1. Introduction
   - Forecasting and Data
   - Forecasting Methods
   - Errors in Forecasting
   - Choosing a Forecasting Technique
   - An overview of Quantitative Forecasting Techniques

2. Basic Statistical concepts
   - Populations
   - Probability
   - Random samples and sample statistics
   - Continuous Probability Distributions
   - Normal distribution, Chi-square, t-, and F- distributions
   - Confidence intervals for population mean

3. Simple Linear Regression
   - The Simple Linear Regression Model
   - The Least Squares Point Estimates
   - Point Estimates and Point Predictions
   - Model Assumptions and the Standard Error
   - Testing the Significance of the slope and the y-intercept
   - Confidence and Prediction Intervals
   - Simple Coefficients of Determination and Correlation
   - An F-test for the model

4. Multiple Linear Regression
   - The Linear Regression Model
   - The Least Squares Estimates, Point Estimates, and Prediction
   - The Mean Square Error and Standard Error
   - Model Utility: R^2, Adjusted R^2, and overall F-test
   - Testing the Significance of an Independent Variable
   - Confidence and Prediction Intervals

5. Time Series Regression
   - Modeling Trend Using Polynomial Functions
   - Detecting Autocorrelation
   - Seasonal Variation
   - Modeling Seasonal Variation with Dummy Variables and Trigonometric Functions
   - Growth Curver Models
   - Handling First Order Autocorrelation

6. Cluster Analysis
   - Introduction to cluster analysis
   - K-means clustering and Heirarchical clustering

7. Addiitional Topics as Time Permits
   - Multiplicative and Additive Decomposition
   - The X-12-ARIMA Seasonal Adjustment Method
   - Simple Exponential Smoothing

Course Materials:

Bruce Bowerman, Richard O'Connell, and Anne Koehler, *Forecasting, Time Series, and Regression, 4th edition*, Brooks/Cole Cengage Learning, 2005, ISBN 978-0-534-40977-7

Gareth James, et. al., *An Introduction to Statistical Learning with Applications in R*, Springer, 2013, ISBN 978-1-4614-7138-7 (eBook)

Trevor Hastie, et. al., *The Elements of Statistical Learning, 2nd Edition*, Springer, 2009, ISBN 978-0-387-84858-7

Instructor's notes published on Blackboard

Course Requirements and Policies

Attendance:

Attendance and class participation are crucial for learning the material for this course. All students are expected to be ON TIME. If you arrive more than 5 minutes after the beginning of lecture, you will be considered absent for the day. If you have four or more unexcused absences, you may receive a grade of WU or F for the course.

Students who miss class are responsible for all material and assignments covered during missed lecture(s).

Academic Honesty:

The Department of Mathematics and the course instructor fully support Baruch College's policy on academic honesty, which states in part:

> "Academic dishonesty is unacceptable and will not be tolerated. Cheating, forgery, plagiarism, and collusion in dishonest acts undermine the college's educational mission and the students' personal and intellectual growth. Baruch students are expected to bear individual responsibility for their work, to learn the rules and definitions that underlie the practice of academic integrity, and to uphold its ideals. Ignorance of the rules is not an acceptable excuse for disobeying them. Any student who attempts to compromise or devalue the academic process will be sanctioned."

Academic sanctions in this class will range from an F on the assignment to an F in this course. A
report of suspected academic dishonesty will be sent to the Office of the Dean of Students. Additional information and definitions can be found at www.baruch.cuny.edu/academic/academic_honesty.html and the Student Guide to Academic Integrity www.baruch.cuny.edu/facultyhandbook/documents/StudentGuideOct06.pdf

Conduct:

Cell phones should be turned off during class and MUST be turned off and put away during all examinations.

Laptops should be used only for taking or reading lectures notes.

