Burlington County College

MTH 107 – Introduction to Statistics

Internet Syllabus

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Course Coordinator
Fall 2010 Semester

Division of Science, Mathematics, and Technology

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General Information

A. Division: Science, Math, and Technology

B. MTH 107: MTH 107 Introduction to Statistics (Internet)

C. Credits: Three (3) credits

D. Prerequisites: MTH 075 Elementary Algebra or one year of high-school algebra

E. Catalog Description

This is a first course in basic statistical concepts. It focuses on frequency distributions of empirical data, calculations of descriptive statistics, probability distributions, confidence intervals, hypothesis testing, chi square, regression, and correlation. Students may receive credit for either MTH 107 or MTH 143, but not credit for both courses.

F. General Course Goals

This course is designed to meet the following overall goals. More specific objectives are listed under each of the separate Unit descriptions.

1. To have the student become skilled in organizing and summarizing empirical data.
2. To have the student become skilled in calculating simple theoretical probabilities.
3. To have the student recognize the characteristics and become skilled in the uses of theoretical probability distributions.
4. To have the students become proficient in basic inferential statistical data analysis.
5. To have the students become skilled in basic analyses of paired data.

G. Materials for Instruction

REQUIRED Materials:

Textbook : Elementary Statistics 11th Edition, by Mario F. Triola, 2010, Addison Wesley Longman, Inc.

Calculator : Specific calculator recommendations appear on the next page.

G. Materials for Instruction (continued)

If you plan to take additional mathematics courses (pre-calculus, calculus, etc.), I recommend the TI-83 or TI-84. These calculators cost about $100.

If this is your last or only math class, I recommend the TI30X-IIS, or the Casio FX300W Plus, both of which are under $20.

At a minimum, your calculator should have the exponential function, square root, factorial function, and parenthesis.

OPTIONAL Materials:

Student Solutions Manual – This book is strongly recommended. The textbook contains only the answers to the odd problems. The Student Solutions Manual also shows all of the steps.

Statdisk Student Laboratory Manual – This book contains exercises and instructions for Statdisk, the software that comes with the book.

H. Accessing the Online Material (WebCT)

In order to access the course, you will need to use a standard web browser like Internet Explorer or Netscape Navigator and a working email address.

Go to the following website: http://bcc.blackboard.com/

Please read the instructions and follow them carefully. Contact me if you still have problems accessing the course.

I. Course Content

Descriptive Statistics	Populations, Samples, and Experiments Summarizing Data and Pictures of Data Measures of Center, Variation, and Position
Probability	Experimental and Theoretical Addition and Multiplication Rule Counting Rules
Probability Distributions	Binomial and Normal Probability Distributions Central Limit Theorem
Inferential Statistics	Estimating a Population Means, Proportions Hypothesis Testing
Analysis of Paired Data	Linear Correlation and Regression

J. Course Evaluation

The course grade is made up of Unit Tests, Projects, Quizzes, and a Final Exam. The percentages for each component are listed below.

Participation 10%
Project 1 ..... 10%
Project 2 ..... 10%
Project 3 ..... 10%
UNIT 1 TEST (Part 1) 6%
UNIT 1 TEST (Part 2) 6%
UNIT 2 TEST (Part 1) 6%
UNIT 2 TEST (Part 2) 6%
UNIT 3 TEST (Part 1) 6%
UNIT 3 TEST (Part 2) 6%
UNIT 4 TEST (Part 1) 6%
UNIT 4 TEST (Part 2) 6%
Final Exam 12%

Descriptions for each component of the course grade are given on the following page.

J. Course Evaluation (continued)

Participation

Participation counts for ten percent of your grade. Each week a question will be posted on the Discussion Board to which each student is expected to respond. The purpose of the discussion questions will be to get you to think about how the concepts presented in the course relate to the outside world. Your grade will be based on the overall quality of your responses which should include a demonstration of your understanding of the concepts in each Unit.

Projects

There are three projects that are described in detail at the end of this document. Students are to complete all parts of each project and submit a project report.

- Sharing data or working in groups is NOT allowed.
- Reports must be submitted via the Assignments tool on the course website.
- The preferred file formats for electronic submission are Microsoft Word or Excel.
- Other file formats may be acceptable, but contact me prior to submission.
- Please try to keep the number of submitted files to a minimum.
- Each report must be received electronically by the due date listed.
- Late reports will be penalized 15 points initially, then another 10 points each day.
- Be sure to keep a copy of anything you submit for a grade.

Unit Tests

All Unit Tests are timed multiple choice tests and are given on the course website. There are separate tests for the first four units, the Unit 5 material is covered on the comprehensive Final Exam. There are no retests.

Final Exam

The Final Exam is a comprehensive test covering the material from all 5 units. Like the Unit Tests, the Final Exam is a timed multiple choice test.

J. Course Evaluation (continued)

Grading Scale

The grading scale for all assignments is as follows :

A = 90% and higher

B+ = 85 to 89%

B = 80 to 84%

C+ = 75 to 79%

C = 70 to 74%

D = 60 to 69%

F = Less than 60%

See page 91 in the textbook for help on calculating your grade.

Important Dates

Project 1 is due on Monday, September 27, 2010.

The last day to take all tests for Unit 1 and Unit 2 is Friday, October 22, 2010.

Project 2 is due on Monday, November 8, 2010.

The last day to take all tests for Unit 3 and Unit 4 is Friday, December 10, 2010.

Project 3 is due on Monday, December 13, 2010.

The last day to respond to all Discussion Questions is Thursday, December 16, 2010.

The last day to take the Final Exam is Thursday, December 16, 2010.

K. Contact Information

The course website is the expected method of communication. I try to check the course website each day and at least once during the weekend. I also try to respond to any messages on the course website within 48 hours. My other contact information is listed below.

Instructor: William Whitfield

Office: Academic Building, Pemberton Campus, Room 310

Phone: (609) 894-9311 extension 1525

Email: wwhitfield@bcc.edu

Fax: (609) 726-1781

Distance Learning Office

Office: Pemberton Library, Room 107

Phone: (609) 894-9311 ext. 1790

L. Course Schedule

While a distance learning course does offer students freedom in their daily progress through the material, there also exists greater responsibility in managing your time. To aid you in this, I have provided a schedule to take you week-by-week through the assignments, projects, and tests.

