

# Economics 310 – WIP: Business and Economics Statistics II

## Syllabus

updated: 8/25/14 7:04 PM

1	Basic Information.....	2
2	Policies.....	2
3	Proposed Schedule.....	5
4	Consulting Report Guidelines .....	6
4.1	Report One: Powerband Bracelet Co.....	6
4.2	Report Two: Gender Paradox.....	9
4.3	Report Three: Game of Authorship.....	12
4.4	Report Four: Statistics of Art .....	16
4.5	Optional Report: Classification.....	19
5	Informal Writing Guidelines.....	21
6	Formal Writing Evaluation Criteria.....	23

*We are drowning in information and starving for knowledge.*

-R. D. Roger

## 1 Basic Information

Classroom	Fine Arts Center 108
Class Times	August 26, 2014 – December 4, 2014 TR 5:40 pm - 6:55 pm
Contact Info.	r-schwinn@neiu.edu (773) 442 – 5699
Exam	Tuesday, October 14 <sup>th</sup>
Instructor	Richard Schwinn
Notable Dates	November 27 – 30      Thanksgiving Holiday
Office	TBA
Office Hours	TR 3:00 pm – 5:30 pm
Text	None
Webpage	<a href="http://neiuport.neiu.edu">http://neiuport.neiu.edu</a> (follow the desire2learn link)

## 2 Policies

Academic Integrity	Students must adhere to the university's student conduct policies. Any behavior that systematically disrupts the learning of other students will not be tolerated.				
Assessment	Attendance	+ Exam	+ Other	+ Reports	→ Grade
	10%	+ 20%	+ 10%	+ 60%	= 100%
	A 100-90%	B 89-80%	C 79-70%	D 69-60%	
Assignment Attendance	There will be one assignment due October 9 <sup>th</sup> . (Max: 5%) Attendance and participation will be taken into account. Each student begins with 100 points. If a student is not present when				

## Economics 310 – WIP: Business and Economics Statistics II

I call their name in class, I deduct 10 points from their participation grade. Each student is allowed up to three class exemptions. (Max: 10%)

### Course Description

Economics 310 – WIP: Business and Economics Stats II 3 Cr.  
This course is a continuation of ECON-220. Topics to be covered include analysis of variance, multiple regression and correlation, time series analysis, nonparametric tests, and decision theory with computer applications. Prerequisites: ECON 215, ECON 217, ECON-220, and ENG 101 with a grade of C or better.

This course has been approved as a Writing Intensive course as part of the Writing Intensive Program (WIP). Successful completion of this course fulfills the Writing Intensive graduation requirement for Economics majors who entered the University in Fall 2008 or later. Speak to your advisor or visit <http://www.neiu.edu/~wip> for more information.

### Course Objectives

Students will

- develop a deeper awareness of the many applications of their technical knowledge in business
- create several professional consulting reports that aim to solve business problems by employing the statistical tools learned in the course
- state and explain the Law of Large Numbers (averages tend to the true mean) and the Central Limit Theorem (large sums of RVs have a normal distribution)
- use z-scores, t-statistics, and  $\chi^2$  statistics to test statistical hypotheses
- detect and explain Simpson's Paradox
- detect, measure, and judge the relevance of observed relationships between a single output variable and multiple input variables (regression)

### Exam

The exam will be held October 14<sup>th</sup> during the usual class time. (Max: 25%)

### Extra Credit

Extra credit in the form of “bonus points”, for participation in discussions and solutions to in-class problems and team challenges, will be offered generously throughout every class.

<b>Formal Writing</b>	You will write four formal consulting reports worth 15% each. Detailed information on these assignments can be found in this syllabus. (Max: $15\% \times 4 = 60\%$ )
<b>Informal Writing</b>	You will write several informal “Theory Reflections” in class worth varying amounts. In sum these reflection papers will make up 10% of your grade. Detailed information on these assignments can be found in the Informal Writing Assignments handout posted on D2L. Additionally, in-class, minute papers exploring the most recent topics covered in the course are scheduled weekly. (Max: 5%)
<b>Method of Instruction</b>	This course is built around writing assignments. Lectures (with class participation), in-class exercises, small and large group discussions, out-of-class projects and active on-line participation through D2L are all used to develop students’ ability to both solve statistical business problems and to relate their solutions and methodologies in clear and precise English. This is a writing intensive course. Writing (including effective and correct English expression) is a major component of the course requirements and active instruction in writing is given throughout the course.
<b>Optional Assignment</b>	One optional and more difficult 5 <sup>th</sup> formal writing assignment worth 20% of the overall grade is offered to replace a basic formal writing assignment of the student’s choosing. The optional assignment is solely intended for top students who seek to distinguish themselves. Class time will not be devoted to explaining this assignment. (Max: 20%)

Students with special needs are invited to contact me.