Statement for Students with Disabilities:

Students with disabilities may be eligible for reasonable accommodations to enable them to participate fully in courses at Baruch College. Any student needing accommodation is requested to speak directly to the Office of Services for Students with Disabilities (VC 2-271; 646-312-4590) and to the instructor as early as possible in the semester (preferably during the first week of class). All discussions will remain confidential.

Evaluation:

Homework will be assigned to be turned in an graded regularly throughout the semester. Additional suggested problems will be posted on the course Blackboard site. These additional questions will not be graded, but you must be able to solve these exercises on your own with full details and complete understanding.

One in-class exam will be given during the semester. A cumulative final project will be given in lieu of a final exam. The project will be at take-home project that is due at the time and date of the final exam scheduled for this course. There are no make-up examinations!

Per department policy, any student who receives a grade below 50% on the final exam will receive a failing grade for the course.

Course Grade Components:

The final grade will be computed according to the following distribution:

- In class exam: 50%;
- Homework: 10% total;
- Final Project: 40%

Course letter grades will be assigned based on the overall percentage as described at http://www.baruch.cuny.edu/undergraduate-advisement-and-orientation/grades-and-gpa.html

Sample Course Schedule:

- Section numbers correspond to "*Forecasting, Time Series, and Regression, 4th edition*" by Bowerman, et.al.
- Sections marked by ** are additional topics which will be covered if time permits
- Section numbers beginning with an ISL are from "*An Introduction to Statistical Learning with Applications in R"* by Gareth James, et. al.
- Sections beginning with ESL are from "*The Elements of Statistical Learning, 2nd Edition"* by Trevor Hastie, et. al.

Lect. #	Topics	Required Reading
1	Forecasting and Data; Forecasting Methods	*1.1, 1.2*
2	Errors in Forecasting; Choosing a Forecasting Technique; Quantitative Forecasting Techniques	*1.3 – 1.5*
3	Populations; Probability; Random samples and Sample Statistics	*2.1 – 2.3*
4	Continuous probability distributions; Normal distributions	*2.4, 2.5*
5	Normal distributions (continued); Chi-square, t-, and F- distributions	*2.5, 2.6*
6	Confidence Intervals for Population mean	*2.7*
7	Simple Linear Regression	*3.1*
8	Least Squares Point Estimates; Point Estimates and Point Predictions	*3.2, 3.3*
9	Model Assumptions and Standard Error; Testing significance of the slope and y-intercept	*3.4, 3.5*
10	Confidence and Prediction Intervals; Simple Coefficients of Determination and Correlation	*3.6, 3.7*
11	Determination and Correlation (continued); An F-test for the model	*3.7, 3.8*
12	Multiple Linear Regression Model	*4.1*
13	Least Squares Estimates, Point Estimation, and Prediction for Multiple Linear Regression	*4.2*
14	Mean Square and Standard Error; Model Utility: R^2, Adjusted R^2, and Overall F-test	*4.3, 4.4*
15	Testing Significance of an Independent Variable	*4.5*
16	Confidence and Prediction Intervals	*4.6*
17	**Test 1 – in class – Chapters 1 - 4**	
18	Modeling Trend Using Polynomial Functions	*6.1*
19	Detecting Autocorrelation	*6.2*
20	Seasonal Variation	*6.3*
21	Modeling Seasonal Variation using Dummy Variables and Trigonometric Functions	*6.4*

22	Growth Curve Models	*6.5*
23	First Order Autocorrelation	*6.6*
24	An Introduction to Cluster Analysis	*ESL 14.3 – 14.3.5*
25	K-mean clustering	*ESL 14.3.6 – 14.3.9* *ISL 10.3.1, 10.5.1*
26	Heirarchical clustering and other clustering methods	*ESL 14.3.10 – 14.3.12* *ISL 10.3.2, 10.3.3, 10.5.2*
27	Multiplicative and Additive Decomposition**	*7.1, 7.2*
28	ARIMA Seasonal Adjustment Method** Simple Exponential Smoothing**	7.3, 8.1
	Final Project - cumulative	