given a placebo. Both groups are then instructed to try to lose weight. The researcher hypothesizes that the people who were given the diet pill will lose more weight.

The diet pill group lost a mean of 4.78 pounds (with a standard deviation of 3.26) during the one month experiment. The members of the placebo group, on the other hand, lost a mean of 3.61 pounds (with a standard deviation of 3.47).

Which type of hypothesis test should be conducted in order to assess whether people using the diet pills lost more weight?

a. single sample t-test
b. dependent samples t-test
c. independent samples t-test

Conduct the appropriate hypothesis test.

STEP 1: State your hypotheses (include both H_0 and H_1). Set $\alpha = .05$, two-tailed.

STEP 2: Set up the criteria for making a decision. That is, find the critical value.

STEP 3: Summarize the data into the appropriate test-statistic. That is, compute the t statistic.

STEP 4: Evaluate the Null Hypothesis (Reject or Fail to reject?)

What is your conclusion?

Worksheet: Chapters 13

1. What is the abbreviation for analysis of variance?

2. When does one conduct an ANOVA?

3. If you obtain a significant F statistic you know that:
   a. at least one mean is statistically different from one other mean
   b. all the means are different from each other
   c. all the means come from the same population
   d. the null hypothesis is probably correct

4. When the null hypothesis is true, then $F = MS_{between} / MS_{within}$ will be equal to:
   a. 0
   b. 1
   c. greater than 1
   d. not enough information given

5. To test the truth or falsity of H_0, we calculate two estimates of the population variance. Which estimate of the population variance is independent of the truth or falsity of H_0?

6. In an ANOVA summary table, what are the sources of variability?

7. Between variability can also be thought of as
   A) between groups variability
   B) within groups variability
   C) total variability
   D) both A and B

8. Within variability can also be thought of as
   A) between groups variability
   B) within groups variability
   C) total variability
   D) both A and B

9. The total variability can also be thought of as
    A) between variability + within variability
    B) error variability
    C) within variability
    D) between variability

Use the following example for questions 10 - 12.

Suppose I was conducting a study to see which network can make people laugh more on Thursday nights. I have three groups: One group watches NBC, the second group watches ABC, and the third group watches CBS. All participants watch television from 8:00 to 10:00 with a tape recorder. The experimenter listens to the tape to record laughter.

10. What is the appropriate statistical test?
    A) Pearson's r
    B) single sample t-test
    C) ANOVA
    D) related measures t-test

11. In this experiment, what are some of the reasons for between groups variability. That is, what are some of the reasons that the groups in an experiment may have different values? (In other words, what are some of the reasons that people in the NBC group have higher laughter scores than people in the CBS group?)

12. In this experiment, what are some of the reasons for within group variability. That is, what are some of the reasons that the subjects within each group may have different scores? (In other words, how come everyone in the NBC group does not have the same laughter score?)

13. What is a multiple comparison procedure (post-test) and why does one need to conduct one when conducting ANOVA?

14. What is Tukey's HSD? When does one compute Tukey's HSD? What does HSD stand for?

15. What do eta-squared and omega-square measure? Which one is more accurate?

16. What are two measures of magnitude of effect? Which measure is less biased?

17. A pool of subjects was randomly divided into five treatment groups. The groups were administered daily doses of vitamin C over a 12-month period. The data in the table represent the number of cold and flu viruses reported by the participants as a function of their vitamin C dosage. Using the .05 level of significance, carry out a complete ANOVA on these data.

0mg	250mg	500mg	1000mg	2000mg
6	3	3	4	1
5	4	3	1	0
3	5	4	0	2
2	4	2	3	1

STEP 1: State your hypotheses.

STEP 2: Set up the criteria for making a decision

STEP 3: Summarize the data into the appropriate test-statistic.

STEP 4: Evaluate H_0. (Reject or Fail to reject)

Conclusion:

18. If appropriate, use Tukey's HSD test to perform pairwise comparisons on the means of the data in the above question.

19. Calculate and interpret η^2 (eta squared) on the data in question 17.
20. Use Tables D.3 and D.4 to determine the critical value for F (F_{crit}) for each of the following situations:

20A. $\alpha = .01$, $df_{group} = 7$, $df_{error} = 60$ _____

20B. $\alpha = .01$, $df_{group} = 4$, $df_{error} = 30$ _____

20C. $\alpha = .05$, $df_{group} = 5$, $df_{error} = 120$ _____

20D. $\alpha = .05$, $df_{group} = 3$, $df_{error} = 24$ _____

21. Complete the ANOVA summary table. You do not need the raw data to complete this table.

Source	SS	df	MS	F
Group (Between)	80	_____	40	_____
Error (Within)	_____	_____	_____	
Total	100	14		

Exam 4: Sample Test

1. If other factors are held constant, increasing the level of confidence from 95% to 99% will cause the width of the confidence interval to:
   a. increase
   b. decrease
   c. not change
   d. there is no consistent relation between interval width and level of confidence

2. In an Analysis of Variance test (ANOVA), what term is used to signify (or is equivalent to) variance?
   a. F-ratio
   b. sum of squares
   c. mean square
   d. degrees of freedom

3. In ANOVA, MS group is best described as the
   a. variance due to between group differences
   b. variability due to individual differences
   c. proportion of total variance due to between group differences
   d. proportion of total variance due to individual differences

4. When conducting an independent measures t-test , if the null hypothesis is rejected:
   a. the samples were drawn from populations that were actually dependent rather than independent.
   b. the mean of one sample is so far from the mean of the other sample that the decision is that the samples come from populations that have different mean values.
   c. the mean of one sample is statistically the same as the mean of the other sample so the decision is that they come from populations that have the same mean value.
   d. both a and c