### 3 Proposed Schedule

DAYS	DATES	TOPICS & EVENTS
Tuesday	8/26/2014	Introduction & Hypothesis Testing
Thursday	8/28/2014	
Tuesday	9/2/2014	$Z, t, X^2, F$
Thursday	9/4/2014	
Tuesday	9/9/2014	Nature of Econometrics
Thursday	9/11/2014	
Tuesday	9/16/2014	Simple Regression Analysis
Thursday	9/18/2014	
Tuesday	9/23/2014	Residual Statistics
Thursday	9/25/2014	
Tuesday	9/30/2014	Multiple Regression
Thursday	10/2/2014	
Tuesday	10/7/2014	More Statistical Tools & Assignment 1 (10/9)
Thursday	10/9/2014	
Tuesday	10/14/2014	Exam One (10/16)
Thursday	10/16/2014	
Tuesday	10/21/2014	Writing Workshop & Report 1 Draft (10/21)
Thursday	10/23/2014	
Tuesday	10/28/2014	Writing Workshop & Report 1 Final (10/28)
Thursday	10/30/2014	
Tuesday	11/4/2014	Writing Workshop & Report 2 Draft (11/4)
Thursday	11/6/2014	
Tuesday	11/11/2014	Writing Workshop & Report 2 Final (11/11)
Thursday	11/13/2014	
Tuesday	11/18/2014	Writing Workshop & Report 3 Draft (11/18)
Thursday	11/20/2014	
Tuesday	11/25/2014	Writing Workshop & Report 3 Final (11/25)
Thursday	11/27/2014	
Tuesday	12/2/2014	Writing Workshop & Report 4 Final (12/4)
Thursday	12/4/2014	

## 4 Consulting Report Guidelines

### 4.1 Report One: Powerband Bracelet Co.

#### 4.1.1 Task

The Powerband Bracelet Company (PBC<sup>1</sup>) has approached you as an outside consultant to create and implement statistical tests for measuring certain aspects of their product. Your report will be used as a reference and training handbook for future employees.

#### 4.1.2 Analytical Problem

In 2013, PBC created the Powerband (PB). The PB is a bracelet claimed to make one better, faster, stronger, and smarter. PBs contain magnets ranging from 10 grams to 100 grams in weight. The 50-gram bracelet is their most popular line. PBC wants you to perform statistical analyses to answer the following questions:

- How *sure* can PBC be that the 50 gram bracelet contains at least 50 grams of magnet?
- Due to the PB's inexplicable popularity, PBC is considering manufacturing the bracelet in a second factory. Variability in the magnet content of bracelets can lead to waste and customer dissatisfaction. How can PBC tell if the production process at the new factory is significantly more variable than the process at the original factory? How sure can they be of this result?
- The price strategist thinks that PBC can charge significantly more for PBs with larger magnets if it can be shown that it's mysterious strength enhancing effects grow stronger with the size of the magnet. The company collected strength data on randomly selected subjects before and after wearing the bracelet for one month. How many more pounds can one lift

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<sup>1</sup> This is a fictitious company. Any resemblance to any existing companies is pure coincidental.

for every additional 10 grams of magnet in their bracelet? How sure can they be of this result?

- Similarly, the company collected data on students GPAs before and after wearing their PBs for one semester. How much does each 10 gram increment of additional magnet increase GPAs? How sure can they be of this result?

#### **4.1.3 Audience**

Your audience is the future full-time analyst PBC plans to hire. You can assume they are recruiting an economics major with a limited background in statistics. You must thoroughly explain the statistics you use and define each equation you estimate with regression. This includes but is not limited to describing the theoretical calculation and background of each statistic.

#### **4.1.4 Purpose**

There are several purposes for assignment:

- To offer you practice using several statistical tools.
- To teach you to write mathematical expressions in word processing software.
- To help you synthesize statistical knowledge in a way that can be shared with non-statisticians.
- To offer another opportunity to prepare a consulting report.