Suggestions for Completing the Lessons

1. Read the Textbook Sections listed in the schedule below. Be sure to take notes as you progress through the material. There are review sheets for each unit on the website to provide additional support. Also write down any questions on any of the material you don't understand and email me or post your question on the discussion board to get help. Be sure to check the website regularly and respond to each of the discussion questions.

2. Complete the homework problems for each section listed in the suggested schedule. Answers to the odd problems are in the back of the text. You may also check your work in the Student Solutions Manual. Also try the problems in the worksheets in this syllabus. The exam questions will be similar to those on the worksheets and in the text. The homework problems are for your own practice and will NOT be graded. Again, contact me for any questions you have about the material.

3. After you have completed the homework problems, work on the course Projects. Due dates for each of the projects are included on the project description sheets at the end of the syllabus.

4. If you have any trouble with the material, please bring your questions to me via email or by posting them on the course website discussion board.

The schedule is on the next page. The content goals referred to in the schedule are described in the next section of the syllabus.

Week-By-Week Schedule

A. Descriptive Statistics

Week	Content Goals	Assignment
1	1-7	Read Chapter 1, Sections 1-1 through 1-5 Section 1-3: Page 16 1-31 odd Section 1-4: Page 23 1-8 odd, 21-27 odd Section 1-5: Page 34 1-8 odd, 27, 29 Read Chapter 2, Sections 2-1 through 2-5 Section 2-2: Page 52 1-7 odd, 15-21 odd Section 2-3: Page 57 1-11 odd Section 2-4: Page 67 1-15 odd
2	8-14	Read Chapter 3, Sections 3-1, 3-2, and 3-3 Section 3-2: Page 94 1-13 odd, 21, 23 Section 3-3: Page 109 1-13 odd, 21, 23
3	15-19	Read Chapter 3, Section 3-4 Section 3-4: Page 126 1-29 odd Review Descriptive Statistics
4	ALL	Unit 1 Test

B. Probability

Week	Content Goals	Assignment
4	1-4	Read Chapter 4, Sections 4-1, 4-2, and 4-3 Section 4-2: Page 147 1-4, 5-21 odd, 25-31 odd Section 4-3: Page 156 1-4, 5-31 odd
5	5-10	Read Chapter 4, Sections 4-4 and 4-5 Section 4-4: Page 167 1-4, 13-21 odd Section 4-5: Page 175 1-4, 9-27 odd
6	11-15	Read Chapter 4, Section 4-7 Section 4-7: Page 189 1-4, 5-27 odd Review Probability
7	ALL	Unit 2 Test

C. Probability Distributions

Week	Content Goals	Assignment
7	1-5	Read Chapter 5, Sections 5-1 and 5-2 Section 5-2: Page 214 1-4, 5-15 odd, 27, 29
8	6-13	Read Chapter 5, Sections 5-3 and 5-4 Section 5-3: Page 225 1-4, 5-31 odd Section 5-4: Page 231 1-4, 5-15 odd Read Chapter 6, Sections 6-1, 6-2, and 6-3 Section 6-2: Page 261 1-4, 9-35 odd Section 6-3: Page 271 1-4, 5-19 odd, 21-27 odd
9	14 & 15	Read Chapter 6, Sections 6-4 and 6-5 Section 6-4: Page 285 1-4 Section 6-5: Page 295 1-4, 5-15 odd Review Probability Distributions
10	ALL	Unit 3 Test

D. Inferential Statistics

Week	Content Goals	Assignment
10	1-5	Read Chapter 7, Sections 7-1 through 7-4 Section 7-2: Page 339 1-4, 17-33 odd, 41, 43 Section 7-3: Page 351 1-4, 9-15 odd, 21, 23, 31 ,33 Section 7-4: Page 365 1-4, 5-13 odd, 17-25 odd
11	6 & 7	Read Chapter 8, Sections 8-1, 8-2, and 8-3 Section 8-2: Page 409 1-4, 5-39 odd Section 8-3: Page 420 1-5, 9-15 odd
12	8 & 9	Read Chapter 8, Sections 8-4 and 8-5 Section 8-4: Page 429 1-4, 7-19 odd Section 8-5: Page 439 1-4, 5, 7, 13-19 odd, 25 Review Inferential Statistics
13	ALL	Unit 4 Test

E. Analysis of Paired Data

Week	Content Goals	Assignment
13	1-6	Read Chapter 10, Sections 10-1 and 10-2 Section 10-2: Page 530 1-4, 5-17 odd
14	7-10	Read Chapter 10, Section 10-3 Section 10-3: Page 547 1-4, 5-17 odd Review for Final Exam

Content Goals and Performance Objectives

A. Descriptive Statistics

Content Goals

1. Identify the relevant population for a given question of interest.
2. Identify possible samples for a given population.
3. Compare and contrast continuous and discrete data.
4. Compare and contrast population parameters and sample statistics.
5. Compare and contrast proper and improper uses of statistics.
6. Construct frequency tables from raw data.
7. Construct and interpret pictures of data.
8. Identify and calculate measures of center.
9. Compare and contrast the different measures of center.
10. Interpret the values for the measures of center.
11. Compare and contrast symmetric and skewed data distributions.
12. Identify and calculate measures of variation.
13. Compare and contrast the different measures of variation.
14. Interpret the values for the measures of variation.
15. Identify and calculate measures of relative standing.
16. Compare and contrast the different measures of relative standing.
17. Interpret the values for the measures of relative standing.
18. Create a 5-number summary for a set of data.
19. Construct and interpret boxplots for sets of data.

A. Descriptive Statistics (continued)

Performance Objectives

1. The student will not be allowed references. The student will identify the relevant population, identify possible samples from that population, and identify appropriate parameters and statistics needed to address a question of interest. Performance will be considered satisfactory if the identified items address the question of interest in a manner consistent with the concepts described in the text. The following content goals are related to this PO : 1, 2, 4, 8, 12, and 15.

2. The student will not be allowed references. The student will identify the type of data and an appropriate method of organizing and summarizing a given set of data. Performance will be considered satisfactory if the type and method identified are appropriate for the data set in a manner consistent with the concepts described in the text. The following content goals are related to this PO : 3, 4, 6, 7, and 18.

3. The student will calculate parameters and statistics. Performance will be considered satisfactory if the values are calculated and the calculation is consistent with the method described in the text. The following content goals are related to this PO : 8, 12, 15, and 18.

4. The student will demonstrate principle and concept understanding. Performance will be considered satisfactory if the principles and concept understanding is demonstrated in a manner consistent with the text. All content goals are related to this PO.