5. Each of the following is part of conducting a independent measures t-test, EXCEPT
   a. difference scores are found for each subject
   b. the population variances are estimated
   c. the comparison is made against a t-distribution
   d. the variance of the distribution of differences between means is computed

6. When conducting an independent measures t-test:
   a. the medians of the two populations are assumed to be equal
   b. the null hypothesis is rejected if the calculated t-statistic you compute is more extreme than the critical-t
   c. only the .01 significance level should be used to increase power
   d. all of the above

7. When conducting an ANOVA, you decide to reject the null hypothesis. Which of the following must be true?

a. between variability > within variability
b. between variability = within variability
c. between variability < within variability
d. between variability > total variability

8. When do you normally use analysis of variance rather than the independent measures t-test?

a. when the population means are unknown
b. when the population variances are unknown
c. when there are more than two means to compare
d. when the data is badly skewed

9. The assumption that the population variances are the same is called

a. the normality assumption
b. a one-tailed test
c. homogeneity of variance
d. the repeated measures assumption

10. If there is no treatment effect, the F ratio is near

a. zero
b. ten
c. infinity
d. one

11. Keeping everything else constant, if we changed from a one-tailed to a two-tailed test, we would expect power to

a. remain unchanged
b. decrease
c. increase

12. If you obtain a significant F-statistic then you know that:

a. at least two means are significantly different from one another
b. all of the means are significantly different from one another
c. all of the means belong to the same population
d. then null hypothesis is probably correct

13. An independent measures experiment uses two samples with n = 8 in each group to compare two experimental treatments. The t-statistic from this experiment will have degrees of freedom equal to

a. 7
b. 14
c. 15
d. 16

14. When doing an independent samples t-test, when **MUST** you pool the variance?
    a. when the sample size is less than 30
    b. when the samples are of unequal sizes
    c. when you are performing a one-tailed test
    d. when you are using an alpha level less than .05

15. A researcher is interested in whether a certain hour-long film that portrays the insidious effects of racial prejudice will affect attitudes toward a minority group. One group of participants (n = 10) watched the movie, and a control group (n= 10) spent the hour playing cards. Both groups were then given a racial attitude test, wherein high scores represented a higher level of prejudice. Summary data were as follows:

Movie		Control	
$\overline{X} = 9.6$	$s_1^2 = 8.94$	$\overline{X} = 11.75$	$s_2^2 = 9.86$

Conduct a two-tailed test with $\alpha = .05$.

Step 1: State the null and research hypotheses in symbols: (2 points)

Step 2: Set up the criteria for making a decision. (1 point)

Step 3: Conduct the appropriate statistical test. (3 points)

Step 4: Based on your answers above, state your decision about the null (1 point)
REJECT **FAIL TO REJECT** (circle one)

What does your decision lead you to conclude about the research question? In other words, state the results of the experiment. (1 point)

16. Which of the following is the least biased measure of magnitude of effect?
    a. eta-squared
    b. omega-squared
    c. beta
    d. delta

17. A pool of subjects was randomly divided into 4 treatment groups. The groups were administered daily doses of Vitamin C over a 12-month period. The data in the table

represents the number of cold and flu viruses reported by the participants as a function of their vitamin C dosage. Using the .05 level of significance, complete the ANOVA.

0mg	500mg	1000mg	2000mg
$\Sigma x_1 = 16$	$\Sigma x_2 = 12$	$\Sigma x_3 = 8$	$\Sigma x_4 = 4$
$\Sigma x_1^2 = 74$	$\Sigma x_2^2 = 38$	$\Sigma x_3^2 = 26$	$\Sigma x_4^2 = 6$
$n_1 = 4$	$n_2 = 4$	$n_3 = 4$	$n_4 = 4$

Step 1: State the null hypotheses in words or symbols. (1 point)

Step 2: Set up the criteria for making a decision (1 point)

Step 3: Conduct the appropriate statistical test. (8 points)

Source	SS	df	MS	F
Group	_____	_____	_____	_____
Error	_____	_____	2	
Total	44	_____		

Step 4: Based on your answers above, state your decision about the null (1 point)

REJECT **FAIL TO REJECT** (circle one)

Based on your decision about the null, is it appropriate to conduct a post-hoc test? (1 point)

YES **NO** (circle one)

Just by looking at the data you used to conduct the test, which group reported the least number of colds and viruses? (1 point)

Conduct a test of Magnitude of Effect using the least biased estimator (2 points)

18B. Interpret the effect size you computed above. (2 points)

19. A researcher conducts an ANOVA test to determine which of 3 treatments (using 33 total subjects) will extend terminal cancer patients lives the longest. The omnibus ANOVA was significant with a $MS_{within} = 36.89$. The mean number of months patients survived for each of the groups is printed below. Conduct a Tukey's post-hoc test to determine which of the groups differed from one another. Set $\alpha = .05$. (5 points)

$\overline{X}_1 = 28.26$ $\overline{X}_2 = 18.39$ $\overline{X}_3 = 17.15$

Final Exam

The non-comprehensive part final exam will be worth 50 points (the same as the other exams) and will cover Chapters 15 and 16 in the text, and Lesson 17-20 online. There will also be a comprehensive section on the final exam worth 15 points. These points will be taken from material on the previous three exams.

In chapter 15 we will not cover the Spearman correlation pp 404-409. Also, the formulas the homework packet and online lecture notes contain for this chapter differ from those the text uses.

Worksheet: Chapter 15

1. A previous student of this class was curious about the relationship between number of hours a person slept before an exam and the number of correct answers on the exam. She asked a sample of 5 people from her residence hall the number of hours they slept before and the number of correct answers they got on their first exam. The data are as follows...

Number of hours slept before exam X	Number of correct answers on exam Y
10	5
12	11
3	0
8	13
5	9

1A. Compute the correlation coefficient and conduct a hypothesis test using the following steps.

