COURSE SYLLABUS
Regression Analysis, STAT 525-01 and 02
Department of Mathematics and Statistics
University of Massachusetts Amherst

Instructor:	Zheni Utic	**Term**:		Fall 2019
Office Hours	Tue:11:45am-12:45pm	**Meeting Days**:	Section 01	Tue/Thr 8:30am:9:45am
	Thr: 11:45am-1:45pm		Section 02	Tue/Thr 10:00am:11:15am
Room:	LGRT 1630	**Location:**		LGRT 141
Phone:	413-545-4239			
Email:	utic@math.umass.edu			

I. Textbook:
Required: *Applied Linear Regression Models* by Kutner, Nachsteim and Neter (4th edition) or, *Applied Linear Statistical Models* by Kutner, Nachtsteim, Neter and Li (5th edition). Both published by McGraw-Hill/Irwin.

II. Prerequisites:
Stat 516 or equivalent (previous coursework in Probability and Statistics, including knowledge of estimation, confidence intervals, and hypothesis testing and its use in at least one and two sample problems. You must be familiar with these statistical concepts beforehand.) Stat 515 by itself is NOT a sufficient background for this course. Familiarity with basic matrix notation and operations is helpful.

III. Course Description :
This course provides an introduction to linear regression. Topics include:

- ✓ Simple linear regression and statistical inferences
- ✓ Correlation analysis
- ✓ Diagnostics and remedial measures
- ✓ Matrix approach to simple linear regression analysis
- ✓ Multiple linear regression and statistical inferences
- ✓ Regression models for quantitative and qualitative predictors
- ✓ Model building (and variable selection) and validation
- ✓ Model diagnostics

IV. Course Objectives:
The focus of this course is on a careful understanding and of regression models and associated methods of statistical inference, data analysis, and interpretation of results, statistical computation and model building. Extensive data analysis using R (no previous computer experience assumed). Satisfies the Integrative Experience requirement for BA-Math and BS-Math majors

V. Computing:
Students are required to use R programming language for the homework sets and the IE project. I will give some examples in class and post codes. R is available free for installation, please follow the links depending on your OS for that purpose:

- R for Windows (32/64 bit): https://cran.r-project.org/bin/windows/base/
- R for Mac: https://cran.r-project.org/bin/macosx/

VI. Graded Assignments:

1. Homework assignments:

Homework is due at the beginning of the class on the due date. There will be approximately ten homework assignments. The lowest two homework scores will be dropped, so the highest remaining homework assignments will be counted towards your final grade. No late homework will be accepted. Unreadable work, scratching out, etc. will not be graded. Please attach all R output, including figures, to your homework. In writing up homework, it is not sufficient to give only the answer to a problem; you must show your work to get full credit.

Any objections to the homework grading, the midterm or final grading should be directed to the instructor, and the student will be notified if a grade change occurs. The request for the change has to be made up to one week after the graded homework was returned to you.

2. Integrative Experience (Project):

There will be one group project that has to be submitted at the end of the semester. Stat 525 counts as an integrative experience (IE) course for undergraduate Math-Stat primary majors and the students in Stat 525 will do an IE project.

3. Exams:

There will be one midterm exam and one final exam. All exams are closed book. For both the midterm and final exam, you are allowed to bring one, 8.5x11(letter size) double-sided formula sheet. You are responsible for taking the final exam at the time it is scheduled by the University. There are **no make-up exams.** The final exam will be comprehensive.

VII. Grading Rubric:

Attendance	5%
Homework	20%
IE project	30%
Midterm	20%
Final (comprehensive)	25%

VIII. Grades:

Grades are assigned as follows:

		69.5-74.4%	C+
92.5-100%	A	64.5-69.4%	C
87.5-92.4%	A-	59.5-64.4%	C-
82.5-87.4%	B+	54.5-59.4%	D+
79.5-82.4%	B	50.5-54.4%	D
74.5-79.4%	B-	$\leq$50.4%	F

IX. Important Dates

Drop/Add Deadline:	Mon, Sept 16
Midterm Examination:	Thr, Oct 17
Withdrawal Deadline:	Tue, Oct 29
Final Examination:	To be confirmed

Holydays: Oct 14, Mon (Columbus Day, Monday schedule follows Tue Oct 15), Nov 11, Mon (Monday schedule follows Wed Nov 13), Nov 24-Dec 1 (Thanksgiving Recess).