5. The student will solve application problems. Performance will be considered satisfactory if problems are solved in a manner consistent with the text. All content goals are related to this PO.

B. Probability

Content Goals

1. Identify the sample space for a given event.
2. Compare and contrast simple events and compound events.
3. Compare and contrast relative frequency probability and the classical approach.
4. Describe the properties of probabilities.
5. Apply the rule for complementary events.
6. Apply the addition rule for probabilities.
7. Identify mutually exclusive events.
8. Apply the multiplication rule for probabilities.
9. Compare and contrast independent and dependent events.
10. Calculate conditional probabilities.
11. Apply the fundamental counting rule.
12. Apply the factorial counting rule.
13. Apply the permutations rule.
14. Apply the special permutations rule (when some items are identical to others).
15. Apply the combinations rule.

B. Probability (continued)

Performance Objectives

1. The student will not be allowed references. The student will find the sample space and/or the size of the sample space for both simple and compound events. Performance will be considered satisfactory if the sample spaces and/or the sample space sizes are identified in a manner consistent with the text. The following content goals related to this PO : 1, 2, 11, 12, 13, 14, 15.

2. The student will not be allowed references. The student will demonstrate understanding of the types and properties of probabilities. Performance will be considered satisfactory if the understanding is demonstrated in a manner consistent with the text. Content goals 3 and 4 are related to this PO.

3. The student will calculate probabilities for both simple and compound events. Performance will be considered satisfactory if the probabilities are calculated in a manner consistent with the methods described in the text. The following content goals are related to this PO : 5, 6, 7, 8, 9, and 10.

4. The student will demonstrate principle and concept understanding. Performance will be considered satisfactory if the principles and concept understanding is demonstrated in a manner consistent with the text. All content goals are related to this PO.

5. The student will solve application problems. Performance will be considered satisfactory if problems are solved in a manner consistent with the text. All content goals are related to this PO.

C. Probability Distributions

Content Goals

1. Describe the properties of a random variable.
2. Compare and contrast discrete and continuous random variables.
3. Describe the properties and requirements for probability distribution.
4. Calculate the mean and standard deviation for discrete probability distributions.
5. Find the expected value for a discrete random variable.
6. Describe the properties for a binomial probability distribution.
7. Calculate probabilities using the binomial probability formula.
8. Calculate probabilities using the binomial probability tables.
9. Calculate the mean and standard deviation for binomial probability distributions.
10. Describe the properties for a density curve (probability density function).
11. Describe the properties of a standard normal distribution.
12. Calculate probabilities using the standard normal table.
13. Find a value using the standard normal table.
14. Describe the Central Limit Theorem and what it implies.
15. Apply the Central Limit Theorem to calculate probabilities for sample means.

C. Probability Distributions (continued)

Performance Objectives

1. The student will not be allowed references. The student will identify probability distributions. Performance will considered satisfactory if the identification is done in a manner consistent with the method described in the text. The following content goals are related to this PO : 3, 6, and 11.

2. The student will calculate parameters for discrete probability distributions. Performance will be considered satisfactory if the parameters are calculated in a manner consistent with the methods described in the text. The following content goals are related to this PO : 4, 5 and 9.

3. The student will calculate probabilities using probability distributions. Performance will be considered satisfactory if the properties are calculated in a manner consistent with the methods described in the text. The following content goals are related to this PO : 7, 8, 12, 15.

4. The student will demonstrate principle and concept understanding. Performance will be considered satisfactory if the principles and concept understanding is demonstrated in a manner consistent with the text. The following content goals are related to this PO : All content goals are related to this PO.

5. The student will solve application problems. Performance will be considered satisfactory if problems are solved in a manner consistent with the text. All content goals are related to this PO.

D. Inferential Statistics

Content Goals

1. Calculate point and interval estimates for a population proportion.
2. Find the sample size required to estimate the population proportion.
3. Calculate point and interval estimates for a population mean when σ is known.
4. Calculate point and interval estimates for a population mean when σ is unknown.
5. Calculate the sample size required to estimate the population mean.
6. Identify the components of a formal hypothesis test.
7. Test claims about a population proportions.
8. Test claims about a population mean when σ is known.
9. Test claims about a population mean when σ is unknown.

D. Inferential Statistics (continued)

Performance Objectives

1. The student will calculate estimates for various population parameters. Performance will be considered satisfactory if the estimates are calculated in a manner consistent with the methods described in the text. The following content goals are related to this PO : 1, 3, and 4.

2. The student will calculate or find the required sample sizes for estimates of various population parameters. Performance will be considered satisfactory if the sample sizes are calculated or found in a manner consistent with the methods described in the text. The following content goals are related to this PO : 2 and 5.

3. The student will test hypotheses concerning various population parameters. Performance will be considered satisfactory if the tests are performed in a manner consistent with the methods described in the text. The following content goals are related to this PO : 6, 7, 8, and 9.

4. The student will demonstrate principle and concept understanding. Performance will be considered satisfactory if the principles and concept understanding is demonstrated in a manner consistent with the text. All content goals are related to this PO.

5. The student will solve application problems. Performance will be considered satisfactory if problems are solved in a manner consistent with the text. All content goals are related to this PO.

E. Analysis of Paired Data

Content Goals

1. Create a scatter diagram for a set of paired data.
2. Interpret a scatter diagram to identify any possible correlation.
3. Calculate the linear correlation coefficient.
4. Interpret the linear correlation coefficient.
5. Describe the properties of the linear correlation coefficient.
6. Test the linear correlation coefficient for statistical significance.
7. Find the regression equation for a set of paired data.
8. Use the regression equation to make predictions about a set of paired data.
9. Identify the marginal change for a set of paired data.
10. Compare and contrast outliers and influential points.

E. Analysis of Paired Data (continued)

Performance Objectives

1. The student will not be allowed references. The student will create a scatter diagram for a set of paired data and identify any possible correlation between the two variables. Performance will be considered satisfactory if the diagram and interpretation are consistent with methods described in the text. Content goals 1 and 2 are related to this PO.

2. The student will calculate the linear correlation coefficient for a set of paired data, identify any possible correlation between the two variables, and test the calculated value for statistical significance. Performance will be considered satisfactory if the calculation, interpretation, and test are done in a manner consistent with the text. The following content goals are related to this PO : 3, 4 and 6.