STEP 1: State your hypotheses (include both H_0 and H_1). Set $\alpha = .01$, two-tailed.

STEP 2: Set up the criteria for making a decision. That is, find the critical value.

STEP 3: Summarize the data into the appropriate test-statistic. That is, compute the correlation.

STEP 4: Evaluate the Null Hypothesis (Reject or Fail to reject?)

What is your conclusion?

1B. According to the data, how many correct answers should they get if they sleep 9 hours (Hint: Compute the regression equation).

2. Use the regression equation below to predict the yearly salary (in thousands) from the number of years of higher education.

$$\hat{Y} = 2X + 12.98$$

2a) Samantha has had 0 years of higher education. Estimate her annual salary. _____

2b) Tabatha has had 11 years of higher education. Estimate her annual salary. _____

2c) What is the slope of this regression equation? _____

2d) What is the intercept of this regression equation? _____

2e) What is the regression coefficient and y-intercept of this regression equation? _____

3. Which type of correlation coefficient should be computed when both the X variable and the Y variable are dichotomous?

a. Pearson
b. Point biserial
c. Phi
d. Spearman

4. What is the difference between the predictor variable and the criterion variable?

5. Listed are 4 correlations. Put them in order showing the highest to lowest degree of relationship: -0.05 +0.26 -0.97 +0.84

6. For the test for significance of a correlation, the null hypothesis states

a. the population correlation is zero
b. the population correlation is not zero
c. the sample correlation is zero
d. the sample correlation is not zero

7. Suppose the correlation between hot chocolate sales and weather temperature is -0.80. What proportion (or percent) of the variability is predicted by the relationship with weather?

a. 80%
b. 40%
c. 20%
d. 64%
e. not enough information to answer this question

8. What is the "best" fitting line?

9. What is predicted (or predictable) variability (r^2)?

10. Use the following data for the next 2 problems.

X	Y
0	9
1	7
2	11

10A. Find the regression equation for predicting Y from X from the above data.

10B. What is the standard error of estimate for the above data. Interpret.

11. A sample of n = 27 pairs of scores (X and Y values) produces a correlation of r = +0.50. Are these sample data sufficient to conclude that there is a non zero correlation between X and Y in the population? Test at the .05 level of significance, two-tailed.

Worksheet: Chapter 16

1. What type of data does one need to have in order to conduct a chi-square test?

2. What is the goodness-of-fit test?

3. What are observed frequencies? What are expected frequencies?

4. Degrees of freedom for the goodness-of-fit test are defined as df = k - 1. What is k?

5. Nonparametric tests are referred to as ____ free tests.
   a. distribution c. definition
   b. measurement d. parameter

6. Degrees of freedom for the test of independence is defined as
   df = (R - 1) (C - 1). What is R? What is C?

7. A chi-square test on two categorical variables is called a
   a. parametric test c. contingency test
   b. goodness-of-fit test d. test of independence

8. Which one of the following statements about chi-square is not true?
   a. chi-square is used primarily with nominal data
   b. the observations must be dependent
   c. no expected frequencies should be less than 5

9. The table below shows the frequencies of new admissions to a metropolitan psychiatric clinic as a function of season. Test the hypothesis that the incidence of depression, as measured in this way, is independent of season. Use $\alpha = .01$. Be sure to state your hypotheses, find your critical value, calculate your test-statistic, and evaluate the null hypothesis. Also state a conclusion.

	Spring	Summer	Fall	Winter
Depression	20	10	12	25
Other diagnosis	15	15	25	20

10. A potential sponsor would like to know whether local viewers prefer some evening news programs over others. The sponsor conducts a viewer preference survey based on a simple random sample of 1000 households. The results are given in the table. Perform a goodness-of-fit test on these data, using $\alpha = .05$.

KTVO	KMDT	KLPF	KZTV
220	200	300	280

STEP 1: State your hypotheses.

STEP 2: Set up the criteria for making a decision

STEP 3: Summarize the data into the appropriate test-statistic.

STEP 4: Evaluate H_0. (Reject or Fail to reject)

Conclusion:

11. The data in the table were gathered in an investigation of possible gender differences in book-carrying behavior among college students. The researcher wants to know if men, compared with women, tend to carry books down at their side rather than in front of them.
Using $\alpha = .05$, test this hypothesis. Be sure to state your hypotheses, find your critical value, calculate your test-statistic, and evaluate the null hypothesis. Also state a conclusion.

	Book-Carrying Styles		
	Down at the Side	In Front	Other
Women	24	70	6
Men	100	46	4

12. How does the Chi-square test of independence differ from the chi-square goodness of fit test?

Final Exam: Sample Test

1. If two variables are related so that as values of one variable increase the values of the other also increase, then the relationship is said to be...
    a. positive
    b. negative
    c. non-existent
    d. neutral

2. The amount of change in a Y variable that accompanies a given amount of change in X is:
    a. slope of a straight line
    b. Y-intercept of a straight line
    c. correlation between X and Y
    d. length of the prediction line

3. The Y-intercept is the value of ___ when the value of ___ is equal to zero.
    a. X; X
    b. X; Y
    c. Y; X
    d. Y; Y

4. The direction of a linear relationship between two variables is given by _____ of r.
    a. the numerical value
    b. the plus or minus sign
    c. both the sign and the numerical value
    d. the numerical value of the denominator

5. In regression analysis, when Y increases by two units for each equal single-unit increase in X, then
    a. the slope equals +2.00
    b. the slope equals +0.50
    c. the intercept equals +0.50
    d. the intercept equals +2.00

6. In a survey of 20 individuals, one of the survey questions provided 7 response alternatives. If the responses were evaluated using a $\chi 2$ test for goodness of fit at the α = .05 level of significance, the critical value for the test-statistic would be
    a. 10.11
    b. 1.63
    c. 12.59
    d. 30.11