#### **4.1.5 Due Dates**

Draft #1	10-21
Completed Report	10-28

All parts of this assignment must be submitted online before class begins on the due date.

#### **4.1.6 Format**

Your report is expected to adhere to the following guidelines:

1. Report must include four sections entitled
  - Methodology,
  - Analysis,
  - Conclusion, and
  - Appendix.
2. All references, calculations, and statistical software output must appear in the appendix.
3. The draft must be submitted in Microsoft Word format.
4. The final version must be submitted PDF format.
5. All statistical sophistry must be relegated to the appendix, including programming code, data, output, logs, etc.
6. Include page numbering and consistent formatting for all fonts, charts, tables, margins, etc.
7. Paper must be a minimum of 4 pages and no longer than 10 pages

#### **4.1.7 Evaluation**

Your first draft will be graded, commented on, and returned to you. You will have one week to revise and submit a second draft for a higher grade. Only the last submitted paper will be factored into your grade. See the evaluation criteria handout for more details.



## 4.2 Report Two: Gender Paradox

### 4.2.1 Task

You are approached by the HR department of your firm to help solve the analytical problem described below. You are to write a report on the situation that will be shared with HR, Legal, and the Executive Board. Since you won't be able to explain any jargon or sophisticated statistics you must assume your audience has no more than a Business Statistics I background in the body of the document. All statistical sophistry must be relegated to the appendix, including programming code, data, output, logs, etc.

### 4.2.2 Analytical Problem

In 2013 and 2014 the firm only accepted applications from outside the company for two jobs: White Collar and Blue Collar. HR is worried that they will be accused of gender discrimination based on the following hiring data set to be released to the public in April.

% Accepted in 2013			% Accepted in 2014	
	B.C.	W.C.		TOTAL
MALE	50%	5%	MALE	45%
FEMALE	60%	8%	FEMALE	10%

HR has specifically asked that you answer the following questions in your report

- (1) HR personnel report that they don't remember the 2013 recruitment being different from the 2014 recruitment.
  - a. Could it be that the data were the same in both years? This is to say, can you show that gender discrimination did not increase in 2010.
  - b. If your answer is yes, explain the mathematics underlying this phenomenon.

- c. Provide an example of data that satisfies the ratios across jobs and gender.
  - d. (BONUS) If such data does exist, can you define the ratios (in terms of Blue Collar to White Collar applications) that they must satisfy?
- (2) What other information should the department release to mitigate any accusations of discrimination?
  - (3) How can what's happened be averted in the future?
  - (4) How can what's happened be explained to others in the company?

#### **4.2.3 Audience**

Your audience for this assignment is comprised of HR, Legal, and the Executive Board of a Fortune 500 company. Don't forget that their statistical background is limited!

#### **4.2.4 Purpose**

There are several purposes for assignment:

- To introduce an important statistical paradox
- To help you synthesize statistical knowledge in a way that can be shared with non-economists and non-statisticians.
- To emphasize clarity in your writing.
- To offer another opportunity to prepare a consulting report.

#### **4.2.5 Due Dates**

Draft #1	11-4
Completed Report	11-11

All parts of this assignment must be submitted via email before class begins on the due date.

#### **4.2.6 Format**

Your report is expected to adhere to the following guidelines:

1. Report must include four sections entitled
  - Methodology,
  - Analysis,
  - Conclusion, and
  - Appendix.
2. All references, calculations, and statistical software output must appear in the appendix.
3. The draft must be submitted in Microsoft Word format.
4. The final version must be submitted PDF format.
5. All statistical sophistry must be relegated to the appendix, including programming code, data, output, logs, etc.
6. Include page numbering and consistent formatting for all fonts, charts, tables, margins, etc.
7. Paper must be a minimum of 4 pages and no longer than 10 pages

#### **4.2.7 Evaluation**

Your first draft will be graded, commented on, and returned to you. You will have one week to revise and submit a second draft for a higher grade. Only the last submitted paper will be factored into your grade. See evaluation criteria handout for more details.

## 4.3 Report Three: Game of Authorship

### 4.3.1 Task

You are approached by Bantam Books to help solve the analytical problem described below.<sup>2</sup> Considering the information you are given, you are to write a report on the situation that will be shared with the company's executive committee. Since you won't be able to explain any jargon or sophisticated statistics in person, you must assume your audience has no more than a Business Statistics I (ECON 220) background in the body of the document.