X. Course policies

1. **Attendance Policy**:
Attendance at class meetings is essential for the academic success. Full time attendance to every class is strongly recommended, attendance will be taken every class. You are allowed to have up to three absences without any credit penalty.
2. **Exams** : If you have a University-approved conflict with any of the exams, you must let me know at least one week before the exam. A conflict exam will be scheduled to take place just before or just after the regularly scheduled exam. Reschedule for the exam is given only for:

i) Documented illness or other critical personal matter where I have been contacted and approved before the exam;

ii) A conflict between two exams. The University policy is that if a student is scheduled to take two examinations at the same time, the faculty member teaching the course with the higher final digit (or digits) in its class number (the unique 5-digit number which represents a particular section in the Schedule of Classes) is required to offer a reschedule for the examination. University policy states that on Wed., Thur. or Friday a scheduled evening exam for a class that meets during the day takes priority over an evening class.

3. **Professionalism Policy**:
Per university policy and classroom etiquette; mobile phones, iPads, *etc*. **must be silenced** during all classroom lectures. Those not heeding this rule will be asked to leave the classroom immediately so as to not disrupt the learning environment. Students are expected to arrive on time for all class meetings. Cell phones are not allowed to be used as a calculator during the exam.
4. **Recording:**
Video or audio recording of any kind is not allowed under any circumstances. Umass Amherst is the owner of all study materials that are provided to you.
5. Academic integrity statement:
Since the integrity of the academic enterprise of any institution of higher education requires honesty in scholarship and research, academic honesty is required of all students at the University of Massachusetts Amherst. Academic dishonesty is prohibited in all programs of the University. Academic dishonesty includes but is not limited to: cheating, fabrication, plagiarism, and facilitating dishonesty. Appropriate sanctions may be imposed on any student who has committed an act of academic dishonesty. Instructors should take reasonable steps to address academic misconduct. Any person who has reason to believe that a student has committed academic dishonesty should bring such information to the attention of the appropriate course instructor as soon as possible. Instances of academic dishonesty not related to a specific course should be brought to the attention of the appropriate department Head or Chair. Since students are expected to be familiar with this policy and the commonly accepted standards of academic integrity, ignorance of such standards is not normally sufficient evidence of lack of intent. Please read Academic Honesty Policy and Procedures: http://www.umass.edu/ombuds/honesty.php/
6. Accommodation Statement
The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. A student with a documented physical, psychological, or learning disability on file with Disability Services (DS) may be eligible for reasonable academic accommodations to help succeed in this course. If you have a documented disability that requires an accommodation, please notify the instructor within the first two weeks of the semester so that we may make appropriate arrangements.