7. A perfect linear relationship of variables X and Y would result in a value of r equal to...
    a. zero
    b. a large value but not +1.00 or -1.00
    c. a small value but not zero
    d. either +1.00 or -1.00

8. Which of the following values of r allows perfect prediction of the Y score from knowledge of the X score?
   a. +2.00
   b. -.50
   c. zero
   d. -1.00

9. Which correlation coefficient represents the weakest association between the X and Y variables?
   a. r = +0.20
   b. r = +0.60
   c. r = -0.50
   d. r = -0.90

10. A study has found a negative correlation between a person's income and his or her blood pressure. This study indicates that __.
   a. income and blood pressure are not related
   b. higher income is associated with higher blood pressure
   c. as income increases, blood pressure tends to increase also
   d. as income increases, blood pressure tends to decrease

11. The population correlation coefficient is represented by...
   a. α
   b. β
   c. μ
   d. ρ

12. A psychologist has found a correlation of +0.54 between measures of need for achievement and college grade point average. Given this knowledge, you would expect that ___.
   a. if you knew a student's need for achievement score, you could predict the student's grade point average perfectly
   b. as need for achievement scores decrease, there is a tendency for college grade point to decrease
   c. as need for achievement scores increase, there is a tendency for college grade point to decrease
   d. there is no relationship between need for achievement and college grade point average

13. The equation of a regression line is $\hat{Y} = -1.4X + 5.0$. From this equation we know that
   a. the line has a negative slope and intersects the X axis at +5.0
   b. the line has a slope of +5.0 and intersects the Y axis at -1.4
   c. the line has a slope of -1.4 and intersects the Y axis at +5.0
   d. X and Y are not linearly related

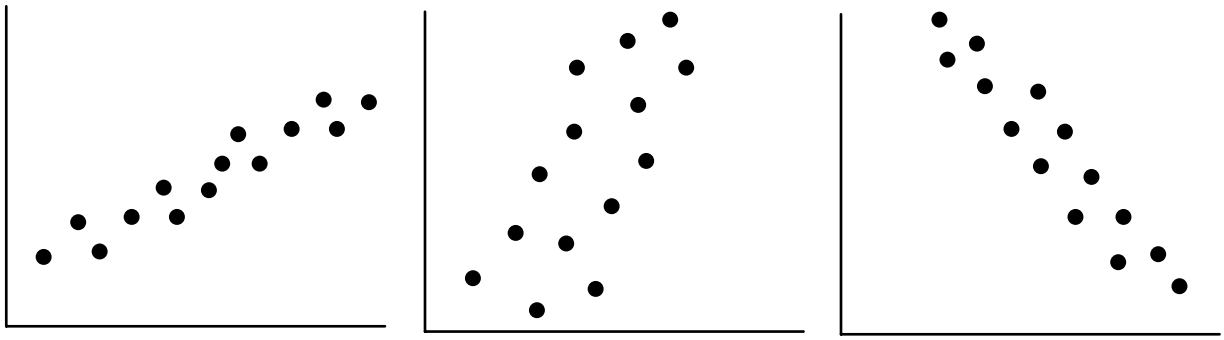
14. In linear regression the difference between a value of Y and $\hat{Y}$ is known as the ...
   a. error of measurement
   b. standard error of estimate
   c. standard deviation
   d. residual

15. The standard error of estimate in linear regression will be zero when
    a. r = zero
    b. r = -1.00 or +1.00
    c. the slope of the regression line is 0.00
    d. the slope of the regression line is 10.00

16. When computing a chi-square test of independence one compares ___ to ___.
    a. sample means; population means
    b. sample variances; population variances
    c. observed frequencies; expected frequencies
    d. sample statistics; population parameters

17. If you fail to reject the null hypothesis in a chi-square test for goodness of fit, then the expected and observed
    a. variances should be about equal
    b. variances should be unequal
    c. frequencies for the cells should be unequal
    d. frequencies for the cells should be equal

(1 points each) Below are three scattergrams. (Note: A scattergram may be the correct answer to more than one question.)



A B C

_____ 18. If you were to compute a correlation between the X and Y variables for each of the three sets of data, which set of data would yield a <u>correlation closest to zero</u>?

_____ 19. If you were to construct a regression equation using the X variable to predict the Y variable for each of the three sets of data, for which set of data would the regression equation have the <u>largest, positive slope</u>?

_____ 20. If you were to construct a regression equation using the X variable to predict the Y variable for each of the three sets of data, for which set of data would the regression equation have the <u>most negative slope</u>?

21. (Runyon & Haber, 1991) In a recent study, Thornton (1977) explored the relationship of marital happiness to the frequency of sexual intercourse and to the frequency of arguments. Twenty-eight married couples volunteered to monitor their daily frequency of sexual intercourse and arguments for 35 consecutive days, and then they indicated their perceived marital happiness using an 11-point scale ranging from very unhappy (1) to perfectly happy (11).

Thornton (1977) reported that the Pearson correlation between ratings of marital happiness and number of arguments was -0.74. Do the appropriate statistical test to determine whether there is a significant linear relationship between happiness and arguments. Set $\alpha = .05$, two-tailed.

STEP 1: State your hypotheses in either words or symbols (2 points)

STEP 2: Set the criteria for making a decision. That is, find the critical value (2 points)

STEP 3: Summarize the data into the appropriate test-statistic.

I have already done this for you: $r = -0.74$

STEP 4: Evaluate the null hypothesis. (1 point)

Based on <u>your</u> results, is there a relationship in the population between happiness and arguments?

YES NO (circle one) (1 point)

What proportion of the variability in happiness can be explained by the number of arguments?