### 4.3.2 Analytical Problem

Famous American author George R. R. Martin is known for his exciting and vivid writing style. Suppose executives at Bantam are concerned that he may be unable to finish his latest novel, *A Dream of Spring*. An auxiliary author was commissioned to write the book based on summary notes provided by Martin. You have been asked to identify whether the replacement author's efforts merit publication in the event that Martin is unable to finish. Bantam would like to assess the performance of the auxiliary author before buying the rights to print the finished version of the book. You have identified several literary peculiarities, otherwise known as writeprints.<sup>3</sup> If Martin's style reveals itself systematically across his writing, you will be able to assess the performance of the auxiliary author in replicating Martin's style.

The following table contains data on the styles of George R. R. Martin and the auxiliary author (Morton (1978) details a similar analysis involving Jane Austen).

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<sup>2</sup> While the subject of this assignment borders on poor taste, it is compelling. Economic profit could certainly motivate such a scenario. I certainly wish George R. R. Martin all the health and happiness possible.

<sup>3</sup> This is a play on the term fingerprint. This study is called stylometry. I fabricated the data in the table.

Given in the table below are the frequencies of particular idiosyncratic phrases in a randomly selected chapter: “such a”, “and I”, and “on the”. And variations of these phrases not preceded by (NPB) the first term.

Linguistic Features	<i>A Game of Thrones</i>	<i>A Feast for Crows</i>	<i>A Dream of Spring</i> (Martin)	Auxiliary Author’s Book
“such a”	14	16	8	2
“a” (NPB “such”)	133	180	93	81
“and I”	12	14	12	1
“I” (NPB “a”)	241	285	239	153
“on the”	11	6	8	17
“the” (NPB “on”)	123	170	83	204

Your report must exhaustively answer the following questions:

- (1) Was George R. R. Martin consistent in these habits of style from one work to another?
- (2) Auxiliary author successfully copy these aspect of her style?
- (3) What additional information would you request from the publisher in order to make a stronger case for your analysis.

### 4.3.3 Audience

Your audience for this assignment is the executive board of the Bantam publishing house. Don’t forget that their statistical background is limited!

### 4.3.4 Purpose

There are several purposes for assignment:

- To introduce you to  $X^2$
- To help you synthesize your statistical knowledge in a way that can be shared with non-economists and non-statisticians
- To encourage you to emphasize clarity in your writing

- To give you the opportunity to prepare a consulting report

#### **4.3.5 Due Dates**

Draft #1 (Mandatory)	11-18
Completed Report	11-25

All parts of this assignment must be submitted online before class begins on the due date.

#### **4.3.6 Format**

Your report is expected to adhere to the following guidelines:

1. Report must include four sections entitled
  - Methodology,
  - Analysis,
  - Conclusion, and
  - Appendix.
2. All references, calculations, and statistical software output must appear in the appendix.
3. The Draft must be submitted in Microsoft Word format.
4. The final version must be submitted PDF format.
5. All statistical sophistry must be relegated to the appendix, including programming code, data, output, logs, etc.
6. Include page numbering and consistent formatting for all fonts, charts, tables, margins, etc.
7. Paper must be a minimum of 4 pages and no longer than 10 pages

#### **4.3.7 Evaluation**

Your first draft will be graded, commented on, and returned to you. You will have one week to revise and submit a second draft for a higher grade. Only the last

submitted paper will be factored into your grade. See evaluation criteria handout for more details.

## 4.4 Report Four: Statistics of Art

### 4.4.1 Task

A wealthy art collector has retained your consulting agency to estimate the value of several art pieces in her collection. You have been given access to a historical database of similar pieces and their prices and are expected to make the best possible forecast. Specifically, your task is to create a parsimonious model that fits the historical data and then to use that model to predict the prices of the collector's art pieces.

### 4.4.2 Analytical Problem

The data involve a large number of variables, some of which may be irrelevant.