Tentative Course Schedule

Date	Num	Chapter Number/Name	HW Due
Sep 3	1	**Introduction. Chapter 0 Review**	
Sep 5	2	**Chapter 1. Linear Regression with One Predictor Variable.** Variable Types. Regression models. SLR. Error terms. Overview Steps	
Sep 10	3	**Chapter 1. Linear Regression with One Predictor Variable.(cont.)** Estimation coefficients. Maximum Likelihood Estimator, Least Squares Estimator. LSE with R	
Sep 12	4	**Chapter 2. Inferences in Regression and Correlation Analysis.** Inference about the regression coefficients β_0 and β_1. Confidence intervals with R.	HW1
Sep 17	5	**Chapter 2. Inferences in Regression and Correlation Analysis. (cont.)** Estimation of $E(Y_h)$ for a given X_h. Prediction of Yh(new) for a given Xh. Estimation and Prediction with R	
Sep 19	6	**Chapter 2. Inferences in Regression and Correlation Analysis. (cont.)** Analysis of Variance approach to regression analysis. Descriptive Measures of Linear Association between X and Y. ANOVA table and R^2 with R.	HW2
Sep 24	7	**Chapter 3. Diagnostics and Remedial Measures.** Diagnostics for X and Y. Residuals and Residual Analysis. Diagnostic plots. Overview of Residual Analysis and Fixing Problems. Diagnostic plots with R.	
Sep 26	8	**Chapter 4. Simultaneous Inferences and Other Topics in Regression Analysis**. Joint Inferences (confidence intervals and hypothesis tests) for the parameters. Simultaneous Estimation of E(Y). Bonferroni and Working-Hotelling confidence intervals for the parameters with R.	HW3
Oct 1	9	**Chapter 5. Matrix Approach to Linear Regression Analysis**. Matrices and Special Types of Matrices. Matrix Addition and Subtraction. Inverse of a Matrix. Matrix multiplication. Matrix Representation of Linear Regression Model. Regression Analysis with Matrices	
Oct 3	10	**Chapter 6. Multiple Regression I.** Multiple Regression Models. Inferences about multiple linear regression models. Representations with R.	HW4
Oct 8	11	**Preparation Midterm exam**	
Oct 10	12	**Midterm exam**	**HW5**
Oct 15	**No class due to Columbus day**		
Oct 17	13	**Chapter 6. Multiple Regression I.(cont.)** Inferences about multiple linear regression models. Diagnostics and Remedial Measures with R.	
Oct 22	14	**Chapter 7. Multiple Regression II.** Extra Sums of Squares. Test for regression coefficients using Extra SS. Extra Sums of squares using R.	
Oct 24	15	**Chapter 7. Multiple Regression II (cont.)** Multicollinearity, Its Effects and Remedies.	HW6
Oct 29	16	Projects preparation: Topic selection Proposal Step 1	
Oct 31	17	Projects preparation: Topic selection Proposal Step 1 Due (Submission Proposal)	
Nov 5	18	Projects preparation: Literature Review. Step 2 Start and Due (Submission Literature Review)	
Nov 7	19	Projects preparation: Data selection. Step 3 Start and Due (Submission Data Set with a Data Summary explanation of the variables)	
Nov 12	20	Projects preparation:. Main methods and analysis Step 4	
Nov 14	21	**Chapter 8. Regression Models for Quantitative and Qualitative Predictors.** Polynomial Regression Models. Regression Models with interaction terms. Interaction Regression Models Case Example with R. Projects preparation: Main methods and analysis Step 4	
Nov 19	22	**Chapter 8. Regression Models for Quantitative and Qualitative Predictors. (cont.)** Regression models with qualitative predictors. Modeling interaction between Quantitative and Qualitative Predictors – Example. Projects preparation: Main methods and analysis Step 4	
Nov 21	23	**Chapter 9. Building the Regression Model I (Model Selection and Validation).** Overview of Model-Building Process. Criteria for Model (Predictor) Selection. Search procedures. Model Validation. Example in R. Projects preparation: Step 5 Outline	HW7
Nov 24-Dec1	Thanksgiving recess		
Dec 3	24	**Chapter 10. Building the Regression Model II (Diagnostics)** Added-Variable Plots (partial regression plots, adjusted variable plots). Three Types of Outlying Observations. Identifying Outlying X observation - Hat Matrix Leverage Values. Identifying Outlying Y observation - Studentized Deleted Residuals. Identifying Influential cases - DFFITS, Cook's distance and DFBETAS measures. Summary Remedies. Multicollinearity among predictors. Projects preparation. Due (Submission Outline and Power Point Presentation).	
Dec 5	25	Presentations Projects	
Dec 10	26	Preparation Final Exam	HW8
Dec 13-19	Final exam date to be confirmed		

-End of the syllabus-