_____ (1 point)

22. Soldiers at Fort Gordon, Georgia and Fort Campbell, Kentucky completed a questionnaire, which included items about cigarette use, alcohol consumption, and coffee consumption (Zvela, Barnett, Smedi, Istvan, & Matarazzo, 1990). One of the questions the researchers wanted to answer was the following: Is there a relationship between smoking and gender in the military? The data are below.

	Gender		
Smoking Status	Male	Female	Total
Current smokers	252	46	298
Ex-smokers	62	29	91
Nonsmokers	170	51	221
Total	484	126	610

Perform a chi-square test of independence on these data. Set $\alpha = .05$

STEP 1: State your hypotheses. (I have already done this for you).

H_0: Gender and smoking status are independent

H_1: Gender and smoking status are not independent

STEP 2: Set up the criteria for making a decision. That is, find the critical value. (2 points)

STEP 3: Summarize the data into the appropriate test-statistic (3 points)

STEP 4: Evaluate the null hypothesis (1 point)

What is your conclusion? (1 point)

23. (Birkes & Dodge, 1993) Below is the weight (in kilograms) and the time to run 1.5 miles (in minutes) for a sample of 5 individuals.

Person	Weight (X)	Time (Y)	X^2	Y^2	XY
1	89	11.4	7,921	129.96	1,014.6
2	75	10.1	5,625	102.01	757.5
3	66	11.1	4,356	123.21	732.6
4	92	12.3	8,464	151.29	1,131.6
5	83	10.5	6,889	110.25	871.5
	405	55.4	33,255	616.72	4,507.8

23a. (3 points) Compute the correlation between weight and running time. (Set up the appropriate formula to receive credit for your answer.)

23b. (5 points) Write the regression equation for predicting running time from weight. (Set up the appropriate formulas to receive credit for your answer.)

23c. (1 point) What is the value for the slope of the regression line in 27b.

23d. (1 point) Predict the running time for a child who weighs 77 kilograms.

23e. (1 point) _____ is the predictor variable and _____ is the criterion variable in the regression equation. (circle one)

a. weight; time
b. time; weight

24. A discount store has prepared a customer survey to determine which factors influence people to shop in the store. A sample of 90 people is obtained and each person is asked to identify from a list of alternatives the most important factor influencing their choice to shop in the store. The data are as follows:

Convenient Location	Low Prices	Good Selection
30	40	20

On the basis of these data can you conclude that there is any specific factor (or factors) that is most often cited as being important? Test at the .05 level of significance with the goodness of fit chi-square test.

Determine the critical region (1 point)

Summarize the data into the appropriate test-statistic (3 points)

Evaluate H_0. (Reject or Retain) (1 point)

Part 2

25. Compute the median and the mode of the following data set.

9 7 4 5 7 2

median _____ (1 point)

mode_____ (1 point)

26. A national test has a mean of 192 and a standard deviation of 10. The author of the exam wants the test to have a mean of 500. What specifically does the author have to do so that her test has a mean of 500 (and the standard deviation remains 10)? (1 point)

27. Which measure of central tendency is used with nominal data? (circle one)(1 point)
    a. mean
    b. median
    c. mode

28. In October of 1981 the mean and the standard deviation on the Graduate Record Exam (GRE) for all people taking the exam were 489 and 126, respectively. Scores on the GRE are normally distributed.

    28a. What percentage of students would you expect to have a score between 400 and 500?

    _____ (1.5 points)

    28b. What is the median of this distribution?

    _____ (1.5 points)

29. A psychologist would like to know how much difference there is between the problem-solving ability of 8-year-old children versus 10-year-old children. A random sample of 10 children is selected from each age group. The children are given a problem-solving test, and the results are summarized as follows:

8-year-olds	10-year-olds
$n = 10$	$n = 10$
$\bar{x} = 36$	$\bar{x} = 39$
$s = 3.50$	$s = 5.27$

30. Perform the appropriate analysis on this data. Set $\alpha = .05$, two-tailed.

    STEP 1: State your hypotheses in symbols (1 point)

STEP 2: Set the criteria for making a decision. That is, what is your critical value?

(1 point)

STEP 3: Summarize the data into the appropriate test-statistic. (2 points)

STEP 4: Evaluate the null hypothesis (1 point)

In a controlled study, more than 70 Dartmouth College students were instructed to use orange-flavored lozenges at the first sign of an incipient cold, sucking on one as often as every two hours. Half the students got zinc lozenges; half the students were given candies that looked and tasted the same, so that none knew who was really taking the zinc.

The participants who were given the zinc had a cold for 4.3 days, as against 9.2 days for those who got the look-alike candies

31A. What was the dependent variable in this study? (circle one) (1 point)

a. type of cold treatment
b. 70 students
c. number of days cold continues
d. Dartmouth College

31B. What was the independent variable in this study? (circle one)(1 point)

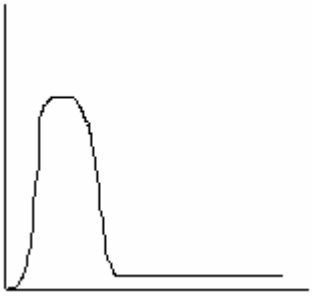
a. type of cold treatment
b. 70 students
c. number of days cold continues
d. Dartmouth College

31C. What is the correct analysis for this experiment? (circle one)(1 point)

a. independent measures t-test
b. related measures t-test
c. chi-square test of goodness of fit
d. single sample t-test

Answers: Chapters 1 and 2

1. A
2A. nominal 2B. ordinal 2C. nominal 2D. ratio 2E. ratio
3A. continuous 3B. discrete
4A. exercise regimen 4B. body fat
5A. music 5B. words recalled 5C. discrete
6A. physical fitness 6B. amount of sleep 6C. continuous 6D. measurement
6E. ratio
7A. 147B. 147C. 557D. 547E. 144 7F. 168
7G. 2
8.



