

Math 329 Mathematical Modeling: Syllabus

— Fall 2016 —

Course text: *An Introduction to Statistical Learning* by James, Witten, Hastie and Tibshirani. 2014.
www-bcf.usc.edu/~gareth/ISL

August

Monday	22	Course Introduction and Syllabus Chapter 1: Introduction Introductory R exercises Exploring the <code>Auto</code> dataset with R
Wednesday	24	Chapter 2: What is Statistical Learning Statistics Review Exercises Section 2.1: What is Statistical Learning? Exploring the <code>Advertising.csv</code> dataset Labs 2.3.1–2.3.3
Friday	26	Exploring the <code>Income1.csv</code> dataset Exercises 2, 4 and 6. Labs 2.3.4–2.3.5. Introduction to \TeX
Monday	29	Section 2.2: Assessing Model Accuracy 2.2.1 Measuring Quality of Fit 2.2.2 The Bias-Variance Trade-Off Exploring the <code>Income2.csv</code> dataset Work on Report (due Friday)
Wednesday	31	2.2.3: The Classification Setting (Bayes and K -Nearest Neighbors) Exercises 1, 3 and 5 Exploring the <code>Default</code> dataset

September

Friday	2	Exercise 7 Report: Exercises 9–10
Monday	5	No classes
Wednesday	7	Exploring other datasets and data competitions
Friday	9	Exercise 8 (report due) Report: Exercises 7–8
Monday	12	Chapter 3: Linear Regression Section 3.1: Simple Linear Regression 3.1.1 Estimating the Coefficients Lab 3.6.2 Exercise 6
Wednesday	14	3.1.2 Assessing the Accuracy of the Coefficients
Friday	16	3.1.3 Assessing the Accuracy of the Model (Residual Standard Error, R^2) Exercises 7–8, 11–12
Monday	19	Review Lab 3.6.3
Wednesday	21	Section 3.2: Multiple Linear Regression 3.2.1 Estimating the Regression Coefficients 3.2.2 Some Important Questions Exercise 1, 9(a)–(d), 10
Friday	23	Report: Exercise 12 from Chapter 4
Monday	26	Section 3.3: Other Considerations in the Regression Model 3.3.1 Qualitative Predictors Lab 3.6.6
Wednesday	28	3.3.2 Extensions of the Linear Model
Friday	30	Report: Exercise 15

October

Monday	3	3.3.3 Potential Problems (non-linearity, correlation, non-constant error variance, outliers, high leverage points, collinearity) Exercise 14, 15 (review of much of the chapter)
Wednesday	5	Section 3.4: The Marketing Plan Exercise 12
Friday	7	Section 3.5: Comparison of Linear Regression with K -Nearest Neighbors
Monday	10	Chapter 4: Classification Section 4.1 An Overview of Classification Section 4.2 Why Not Linear Regression Section 4.3 Logistic Regression 4.3.1 The Logistic Model
Wednesday	12	4.3.2 Estimating the Regression Coefficients Lab 4.6.2
Friday	14	No classes (Fall break: 13–14 October)
Monday	17	4.3.3 Making Predictions Exercise 7
Wednesday	19	4.3.4 Multiple Logistic Regression
Friday	21	4.3.5 Logistic Regression for > 2 Response Classes Report: Exercise 6
Monday	24	Section 4.4 Linear Discriminant Analysis Lab 4.6.3
Wednesday	26	4.4.1 Using Bayes' Theorem for Classification
Friday	28	4.4.2 Linear Discriminant Analysis for $p = 1$ Report: Exercise 10 (a)–(e), (h)
Monday	31	4.4.3 Linear Discriminant Analysis for $p > 1$

November

Wednesday	2	4.4.4 Quadratic Discriminant Analysis Lab 4.6.4. Exercises 3, 5
Friday	4	Section 4.5 A Comparison of Classification Methods Lab 4.6.1, 4.6.5, Exercise 8
Monday	7	Chapter 5: Resampling Methods Section 5.1 Cross-Validation 5.1.1 The Validation Set Approach Lab 5.3.1
Wednesday	9	5.1.2 Leave-One-Out Cross-Validation Lab 5.3.2
Friday	11	5.1.3 k -Fold Cross-Validation Lab 5.3.3 Report: Exercise 5
Monday	14	5.1.4 Bias-Variance Trade-Off for k -Fold Cross-Validation Exercise 6
Wednesday	16	5.1.5 Cross-Validation on Classification Problems Exercise 7
Friday	18	Report: Exercise 3, 8
20 – 27 November: Thanksgiving Break		
Monday	28	Section 5.2 The Bootstrap Lab 5.3.4, Exercise 1
Wednesday	30	Exercise 9

December

Friday	2	Report: Exercise 2, 4
5–9: Final Exams		

The final exam will be held in our usual classroom at the officially-scheduled time.
See www.shepherd.edu/register/finals_schedule.html.