3. The student will find the regression equation for a set of paired data, then use that equation to make predictions about a set of paired data. Performance will be considered satisfactory if the equation is found and applied in a manner consistent with the text. Content goals 7 and 8 are related to this PO.

4. The student will demonstrate principle and concept understanding. Performance will be considered satisfactory if the principles and concept understanding is demonstrated in a manner consistent with the text. The following content goals are related to this PO : All content goals are related to this PO.

5. The student will solve application problems. Performance will be considered satisfactory if problems are solved in a manner consistent with the text. All content goals are related to this PO.

Additional Materials

A. Review of Required Math Skills

Decimal Operations

1. a) $0.9 + 0.5 - 0.07$ =

   b) 0.4×0.2 =

   c) $\frac{0.12}{0.04}$ =

   d) $\frac{4.5}{0.5}$

2. a) $5.38 + 0.201 - 1.004$ =

   b) 6.22×0.201 =

   c) $\frac{9.12}{3.4}$ =

   d) $\frac{68.31}{0.02}$ =

Decimals & Percentages

3. Convert to decimal form

   a) 25% =

   b) 1.25% =

   c) 46.7% =

4. Convert to percentages

   a) 0.00015 =

   b) 0.82 =

   c) 0.0307 =

Signed Numbers

5. a) (-2) + 3 + (-6) + (-5) =

   b) (-5) (-1) + (2) (-3) + (-9) (1) =

   c) (-1.45) (-6.88) – (0.625) (18) =

Exponents & Square Roots

6. a) 3^4 =

   b) $(3.14)^2$ =

   c) $\left(\frac{1}{2}\right)^8$ =

   d) $(0.90)^{12}\ (10)^8$

7. a) $\sqrt{9+4}$ =

   b) $\sqrt{9 \times 4}$ =

   c) $\sqrt{\frac{5}{7}}$ =

   d) $\sqrt{\frac{7.22}{0.3}}$ =

A. Review of Required Math Skills (continued)

Order of Operations

8. a) $\dfrac{8\times 56.80 - 14.60\times 26}{7.11\times 12.5}$ =

b) $\sqrt{\dfrac{3}{8}+\dfrac{2}{9}}$ =

c) $\dfrac{0.917}{\sqrt{\dfrac{1-0.917^2}{8-2}}}$

d) $\sqrt{\dfrac{3.4^2}{12}+\dfrac{2.8^2}{10}}$ =

Equations

9. a) Given : $y = m\,x + b$, find y if $b = 5.21$, $m = 0.5$, and $x = 35.0$

b) Given : $y = m\,x + b$, find x if $b = 0$, $m = -1.33$, and $y = 1{,}283$

c) Given : $y = m\,x + b$, find m if $b = -100$, $x = 50$, and $y = -325$

d) Given : $y = m\,x + b$, find b if $m = -8.21$, $x = 1.5$, and $y = 2.45$

Rounding Off

To round off, add 1 to the digit in the place you are rounding to if the next digit is 5 or greater. Otherwise, leave the digit as it is. Drop any digits beyond the place to which you are rounding.

10. a) $\dfrac{8.51-7.00}{0.896}$ = (round off to the 2nd decimal place)

b) $\dfrac{154-143}{\dfrac{5.21}{\sqrt{30}}}$ = (round off to the 4th decimal place)

c) $6.22 + (0.42)(1.563)$ = (round off to the 3rd decimal place)

Significant Digits

Significant digits are counted to the right, starting with the first non-zero digit. For example, 10.250 has 5 significant digits, 0.0103 has 3 significant digits, and 0.007 has only one.

11. a) $(8.76)^3$ = (round off to 4 significant digits)

b) $2.575\left(\dfrac{0.92}{\sqrt{12}}\right)$ = (round off to 3 significant digits)

c) $312 - (2.31)(27.6)$ (round off to 2 significant digits)

B. Review of Summation Notation

Summation Notation : $\sum_{i=1}^{n} x_i = x_1 + x_2 + x_3 + \ldots + x_n$

Σ (Capital Sigma) : a command that tells you to sum (add) a series of numbers

x : addend, a variable representing the numbers to be added

i : index variable, not always shown

n : the number of addends, not always shown

e.g. Suppose we wanted to add the prices of items on a grocery list

The prices are as follows : \$1.99, \$3.29, \$2.09, \$0.69, \$1.15

The prices can be represented as a set : $x_i = \{ 0.69, 1.15, 1.99, 2.09, 3.29 \}$

$x_1 = 0.69$, $x_2 = 1.15$, $x_3 = 1.99$, $x_4 = 2.09$, $x_5 = 3.29$, and $n = 5$

$$\sum_{i=1}^{5} x_i = 0.69 + 1.15 + 1.99 + 2.09 + 3.29 = \$9.21$$

Sum of Squares : $\sum_{i=1}^{n} x_i^2 = x_1^2 + x_2^2 + x_3^2 + \ldots + x_n^2$ (square each term first, then sum)

e.g. $x_i = \{ 0, 1, 2, 3, 4, 5 \}$

$$\sum x^2 = 0^2 + 1^2 + 2^2 + 3^2 + 4^2 + 5^2 = 55$$

Square of the Sum : $\left(\sum_{i=1}^{n} x_i \right)^2 = (x_1 + x_2 + x_3 + \ldots + x_n)^2$ (sum first, then square the total)

e.g. $x_i = \{ 0, 1, 2, 3, 4, 5 \}$

$$\left(\sum x\right)^2 = (0 + 1 + 2 + 3 + 4 + 5)^2 = 15^2 = 225$$

note : $\sum x^2 \neq \left(\sum x\right)^2$

Sum of Products : $\sum_{i=1}^{n} x_i y_i = x_1y_1 + x_2y_2 + x_3y_3 + \ldots + x_ny_n$ (multiply first, then sum)

e.g. $x = \{ 0, 1, 2, 3, 4 \}$ $y = \{ 2, 2, 3, 5, 7 \}$

$$\sum xy = (0 \times 2) + (1 \times 2) + (2 \times 3) + (3 \times 5) + (4 \times 7)$$

$$\sum xy = 0 + 2 + 6 + 15 + 28 = 51$$

B. Review of Summation Notation (continued)

Product of Sums : $\sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i = (x_1 + x_2 + x_3 + \ldots + x_n) \times (y_1 + y_2 + y_3 + \ldots + y_n)$