9.

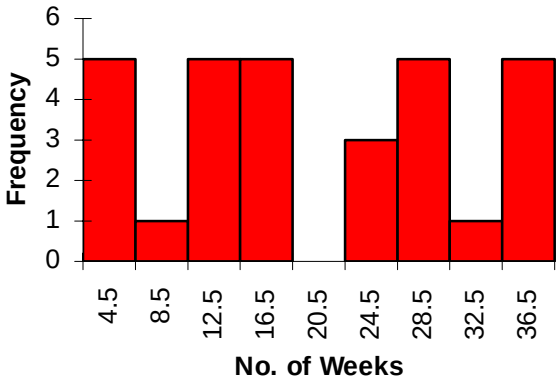
Interval	Real Limits	Mid-point	Frequency	Cumulative Frequency	Relative Percentage	Cumulative Percentage
0-1	-0.5-1.5	.5	3	3	15	15
2-3	1.5-3.5	2.5	6	9	30	45
4-5	3.5-5.5	4.5	5	14	25	70
6-7	5.5-7.5	6.5	4	18	20	90
8-9	7.5-9.5	8.5	0	18	00	90
10-11	9.5-11.5	10.5	2	20	10	100

10. 30%
11. 18
12. 5.5. 70% of the scores fall at or below 5.5.
13. 45th percentile. 45% of the scores fall at or below 3.5.

Answers: Chapters 2 and 3

1A. 8.00 1B. 8.00 1C. 8.00

2.



3) A

4A) B

4B) C

4C) C

5) B

6) C

Answers: Chapters 3

1A. 2,3,4
1B. 4
1C. 4.25
2 c
3 a
4A. c
4B. Papa John's
4C. Papa John's
5. b
6 170
7 9
8. 9
9. 5
10. 9
11 b
12. 40.6
12. 40.1
12. No, on average both groups are fairly accurate

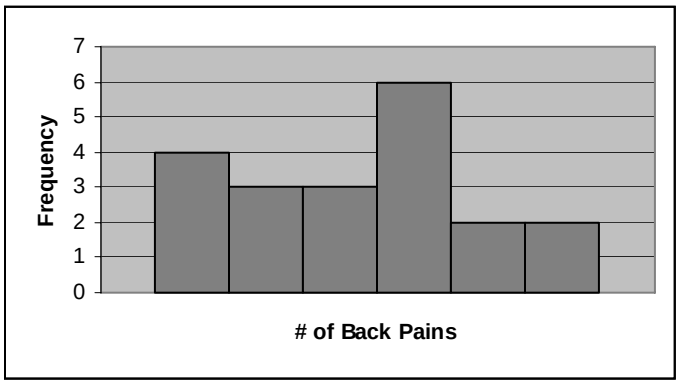
Exam 1: Sample Test Answers

1) D 2) A 3) A 4) B 5) D 6) D 7) D 8) C 9) A 10) B 11) C
12) A 13) D 14) D 15) B 16) B
17) 2
18) -18
19) -6
20) 15.5
21) 16.5
22) 18
23A) 50% 23B) 19.5 23C) 3 23D) 50th

Class Intervals

Apparent Limits	Real Limits	Midpoint	Frequency	Cum f	Relative Percent	Cum Relative Percent
0-4	-.5-4.5	2	4	4	20	20
5-9	4.5-9.5	7	3	7	15	35
10-14	9.5-14.5	12	3	10	15	50
15-19	14.5-19.5	17	6	16	30	80
20-24	19.5-24.5	22	2	18	10	90
25-29	24.5-29.5	27	2	20	10	100

23E)



Answers: Chapter 4

1A. 8.83
1B. 2.97
1C. 4
2. C
3A. Sample B
3B. 1.72
3C. 32
4A. No, on average both groups are fairly accurate
4B. 9.22
4C. 2.56
4D. Sample B
5. Scores, on the average, cannot be 13.5 points away from the mean on a 10-point scale

Answers: Chapters 5 and 6

1. 24.18%
2. 53.50%
3. 89th
4. 75.18
5. 21.48%
6. 57.04%
7. 21.48%
8. 4.84%
9. 57.65 to 82.35
10. 1610
11. 60
12. 53.51
13. 2.02
14. Third-world man lived longer for his distribution (z=1.16) than the other man (z=.31)
15. 44.6
16. 1.28
17. 56.4
18. 45.8, 54.2

Answers: Chapter 6

1. a
2A. .75
2B. .15
3. .0769
4. .5
5. .0385
6. .1176
7A. .19
7B. .38
8. D
9A. .5905
9B. .3048
9C. .4095
9D. .1905
9E. .3226
9F. .7209

Exam 2: Sample Test Answers

1) D 2) C 3) C 4) C 5) B 6) D 7) C 8) C 9) B 10) D

11) .054

12) .1586

13) 19

14A) 132.8 14B) 21.96% 14C) 113.44 14D) Z= -1.25, prob = .1056

15) 27.75

16) 5.26

17a) 0.2 b) 0.6 c) .08 d) 0.04

Answers: Chapters 7 and 8

1A. two-tail
1B. The percentage of body fat for exercisers will not differ from those who do no exercise
$\mu_{exercise} = 20$
1C. The percentage of body fat for exercisers will be different from those who do no exercise
$\mu_{exercise} \neq 20$

2A. one-tail
2B. Participants taking the new drug will recall less than or the same amount of words as the untreated population.
$\mu_{new\ drug} \leq 25$
2C. Participants taking the new drug will recall more words than the untreated population.
$\mu_{new\ drug} > 25$
3. .0023

4. 1.64, $\pm$ 2.58, 2.33
5. A
6. B
7. A
8. A
9. C
10. p(Type II error | null is false) = β
ıı p(Type II error | null is true) = 0
12. see p. 133

15. a
16. b
17. a
18. b

Answers: Chapter 7 & 8 (Part 2)

1. H_0: $\mu \geq 6.3$

   H_1: $\mu < 6.3$

   critical $z = z_{.05} = -1.64$

   $z_{obtained} = -2.11$

   Reject H_0

   Patients in the new program are released from the hospital in less time.

