Learning Objective in the first 5 lectures (Section 1 of the Course)

Be able to conduct rigorous statistical analysis for discrete data and develop discrete response statistical models to answer “data science” questions

Discrete Response Variable

- Binary
- Unordered multiclass
- Ordered multiclass
- Count variable

Binomial Probability Model: 1 Variable	Multinomial Probability Model: 1 Variable	Poisson Probability Model: 1 Variable
Binomial Probability Model: 2 Variables	Multinomial Probability Model: 2 Variables	Poisson Probability Model: 2 Variables
Binomial Probability Model: N Variables	Multinomial Probability Model: N Variables	Poisson Probability Model: N Variables
Binary Logistic Regression	Multinomial Logistic Regression	Poisson Regression
	Ordinal Logistic Regression	
Coin tossing	dice casting	Counts within a time period

- Parameter estimation
- Statistical inference

- Regression parameters
- Odds of a class being observed
- Probability of a class being observed

- Wald-based Approach
- Likelihood Ratio Based Approach

- A Key Assumption:
  - Independence across observations

Learning Objective in the second 5 lectures (Section 2 of the Course)

Be able to conduct rigorous statistical time series analysis and develop statistical time series models to answer “data science” questions

Part II: Time Series

1. Introduction to time series analysis
2. Time Series Regression and Exploratory Time Series Data Analysis
3. Autoregressive Model (AR) and Moving Average Model (MA)
4. Mixed Autoregressive Moving Average Model (ARMA), Random Walk and Integrated Process, Autoregressive Integrated Moving Average Model (ARIMA), and Seasonal ARIMA
5. Vector Autoregressive Model (VAR)

Time Series Data

- **Univariate time series**
- **Multivariate time series**

Basic Concepts and Intro to TSA

- Time series
- Stochastic process
- Stationarity
- TS Forecasting Formulation

Modeling

- Modeling Trend
- Modeling Seasonality
- Model both trend and seasonality using simple techniques

Modeling

- AR
- MA
- ARMA
- ARIMA
- SARIMA

VAR, cointegration

Learning Objective in the last 3 lectures (Section 3 of the Course)

Be able to conduct rigorous statistical analysis on panel data and develop statistical panel data models to answer “data science” questions

Panel Data

Data with both the temporal and cross-sectional dimensions

EDA on panel data

Modeling

- OLS (ignoring the panel structure)
- OLS (for independent cross-sections)
- Pooled OLS
- First Difference

Modeling

- Fixed Effect Models
- Random Effect Models

Modeling

- Mixed Effect Models