e.g. $x = \{ 0, 1, 2, 3, 4 \}$ $y = \{ 2, 2, 3, 5, 7 \}$

$\sum x \sum y = (0 + 1 + 2 + 3 + 4) \times (2 + 2 + 3 + 5 + 7)$

$\sum x \sum y = 10 \times 19 = 190$

note : $\sum xy \neq \sum x \sum y$

Summation Rules :

$$\sum_{i=1}^{n} (x_i \pm y_i) = \sum_{i=1}^{n} x_i \pm \sum_{i=1}^{n} y_i$$

e.g. $x = \{ 0, 1, 2, 3, 4 \}$ $y = \{ 2, 2, 3, 5, 7 \}$

$\sum (x + y) = (0+2) + (1+2) + (2+3) + (3+5) + (4+7) = 2+3+5+8+11 = 29$

$\sum x + \sum y = (0 + 1 + 2 + 3 + 4) + (2 + 2 + 3 + 5 + 7) = 10 + 19 = 29$

$\sum (x - y) = (0-2) + (1-2) + (2-3) + (3-5) + (4-7) = -2 + -1 + -1 + -2 + -3 = -9$

$\sum x - \sum y = (0 + 1 + 2 + 3 + 4) - (2 + 2 + 3 + 5 + 7) = 10 - 19 = -9$

$$\sum_{i=1}^{n} cx_i = c \sum_{i=1}^{n} x_i$$ where c is a constant

e.g. $x = \{ 0, 1, 2, 3, 4 \}$

$\sum 3x = (3 \times 0) + (3 \times 1) + (3 \times 2) + (3 \times 3) + (3 \times 4) = 0+3+6+9+12 = 30$

$3 \sum x = 3 \times (0 + 1 + 2 + 3 + 4) = 3 \times 10 = 30$

C. Descriptive Statistics Review Problems

1. Define the following terms and variables :

a. population	e. n	i. σ
b. sample	f. $\bar{x}$	j. s^2
c. parameter	g. μ	k. s
d. statistic	h. σ^2	l. P_{20}

2. Identify each of the following as qualitative, discrete quantitative, or continuous quantitative data. Also identify the level of measurement used (nominal, ordinal, interval, or ratio).

   a. The hair color of children auditioning for a part in a commercial.
   b. The number of stop lights between Pemberton and Mt. Laurel.
   c. The length of time required for a wound to heal when trying a new medicine.
   d. The birth year of job applicants.
   e. The answers to a survey question “strongly agree, agree, disagree, strongly disagree”.

3. The speeds of 55 cars measured on a city street were as follows :

27	23	22	38	43	24	35	26	28	18	20
25	23	22	52	31	30	41	45	29	27	43
29	28	27	25	29	28	24	37	28	29	18
26	33	25	27	25	34	32	36	22	32	33
21	23	24	18	48	23	16	38	26	21	23

   a. Construct a frequency distribution table for the data set using 8 classes.
   b. Add a column giving the relative frequency for each class.
   c. Add a column giving the cumulative frequency for each class.
   d. Is the data skewed to the left, skewed to the right, or symmetric?

4. Fifteen people were asked the number of hours they slept last night, and the responses are listed below :

   5, 6, 6, 8, 7, 7, 9, 5, 4, 8, 11, 6, 7, 8, 7

   a. Calculate the mean, median, mode, and midrange.
   b. Estimate the standard deviation using the range rule of thumb.
   c. Calculate the sample variance and the sample standard deviation.
   d. How many standard deviations from the mean is 12?
   e. Find P_{10} and Q_1.
   f. Find the percentile rank of 10.

5. A new brand of car tires had a mean mileage of 30,000 miles with a standard deviation of 2,500 miles.

   a. What are the minimum and maximum “usual” values for the tire mileages?

   b. Would it be unusual for a tire to last 28,500 miles?

   c. Would it be unusual for a tire to last 37,000 miles?

D. Probability Review Problems

1. Identify each of the following as simple or compound events. Also identify the size of the sample space.

    a. Draw one marble from a box that contains one red, one green, and one yellow marble.
    b. Roll a pair of dice and observe the sum of the dots.
    c. Choose 3 volunteers from a squad of 12 soldiers.
    d. Vote for one of 6 candidates running for office.
    e. Choose a restaurant and a movie from 5 available restaurants and 16 available movies.

2. The probability of a certain event = _____ .

3. The probability of an impossible event = _____ .

4. Identify each of the following as independent or dependent.

    a. Rolling a pair of dice and observing a "1" on the first die and a "1" on the second die.
    b. Rolling a pair of dice and observing a "2" on one of the dice and having a "total of 10".
    c. Drawing a "heart" from a standard deck of cards, and drawing a second one without replacement.
    d. Drawing a "heart" from a standard deck of cards, and drawing a second one with replacement.
    e. Studying for an exam and passing an exam.

5. Given : $P(A) = 0.3$, $P(B) = 0.4$, and $P(A \text{ and } B) = 0.10$.

    a. Are A and B independent
    b. Are A and B mutually exclusive?
    c. Find $P(B \mid A)$
    d. Find $P(\overline{A})$
    e. Find $P(A \text{ or } B)$
    f. Find $P(A \mid B)$

6. A certain genetic trait is associated with eye color. A sample of 300 people yields the following results :

Trait?	Blue Eyes	Brown Eyes	Green	Total
Yes	70	30	20	120
No	20	110	50	180
Total	90	140	70	300

    a. What is the probability a randomly selected person has blue eyes?
    b. What is the probability a randomly selected person has brown eyes or has the trait?
    c. What is the probability a randomly selected person has the trait, given that they have brown eyes?
    d. If 2 people are randomly selected, what is the probability both have green eyes?

7. A group of 12 students are randomly selected to take a new computer class being offered for the first time. If 20% of all BCC Students are full-time, find the probability at least one of them is full-time.

8. A student driving to Florida for Spring Break has 12 CDs to choose from to listen to in the car on the trip.

    a. If the student chooses a play list of just 10 discs, how many sequences are possible?
    b. If the student chooses 8 discs to take, how many different groups of 8 are possible?
    c. How many orders are possible if all 12 discs are played?

E. Probability Distributions Review Problems

1. Given the following probability distribution…

x	P(x)
1	0.12
2	0.18
3	0.28
4	0.42
Σ	1.00

a. Find the mean

b. Find the variance

c. Find the standard deviation

2. Ninety percent of trees planted by a landscaping company survive.

   a. What is the probability that exactly 5 out of 10 planted trees survive?
   b. What is the probability that at least 8 out of 10 planted trees survive?
   c. If a company plants 25 trees in a week, what is the probability that 20 of them survive?