2. see sampling distributions on web page 3. D

4. The first is used for finding the probability of an individual value, the second for finding the probability of a sample of values. In the same way σ estimates the average difference between μ and X, $\sigma/\sqrt{n}$ estimates the average difference btw/ μ and $\overline{X}$

5. ±2.898

6. Sample size, alpha level, one- or two-tailed test 6B. Sample size, alpha

7. alpha, N, distance between means, sigma, one-tail vs. two-tail test.

Exam 3: Sample Test Answers

1) A 2) A 3) A 5) A 5) B 6) D 7) D 8) D 9) D 10) C 11) A 12)A

13) **Step 1**: H_1: People with a HS degree earn less than other company employees
H_0: People with a HS degree earn the same or more than other company employees
Step 2: -1.64
Step 3: $t = \frac{24,1000 - 27,000}{6,000 / \sqrt{15}} = \frac{-2900}{6000 / 3.873} = \frac{-2900}{1549.19} = -1.87$
Step 4: Reject
People with a HS degree earn less than other company employees

14) **Step 1:**
H_1: Snow leopards have a different number of spots than African leopards
H_0: Snow leopards have the same number of spots as African leopards
H_1: $\mu_{Snow} = 25$
H_0: $\mu_{Snow} \neq 25$
Step 2: ± 1.96
Step 3: $z = \frac{30 - 25}{7 / \sqrt{15}} = \frac{5}{7 / 3.873} = \frac{5}{1.81} = 2.76$
Step 4: Reject the null

conclusion: there is a different number of spots for Snow leopards

Answers: Chapter 9

1. H_0: $\mu \leq 80$
   H_1: $\mu > 80$
   critical $t = t_{.05} = +1.67$
   $t_{obtained} = 4.48$
   Reject H_0

2. H_0: $\mu = 80$
   H_1: $\mu \neq 80$
   critical $t = t_{.05} = \pm 2.08$
   $t_{obtained} = 3.25$
   Reject H_0
   Type A persons have significantly higher blood pressure than the average person.
   ($CI_{.95} = 84.68 \leq \mu \leq 101.32$), 95% sure that the population of Type A men have a mean blood pressure in this range.

3. a. 12
   b. 5.2
   c. 18

4A. One-tailed

4B. H_0: $\mu \geq 7$ minutes
   H_1: $\mu < 7$ minutes
   critical $t = t_{.05} = -1.833$
   $t_{obtained} = 1.47$
   Retain H_0
   The sample does not run the mile in less time than the pop.

4C. $CI_{.95} = 6.51 \leq \mu \leq 9.31$, 95% sure that the population the sample of troopers comes from has a mean running time in this range.

5. H_0: $\mu \geq 34$
   H_1: $\mu < 34$
   critical $t = t_{.05} = -1.699$
   $t_{obtained} = -2.73$
   Reject H_0
   The batteries last significantly less time than claimed by the manufacturer.

6A. ± 2.262 6B. -2.457 or $+2.457$
6C. -1.68 or $+1.68$ 6D. ± 2.62

Answers: Chapter 10

1. c 2. a 3. 2.87

4. c

H_0: $\mu_{em} = \mu_{tm}$

H_1: $\mu_{em} \neq \mu_{tm}$

critical $t = t_{.05} = \pm 2.042$

$t_{obt} = 2.46$

Reject H_0

The students in the experimental teaching class performed significantly better on the final exam than students in the traditional class.

5. c

H_0: $\mu_{sp} = \mu_{nc}$

H1: $\mu_{sp} \neq \mu_{nc}$

critical $t = t_{.05} = \pm 2.678$

$t_{obt} = 3.83$

Reject H_0

Social phobic patients rated themselves significantly worse on public speaking performance than did nonclinicals.

6. c

H_0: $\mu_{diet} = \mu_{placebo}$

H_1: $\mu_{diet} \neq \mu_{placebo}$

critical $t = t_{.05} = \pm 2.042$

$t_{obt} = 1.02$

Fail to reject H_0

Diet pills do not work. Diet pills are <u>not</u> significantly more effective than placebos in losing weight.

Answers: Chapters 13

1. ANOVA
2. When you wish to compare more than two sample means.
3. A
4. B
5. within group variability (variance)
6. Between/ Within/Total .
7. A
8. B
9. A
10. C
11. Individual differences (e.g., Some people laugh more than others.)
    Error (e.g., The tape recorder picked up other noise which made it difficult to hear the laughter.)
    Treatment (e.g., Some networks are funnier than others.)
12. Individual differences
    Error
13. ANOVA only tells us that at least 2 means differ, but not which ones…must do Tukey's post-hoc test to compare multiple groups and determine which means differ.
14. Tukey's HSD is a post-test (multiple comparison procedure). One computes a Tukey's HSD when the null hypothesis has been rejected to determine which of the groups are significantly different from each other. HSD stands for honestly significant difference.
15. both measure magnitude of the effect. Omega-square is more accurate.
16. eta-square and omega-square. Omega-square is less biased.
17. H_0: $\mu_1=\mu_2=\mu_3=\mu_4=\mu_5$
    H_1: At least one mean is different from the others
    $F_{.05}(4,15) = 3.06$
    $F_{obt} = 3.93$
    Reject H_0
    At least one group reported more cold and flue viruses than at least one other group.
    After conducting the Tukey HSD, we can conclude, Subjects taking no Vitamin C and subjects taking 250 mg. of Vitamin C reported significantly more cold and flu viruses than persons taking 2000 mg. of Vitamin C.
18. Tukey's HSD = 2.88
19. $\eta^2=.51$
20A. 2.95
20B. 4.02
20C. 2.29
20D. 3.01
21.