<i>Variable</i>	<i>Definition</i>
Price	Price paid for auctioned painting, in US Dollars
Public	Dummy variable for provenance: coded 1 if painting originates from public collection (gallery or museum), 0 otherwise
Art books	Dummy variable for literature: coded 1 if painting was included in prestigious art book, 0 otherwise
Born	Painter's year of birth
Died	Painter's year of death (if applicable)
Dead	Dummy variable for death: coded 1 if painter was dead at time of auction
Year_Painted	Year in which painting was produced
Age	Age of artist when painting was produced
Oil	Dummy variable for medium: coded 1 if oil painting , 0 otherwise
Area	Area of the painting in square centimeters
Signed	Dummy variable: coded 1 if painting is signed by artist, 0 otherwise
Still_life	Dummy variable for theme: coded 1 if main theme of painting is still-life, 0 otherwise
Portrait	Dummy variable for theme: coded 1 if main theme of painting is portrait, 0 otherwise
Landscape	Dummy variable for theme: coded 1 if main theme of painting is landscape, 0 otherwise
Americas	Dummy variable for origin: coded 1 if artist was born or did most of his work in Argentina, 0 otherwise
Europe	Dummy variable for origin: coded 1 if artist was born or did most of his work in Brazil, 0 otherwise
Asia	Dummy variable for origin: coded 1 if artist was born or did most of his work in the Caribbean, 0 otherwise



Parsimony technically means unwillingness to spend money. In statistical problem solving, it refers to the desire for succinctness. In the presence of uncertainty, statistical explanations requiring fewer assumptions are valued over more complicated ones since simpler models tend to offer more *insight*. We will discuss these concepts at length in the context of multiple regressions.

#### **4.4.3 Audience**

Your audience consists of your client, colleagues, and supervisor. You can assume some familiarity with statistics and statistical methods, but you should include descriptions of standard statistics (t-stats, etc.) in the body of the paper. Discussion of any more advanced tools should be reserved for the appendix.

#### **4.4.4 Purpose**

There are several purposes for assignment:

- To offer you practice using several statistical tools.
- To teach you to write mathematical expressions in word processing software.
- To help you synthesize statistical knowledge in a way that can be shared with non-statisticians.
- To offer another opportunity to prepare a consulting report.

#### **4.4.5 Due Dates**

Completed Report

12-4

All parts of this assignment must be submitted online before class begins on the due date.

#### **4.4.6 Format**

Your report is expected to adhere to the following guidelines:

1. Report must include four sections entitled
  - Methodology,
  - Analysis,
  - Conclusion, and
  - Appendix.
2. All references, calculations, and statistical software output must appear in the appendix.
3. The draft must be submitted in Microsoft Word format.
4. The final version must be submitted PDF format.
5. All statistical sophistry must be relegated to the appendix, including programming code, data, output, logs, etc.
6. Include page numbering and consistent formatting for all fonts, charts, tables, margins, etc.
7. Paper must be a minimum of 4 pages and no longer than 10 pages

#### **4.4.7 Evaluation**

Only one submission of this paper is required. It will be evaluated according to the evaluation criteria handout.

## **4.5 Optional Report: Classification**

### **4.5.1 Task**

You are an analyst at American Express tasked with raising and lowering interest rates for a set of customers. Based on historical customer data, you will estimate a probability of default for each customer. You are to suggest increased rates for high risk customers and lowered rates for low risk customers according to your model.

### **4.5.2 Analytical Problem**

Logistic Regression is a multivariate technique that quantifies the relationship between a set of predictor variables and a binary dependent variable. The dependent variable “default” is coded as either "1" for a default or "0" otherwise. A logistic regression model coded in this way will produce a score that reflects the probability of default based on any observation of the predictor variables.

### **4.5.3 Audience**

Your audience is your supervisor and colleagues. The report should include the scores that your model implies for all of the historical data as well as recommendations for the 10 customers assigned to you.

### **4.5.4 Purpose**

There are several purposes for this assignment:

- To offer you practice using several statistical tools.
- To teach you to implement logistic regression in excel.
- To help you synthesize statistical knowledge in a way that can be shared with non-statisticians.
- To offer another opportunity to prepare a consulting report.

#### **4.5.5 Due Dates**

Completed Report

12-4

#### **4.5.6 Format**

Your report is expected to adhere to the following guidelines:

1. Report must include four sections entitled
  - Methodology,
  - Analysis,
  - Conclusion, and
  - Appendix.
2. All references, calculations, and statistical software output must appear in the appendix.
3. The draft must be submitted in Microsoft Word format.
4. The final version must be submitted PDF format.
5. All statistical sophistry must be relegated to the appendix, including programming code, data, output, logs, etc.
6. Include page numbering and consistent formatting for all fonts, charts, tables, margins, etc.
7. Paper must be a minimum of 4 pages and no longer than 10 pages

#### **4.5.7 Evaluation**

Your first draft will be graded, commented on, and returned to you. You will have one week to revise and submit a second draft for a higher grade. Only the last submitted paper will be factored into your grade. See evaluation criteria handout for more details.