3. Find the mean and the standard deviation for each of the following binomial random variables :

   a. the number of "tails" seen on 25 flips of a balance coin
   b. the number of "ones" seen in 50 rolls of a fair die
   c. the number of broken eggs in a dozen, if 5% of all eggs break during transit

4. Given a standard normal distribution with a mean of 0 and a standard deviation of 1…

   a. What is the probability a randomly selected value has a z-score less than +1.65?
   b. What is the probability a randomly selected value has a z-score more than +0.37?
   c. What is the probability a randomly selected value has a z-score between –2.09 and –0.55?

5. An electronic scale used by a grocery is inaccurate, so the average weight for "one pound" fruit is 15.25 ounces with a standard deviation of 0.55 ounces. The weights fit a normal distribution.

   a. What is the probability the scale reads over 16 ounces for "one pound"?
   b. What is the probability the scale reads under 14 ounces for "one pound"?
   c. What is the probability the scale reads between 14.5 and 16.5 ounces for "one pound"?

6. The finishing times for a local marathon were normally distributed with a mean of 270 minutes and a standard deviation of 35.6 minutes.

   a. What is the 25^{th} percentile for this data set?
   b. What is the percentile corresponding to a finishing time of 300 minutes?
   c. What is the percentile corresponding to a finishing time of 240 minutes?

7. Scores for a statistics quiz are normally distributed with a mean of 72.9 and a standard deviation of 9.83.

   a. What is the probability one student scores between 90 and 100?
   b. What is the probability a class of 30 students get an average score above 90?

F. Inferential Statistics Review Problems

1. The lengths of 100 fish caught from a nearby stream have a mean length of 6.25 inches and a standard deviation of 1.06 in. Find the 95% confidence interval for the population mean length.

2. According to a recent survey of 15 ski instructors, their average teaching income last year was $4500 with a standard deviation of $750. If the incomes are normally distributed, find the 99% confidence interval for the population mean teaching income.

3. In an opinion survey, 200 randomly selected office assistants were polled. It was found that 68% of the poll participants felt they were being overworked. Construct the 90% confidence interval estimate of the percentage of office assistants who feel they are overworked.

4. An amusement park wants to estimate the number of years they retain employees. How large a sample needs to be taken to estimate the true population mean within 0.125 years with 90% confidence? A prior study indicates the standard deviation is 1.0 years.

5. A movie rental chain is considering a reduction in rental fees. Before making a final decision, management wants to estimate the percentage of its customers who would rent more movies if the prices were lower. How many customers should they survey? Assume they want 99% confidence the estimate is within 4 percentage points of the true population proportion.

6. Accuracy of clocks and watches can be measured in terms of how many seconds they lose in a month. A watch company claims their watches have an average accuracy of 10.8 seconds. A sample of 50 of the company's watches yields an average accuracy of 15.3 seconds. Assuming the population standard deviation is 5.31 seconds, use the sample to test the company's claim at the 0.01 significance level.

7. A frozen food company claims their dinners contain less than 5 grams of fat per serving. Laboratory tests of 12 of the dinners result in an average of 4.75 grams with a standard deviation of 0.95 grams. Assuming the fat contents are normally distributed, test the company's claim at the 0.05 significance level.

8. In a survey of 1200 pet owners, 26% say they would consider having their pet cloned if their pet should die. Use a 0.10 significance level to test the claim that over one-fourth of all pet owners would consider cloning their pets.

G. Analysis of Paired Data Review Problems

1. For each of the 3 pairs of data listed below :

   a. Construct a scatter diagram.
   b. Identify the type of correlation which may exist (positive, negative, or no correlation)
   c. Calculate the correlation coefficient.
   d. Test the correlation coefficient for statistical significance.

Data Set 1

x	y
8	31
9	25
9	40
10	27
11	35
9	29
9	25
9	34
11	27
11	36

Data Set 2

x	y
2.5	40
3.0	43
4.0	30
3.5	35
2.7	42
4.5	19
3.8	32
2.9	39
5.0	15
2.2	44

Data Set 3

x	y
12	7
6	5
9	10
15	14
11	12
15	9
8	6
16	11
12	11
6	8

2. The weight, city mileage, and highway mileage are listed below for 6 models of domestic cars :

Weight (lbs.)	City Mileage (mpg)	Highway Mileage (mpg)
2948	23	31
3536	19	27
3472	19	27
2782	20	29
3766	14	21
4367	16	25

   a. Find the regression equation using the weight for x and the city mileage for y.
   b. Use the regression equation from part (a) to estimate the city mileage for a car weighing 3500 lbs.
   c. Find the regression equation using the city mileage for x and the highway mileage for y.
   d. Use the regression equation from part (c) to estimate the highway mileage for a car that gets 22 mpg city mileage.

H. Solutions

Review of Required Math Skills

1a. 1.33
b. 0.08
c. 3
d. 9

2a. 4.577
b. 1.25022
c. 2.68235…
d. 3415.5

3a. 0.25
b. 0.0125
c. 0.467

4a. 0.015%
b. 82%
c. 3.07%

5a. -10
b. -10
c. -1.274

6a. 81
b. 9.8596
c. 0.00390625
d. 28242953.65

7a. 3.6055…
b. 6
c. 0.8451…
d. 4.9057…

8a. 0.8416…
b. 0.7728…
c. 5.6311…
d. 1.3218…

9a. 22.71
b. -964.66…
c. -4.5
d. 14.765

10a. 1.69
b. 11.5642
c. 6.876

11a. 672.2
b. 0.684
c. 250

Descriptive Statistics

1a. The complete collection of the elements to be studied.
b. A subset of elements drawn from a population.
c. A numerical measure describing a population characteristic.
d. A numerical measure describing a sample characteristic.
e. sample size
f. sample mean
g. population mean
h. population variance
i. population standard deviation
j. sample variance
k. sample standard deviation
l. 20th percentile

2a. qualitative, nominal
b. discrete quantitative, ratio
c. continuous quantitative, ratio
d. discrete quantitative, interval
e. qualitative, ordinal

3a.