Source	SS	df	MS	F
Group	80	2	40	23.95
Error	20	12	1.67	
Total	100	14		

Exam 4: Sample Test Answers

1)A 2) C 3) A 4) B 5) A 6) B 7)A 8) C 9) C 10) D

11) B 12) A 13) B 14) B

15A) Step1: H_0: $\mu_{film}=\mu_{nofilm}$ H_1: $\mu_{film} \neq \mu_{nofilm}$ Step2: $\pm$ 2.1009

Step 3: $$t = \frac{9.6 - 11.75}{\sqrt{\frac{9(2.99)^2 + 9(3.14)^2}{10+10-2}\left[\frac{1}{10}+\frac{1}{10}\right]}} = \frac{-2.15}{\sqrt{\frac{80.46+88.736}{18}[.2]}} = \frac{-2.15}{1.37} = -1.56$$

Step 4: Fail to Reject.....so, no differences in attitudes between the film and no film group

16) B

17) Step 1: $\mu_1=\mu_2=\mu_3=\mu_4$ Step 2: 3.49 Step 3:

Source	SS	df	MS	F
Group	20	3	6.67	3.33
Error	24	12	2	
Total	44	15		

Step 4: Fail to reject.....no.....200mg group

18A) ω^2 = .30 18B) 30% of the variability in number of cold virus reported is due to amount of vitamin C consumed.

19. HSD = 6.39
Groups 1 and 2 differ (difference=9.87), Groups 1 and 3 significantly differ (difference = 11.11), Groups 2 and 3 do not differ (difference = 1.24).

Answers: Chapter 15

1A. H_0: $\rho = 0$
H_1: $\rho \neq 0$
$r_{crit} = \pm .959$
$r = .56$
Fail to reject H_0
There is insufficient evidence to conclude that there is a significant linear relationship.

1B. The regression equation is $\hat{Y} = .79X + 1.57$.
The answer is 8.68 or 8 answers.

2A. 12,980
2B. 34,980
2C. 2
2D. 12.98
2E. 2 and 12.98
3. c
4. See page 414 of your text
5. -0.97, +0.84, +0.26, -0.05
6. a
7. d
8. See page 414 of your text
9. variability in Y that is explained by differences in X
10A. $\hat{Y} = X + 8$
10B. 2.45 The standard deviation of points about the regression line (standard error) is 2.45.
11. Yes

Answers: Chapter 16

1. Categorical or frequency data
2. See p. 428 of your text
3. See pp. 230-431 of your text
4. k stands for k-k-categories (number of groups)
5. A
6. See p. 442 of your text
7. D
8. B
9. H_0: The incidence of depression is independent of season.
   H_1: The incidence of depression is not independent of season.
   $\chi^2_{crit} = 11.35$
   $\chi^2 = 7.22$
   Retain H_0
   The incidence of depression is not independent of season.
10. H_0: observed frequencies are equal to the expected frequencies
    H_1: observed frequencies are not equal to the expected frequencies
    $\chi^2_{crit} = 7.82$
    $\chi^2 = 27.2$
    Reject H_0
    Local viewers prefer some evening news programs over others.
11. H_0: Book-carrying styles are independent of gender
    H_1: Book-carrying styles are not independent of gender
    $\chi^2_{crit} = 5.99$
    $\chi^2 = 43.69$
    Reject H_0
    Men compared with women tend to carry books down at their side rather than in front of them.
12. Chi-square test of independence: consider 2 variables at once to determine if they are independent (related).
    Chi-square goodness of fit test: consider 1 variable at a time. Compares actual data to what we expect by chance.

Final Exam: Sample Test Answers

1) A 2) A 3) C 4) B 5) A 6) C 7) D 8) D 9) A 10) D 11) D 12) B
13) C 14) D 15) B 16) C 17) D 18) B 19) B 20) C

21) STEP 1: H_0: $\rho = 0$ H_1: $\rho \neq 0$
Null: The correlation does not exist in the population
Alternative: The correlation does exist in the population
STEP 2: df = n - 2 = 28 - 2 = 26 $r_{crit} = \pm 0.374$
STEP 4: Reject the null.....so, yes there is a relationship
What proportion of the variability....? .5476

22) STEP 2: df = (3-1)(2-1) = 2 $\chi^2_{crit} = 5.99$
STEP 3: $\chi^2_{obtained} = 1.02 + 3.93 + 1.44 + 5.53 + .16 + .63 = 12.71$
STEP 4: Reject null
conclusion? Gender and smoking status are not independent. There is a relationship between gender and smoking status

23a) r = +0.5658 = +.57
23b) Y = .0453X + 7.41
23c) .0453
23d) 10.898 rounds to 10.90
23e) **a. weight; time**

24) critical = 5.99; $\chi^2_{obtained} = 6.67$; Reject
25) median 6 mode 7
26) Adding a constant to each score will change the mean without having an effect on the standard deviation. Add 308 to each score.
27) **c. mode**
28a) 29.7% z = +0.09 z = -0.71 area = .0359 area = .2611
.0359 + .2611 = .2970
28b). 489
29)STEP 1: H_0: $\mu_1 = \mu_2$ H_1: $\mu_1 \neq \mu_2$
STEP 2: df = 18 $t_{crit} = \pm 2.101$
STEP 3: $t_{obtain} = -1.5$
STEP 4: Fail to reject null
30a) C 30b) A 30c) A