## **5 Informal Writing Guidelines**

### **5.1.1 Task**

Theory Reflections are short, informal writing assignments tied to specific theoretical concepts listed in the syllabus. You should focus on what you know. Do not use the reflection to cut and paste definitions rather use it as an opportunity to flesh out what you've learned and that you can reproduce without resources on hand. Do not spend time worrying about grammar, spelling, or punctuation – focus on your ideas. You will be asked to complete tasks such as answering brief questions about a particular theory, comparing and contrasting different theories, and developing questions you have about theoretical concepts. The task is always to show that you have engaged with the material at a level that allows you to gain understanding from it or to develop questions about it.

### **5.1.2 Purpose**

There are several purposes for these reflections:

To help you to better understand theoretical concepts

To allow me the opportunity to check your understanding of the concepts

To provide you with the opportunity to develop questions about theory

To help you organize the knowledge you gain in this course

### **5.1.3 Due Dates**

Reflections assignments will be assigned as we move through the semester – roughly one Reflection every other week. Details for each particular Reflection will be located on D2L.

### **5.1.4 Format**

Each Reflection needs to be saved and submitted as a Word document (.doc or .docx). Your name, the date, ECON 310, and “Reflection” with the number should be single-spaced in the center of the first page.

### **5.1.5 Evaluation Criteria**

Each Reflection is worth a possible 1%. You receive credit based on the following:

Submission

I will provide you with feedback related to your work and try to help you with anything that is not accurate or questions that you might have. I will not accept late assignments.

## **6 Formal Writing Evaluation Criteria**

### **6.1.1 Length Requirements**

10% is automatically earned by submitting a paper that adheres to the 4-10 page length requirement. The audience for your report has a finite attention span so you must complete your conclusion in fewer than 10 pages. Writing, but not computer output, in the appendix may be used toward fulfilling the 4-page minimum. And pages in the appendix (only) exceeding the 10-page maximum will not adversely affect your grade.

### **6.1.2 Grading Rubric**

The grading rubric found on the following page will be used to assess your formal writing projects. Your work will be assessed across the six criteria identified in the table. The point totals above each column represent guidelines. Although most points will be awarded precisely according to the rubric guidelines, additional points are possible in the case of work that is extraordinary in some dimension.

Economics 310 – WIP: Business and Economics Statistics II

NAME: \_\_\_\_\_ REPORT #: \_\_\_\_\_

(Project submission earns 10 points)

CATEGORY	15 points	12 points	10 points	6 points
Statistical Concepts	Explanation shows complete understanding of the statistical concepts used to solve the problem(s).	Explanation shows substantial understanding of the statistical concepts used to solve the problem(s).	Explanation shows some understanding of the statistical concepts needed to solve the problem(s).	Explanation shows very limited understanding of the underlying concepts needed to solve the problem(s) OR is not written.
Errors	90-100% of the steps and solutions have no errors.	Almost all (85-89%) of the steps and solutions have no errors.	Most (75-84%) of the steps and solutions have no errors.	More than 75% of the steps and solutions have errors.
Explanation	Explanation is detailed and clear.	Explanation is clear.	Explanation is a little difficult to understand, but includes critical components.	Explanation is difficult to understand and is missing several components OR was not included.
Neatness and Organization	The work is presented in a neat, clear, organized fashion that is easy to read.	The work is presented in a neat and organized fashion that is usually easy to read.	The work is presented in an organized fashion but may be hard to read at times.	The work appears sloppy and unorganized. It is hard to know what information goes together.
Terminology and Notation	Correct terminology and notation are always used, making it easy to understand what was done.	Correct terminology and notation are usually used, making it fairly easy to understand what was done.	Correct terminology and notation are used, but it is sometimes not easy to understand what was done.	There is little use, or a lot of inappropriate use, of terminology and notation.
Completion	The four required sections (Methodology, Analysis, Conclusion, and Appendix) are present and compellingly support your analysis.	The four required sections are present and support the analysis.	At least three of the required sections are present in the report and each generally supports the analysis.	The report is missing required sections or generally does not support the analysis.