speed	frequency	relative	cumulative
16-20	5	0.091	5
21-25	17	0.309	22
26-30	16	0.291	38
31-35	7	0.127	45
36-40	4	0.073	49
41-45	4	0.073	53
46-50	1	0.018	54
51-55	1	0.018	55

d. Skewed Right

4a. mean = 6.9, median = 7, mode = 7, midrange = 7.5
b. standard deviation ≈ (11 - 4)/4 = 1.8
c. variance = 3.1, standard deviation = 1.8
d. z = (12 – 6.9) / 1.8 = 2.83s above the mean
e. $P_{10} = 5$, $Q_1 = 6$
f. 93rd percentile

5a. minimum = 30,000 – 2*2,500 = 25,000
Maximum = 30,000 + 2*2500 = 35,000
b. minimum < 28,500 < maximum, so it is not unusual
c. 37,000 > maximum, so it would be unusually high

Probability

1a. Simple event n = 3
b. Compound event n = 36
c. Compound event n = 220
d. Simple event n = 6
e. Compound event n = 80

2. P(certain) = 1 = 100%

3. P(impossible) = 0 = 0%

4a. Independent
b. Dependent
c. Dependent
d. Independent
e. Dependent

5a. No (dependent)
b. No
c. 0.333
d. 0.7
e. 0.6
f. 0.25

6a. P(blue) = 90/300 = 0.3
b. P(brown or yes) = (140 + 120 – 30) / 300 = 0.767
c. P(yes | brown) = 30/140 = 0.214
d. P(2 brown) = (140/300)(139/299) = 0.217

7. P(at least 1) = 1 – P(none) = 1 – (0.80)^{12} = 0.931

8a. ${}_{12}P_{10}$ = 239,500,800
b. ${}_{12}C_{8}$ = 495
c. 12! = 479,001,600

H. Solutions (continued)

Probability Distributions

1a. mean = 3.0
b. variance = 1.1
c. standard deviation = 1.0

2a. Using binomial formula : P(5) = 0.00149
Using Table A-1 : P(5) = 0.001
b. P(at least 8) = P(8) + P(9) + P(10) = 0.93
Using Table A-1 : 0.194 + 0.387 + 0.349 = 0.930
c. Using binomial formula : P(20) = 0.0646

3a. mean = 12.5 standard deviation = 2.5
b. mean = 8.3 standard deviation = 2.6
c. mean = 0.6 standard deviation = 0.8

4a. P(z < 1.65) = 0.9505
b. P(z > 0.37) = 1 – 0.6443 = 0.3557
c. P(-2.09 < z < -0.55) = 0.2912 – 0.0183 = 0.2729

5a. P(x > 16) = 1 – 0.9131 = 0.0869
b. P(x < 14) = 0.0116
c. P(14.5 < x 16.5) = 0.9884 – 0.0869 = 0.9015

6a. P_{25} = 246.148
b. 300 ≈ 80 th percentile (0.7995)
c. 240 ≈ 20 th percentile (0.2005)

7a. P(90 < x < 100) = 0.9971 – 0.9591 = 0.0380
b. P($\overline{x}$ > 90) = 1 – 0.9999 = 0.0001

Inferential Statistics

1. 6.04 in. < μ < 6.46 in.

2. $3,924 < μ < $5,076

3. 0.626 < p < 0.734

4. n = 174

5. n = 1037

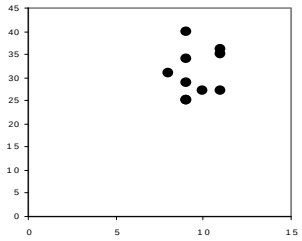
6. z critical = ±2.575, z test = 5.992
p-value = 2 * 0.0001 = 0.0002

7. t critical = –1.796, t test = –0.912
Using Table A-3 : p-value > 0.10
Using TI-83 : p-value = 0.191

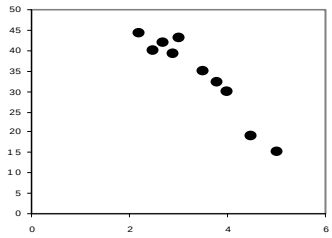
8. z critical = +1.282, z test = 0.80
p-value = 1 – 0.7881 = 0.2119

Analysis of Paired Data

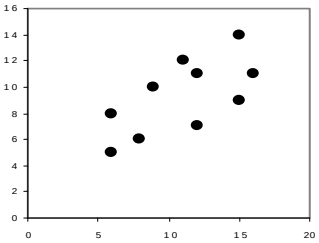
1. Data Set 1 r = 0.132, which is not significant



Data Set 2 r = –0.959, which is significant at the 0.01 level



Data Set 3 r = 0.661, which is significant at the 0.05 level



2a. y = –0.00422 x + 33.1
b. y = –0.00422 (3500) + 33.1 = 18.3 mpg
c. y = 1.07 x + 6.86
d. y = 1.07 (22) + 6.86 = 30.4 mpg

MTH 107 - Project 1 **Due Date: Monday, September 27, 2010**

This project will give you the opportunity to apply the analysis methods of descriptive statistics to sets of data. You will collect data, analyze data, and write a project report.

Complete the following :

1. In paragraph form, describe your first topic. You may choose any topic you wish as long as it involves **quantitative** data (numbers) of some kind; however you may not use age for your data. Identify the relevant population relating to your topic. Next, obtain data in order to address your question of interest. Collect a sample related to your question of interest where the sample size (n) is 40 or more by conducting a survey. Remember, the data must be **quantitative** as the term is defined in the text, so for whatever survey question you ask, the answer must be a number. In paragraph form, describe how you obtained your data. Include the phrasing of the question you asked, who you asked (e.g. friends, family, coworkers, etc.), and how you asked (e.g. surveyed a class, chat, email, etc.). If you are unsure as to whether or not your data is **quantitative**, please contact me for help.

2. For your quantitative data
   a. Provide a list of your data sorted in ascending order. This should be a list of at least 40 numbers.
   b. Create a frequency distribution table using at least 5 classes (see pages 47 & 48).
      Show the class limits, class frequencies, relative frequencies, and cumulative frequencies.
   c. Create a histogram using the class frequencies from part (b) (see Chapter 2-3).
   d. Create an ogive using the cumulative frequencies from part (b) (see page 61).
   e. In paragraph form, describe what you have found and write any conclusions you could draw based on the sample you have collected and analyzed.

