

# ISYE 4031 REGRESSION AND FORECASTING

## Required for BSIE

**Credit:** 3-0-3

**Coordinators:** Profs. Ethan Lee and Jing Li Fall 2025

**Prerequisite(s):** ISYE 3030

### Text:

- *Forecasting, Time Series, and Regression (FTR)* by Bowerman, O'Connel, and Koehler, Duxbury Applied Series, 4<sup>th</sup> Edition, Duxbury Applied Series.
- *Linear Models with R (LMR)* by Julian J. J. Faraway, 2<sup>nd</sup>/3<sup>rd</sup> edition, Chapman & Hall/CRC
- *An Introduction to Statistical Learning with Application in R (ISL)* by Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, 2<sup>nd</sup> edition, Springer
  - Online Resource:  
<https://www.statlearning.com/>
  - ISL also has a version in Python
- *Forecasting: Principles and Practice (FPP)* by Rob Hyndman and George Athanasopoulos, 2<sup>nd</sup>/3<sup>rd</sup> edition, OTexts: Melbourne, Australia.
  - Online Resources:  
<https://otexts.com/fpp2/>  
<https://otexts.com/fpp3/>

### Catalog Description:

Regression analysis: multiple linear regression, diagnostics, and variable selection.  
Basic statistical learning methods: Logistic Regression, Ridge Regression & LASSO (Shrinkage methods), PCA. Optional: KNN, K-Means.  
Forecasting: exponential smoothing techniques and autoregressive moving average models.

### Course Description

The objective of this course is to learn about regression, basic statistical learning methods related to regression, time series, and other forecasting models and their applications in various fields of science and engineering.

### Software

A software package will be used in this class for assignments and projects. *R* and *Python* are the preferred programming languages.

## Honor Code

Make sure that you are aware of the GT Honor Code by visiting

<https://www.policylibrary.gatech.edu/student-affairs/academic-honor-code>

Any violation of the Honor Code (e.g., cheating in assignments or tests, not being truthful, plagiarism, etc.) may result in an F in this class.

Also, the student government and faculty representatives have developed a new Student-Faculty Expectations document. Please see the page: <https://catalog.gatech.edu/rules/22>

## Special Needs

Georgia Tech provides upon request appropriate academic accommodations for students with disabilities. <https://disabilityservices.gatech.edu>

## Topical Outline: 15 instructional weeks

Topics	Weeks
Review of statistics, t-test, f-test, and the use of $p$ -Value: FTR Ch2	1
Review of linear regression: FTR Ch3-4, LMR Ch2-4, ISL Ch3	2
Model diagnostics and residual analysis: FTR Ch5, LMR Ch5-7	2
Variable selection: FTRCh5, LMR Ch10, ISL Ch6	2
Statistical Learning methods: ISL Ch4, 6, 10, LMR Ch11	3-4
Forecasting: Time series regression: FTR Ch6, FPP Ch7	1
Exponential smoothing: FTR Ch8, FPP Ch8	1
ARIMA models: FTR Ch9, FPP Ch9	2
Optional: Seasonal ARIMA modeling: FTR Ch11	[1]
Total	14-15

## Outcomes and their relationships to ISyE Program Outcomes

At the end of this course, students will be able to:

1. Formulate real life problems using regression, statistical learning and forecasting models.
2. Collect appropriate data to estimate the models and understand which data are useful in solving the problem.
3. Use statistical software to estimate the models from real data.
4. Draw conclusions from the estimated models to solve the real life problems.

<b>Course outcome  \ Program Outcomes</b>	1. identify, formulate solve engg prob by engg, sci & Math	2. produce solutions consider public health, safety, welfare, global, cultural, social, environ & economic	3 communicate with a range of audience	4 recognize ethical & professional responsibilities, make informed judgement consider resolutions in global, economic, environ and societal context.	5. effective on a team provide leadership, collaborative and inclusive envirm, plan tasks & meet objectives	6. develop and conduct experiment, analyze and interpret data & use engineering judgement to draw conclusions.	7. acquire and apply new knowledge using appropriate learning strategies
1. Formulate real life problems using regression, statistical learning and forecasting models.	H						
2. Collect appropriate data to estimate the models and understand which data are useful in solving the problem						H	
3. Use statistical software to estimate the models from real data							
4. Draw conclusions from estimated models to solve real life problems	H						

#### **Evaluation of the important outcomes**

The outcome 1, 2 and 4 will be assessed by the project.