3. In paragraph form, describe your second topic. You may choose any topic you wish as long as it involves **qualitative** data (categories) of some kind. Identify the relevant population relating to your topic. Collect a sample related to your question of interest where the sample size (n) is 40 or more and there are **at least 4 different categories**. Again, you must obtain your data by conducting a survey. In paragraph form, describe how you obtained your data. Include the phrasing of the question you asked, who you asked (e.g. friends, family, coworkers, etc.), and how you asked (e.g. surveyed a class, chat, email, etc.). If you are unsure as to whether or not your data is **qualitative**, please contact me for help.

4. For your qualitative data
   a. Summarize your data in a table.
      Include one column for the category, one for the frequency, and one for the relative frequency.
   b. Create a Pareto Chart (see page 63)
   c. Create a Pie Chart.
      You must use a computer program such as Excel or Statdisk, handwritten pie charts are not acceptable.
   d. In paragraph form, describe what you have found and write any conclusions you could draw based on the sample you have collected and analyzed.

Your report should be typed and neatly organized. Sharing data or working in groups is NOT allowed. Your report must be turned in on the due date listed at the top of this page. Late reports will be penalized 15 points initially, then an additional 10 points each day beyond the due date.

MTH 107 - Project 2 **Due Date: Monday, November 8, 2010**

This project will give you the opportunity to apply the analysis methods of descriptive statistics to sets of data. You will also collect data, analyze data, and write a project report.

Complete the following :

1. In paragraph form, describe your topic. You may choose any topic you wish as long as it involves **quantitative** data (numbers) of some kind; however you may not use age for your data. Identify the relevant population relating to your topic.

2. Next, obtain data in order to address your question of interest. Collect **two** samples related to your question of interest where the sample size (n) is 40 or more for each sample. One sample should represent one characteristic of your population, while the other sample represents a corresponding aspect, however, the data you collect for each sample must measure the same variable. For example, ask 40 men and 40 women how much they weigh, or ask 40 smokers and 40 nonsmokers how many minutes per week they exercise. The purpose of this is to allow you to compare values in the two different groups in your population and determine if they groups differ. You must obtain your data by conducting a survey. In paragraph form, describe how you obtained your data. Include the phrasing of the question you asked, who you asked (e.g. friends, family, coworkers, etc.), and how you asked (e.g. surveyed a class, chat, email, etc.). If you are unsure as to whether or not your data is **quantitative**, please contact me for help.

3. a. Provide lists of your data sorted in ascending order. This should be 2 lists of at least 40 numbers each.

   FOR BOTH SAMPLES

   b. Calculate the mean, median, and mode using the methods described in Chapter 3-2.

   c. Create a frequency distribution table using at least 5 classes (see pages 47 & 48).
   Show the class limits, class frequencies, relative frequencies, and cumulative frequencies.

   d. Calculate the range, and then use the range rule of thumb to estimate the standard deviation
   See pages 104 & 105.

   e. Calculate the standard deviation and the variance from the original data.
   Use either Formula 3-4 or 3-5 for the standard deviation calculation.

   f. Use the mean from part 3b and the standard deviation from part 3e to find the minimum and maximum "usual" values (see pages 104 & 105).

   g. Find the 5 number summary (see page 121).

4. Create a boxplot for the two samples. See the boxplots in section 3-4 for examples.

5. In paragraph form, describe what you have found and write your conclusions based on your samples and the analyses you have performed. Be sure to comment on any similarities and/or differences between the samples and explain why they exist.

Your report should be typed and neatly organized. Sharing data or working in groups is NOT allowed. Your report must be turned in on the due date listed at the top of this page. Late reports will be penalized 15 points initially, then an additional 10 points each day beyond the due date.

MTH 107 - Project 3 **Due Date: Monday, December 13, 2010**

This project will give you the opportunity to apply the analysis methods of inferential statistics to sets of data. You will also collect data, analyze data, and write a project report.

Complete the following :

1. In paragraph form, describe your topic. Your topic must involve a quantitative random variable (numbers), and a binomial random variable ("yes/no" question). For example, if you were interested in student performance, you could use GPA for the quantitative variable, and whether they work full-time as the binomial variable. Identify the relevant population relating to your topic.

2. Formulate hypotheses about the value of the population parameters of interest (See Chapters 8-1 & 8-2).

   First, propose a hypothesis about the proportion for people who will say "yes" to your binomial question. Your hypothesis must contain only one number. For example "at least 25% will say yes", "more than 30% will say yes", or "15% will say yes" are acceptable, "between 10% and 30% will say yes" is not acceptable.

   Next, propose a hypothesis about the population mean of your quantitative data. Your hypothesis must contain only one number. For example "the average is at most 3.0", "the average is under 2.5" are acceptable, or "the average is not 4.0" are acceptable, "the average is between 0.5 and 4.0" is not acceptable.

   You will test both hypotheses using the data you will collect.

3. Obtain data in order to address your question of interest. You will need to poll at least 40 people, asking two questions: a yes/no (binomial) question, and a question that yields a number (<u>you may not use age</u> for your data). For example you could ask, "Do you work full-time and what is your GPA?" In paragraph form, describe how you obtained your data. Include the phrasing of the question you asked, who you asked (e.g. friends, family, coworkers, etc.), and how you asked (e.g. surveyed a class, chat, email, etc.). Include a list of the values for the quantitative data <u>sorted in ascending order</u> in your project report.

4. For the binomial (yes/no) data
   a. Calculate the proportion who answered "yes" and the proportion who answered "no."
   b. Calculate the 95% Confidence Interval for the proportion who answered "yes" (see page 333). Be sure to show both limits for the interval.
   c. Use your survey results and the p-value method to test the hypothesis for the proportion you proposed in Part 2. Show work for all steps including the formulas you use. Use $\alpha = 0.05$ (see Chapter 8-3 and page 414).

5. For the quantitative sample
   a. Calculate the sample mean and the sample standard deviation (see Chapter 3)
   b. Calculate the 95% Confidence Interval for the population mean (see Chapter 7-4). Be sure to show both limits for the interval.
   c. Use your survey results and the traditional method to test the hypothesis for the mean you proposed in Part 2. Show work for all steps including the formulas you use. Use $\alpha = 0.05$ (see Chapter 8-5).

6. In paragraph form, describe what you have found and write your conclusions based on your sample and the analyses you have performed.

Your report should be <u>typed and neatly organized</u>. You may perform your analysis using a computer, or you may do it by hand. In either case, all work must be shown, and it must be neat and organized. Sharing data or working in groups is NOT allowed. Your report must be turned in on the due date listed at the top of this page. Late reports will be penalized 15 points initially, then an additional 10 points each day beyond the due date.