Course Info

Syllabus: STAT 340 Syllabus Powers Fall 2024.pdf (https://canvas.wisc.edu/courses/427090/files/40634843?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40634843/download?download_frd=1)

Lecture: Tuesday, Thursday 1-2:15 in 204 Educational Sciences (1025 W. Johnson St.)

Instructor: Brian Powers, brpowers2@wisc.edu (mailto:brpowers2@wisc.edu)

Office Hours:

- Wednesdays 1-2:30 on zoom https://uwmadison.zoom.us/j/91763501216?pwd=RkxLQlZUR0dTcVQ0c3Jad2hDQ2lNdz09 (https://uwmadison.zoom.us/j/91763501216?pwd=RkxLQlZUR0dTcVQ0c3Jad2hDQ2lNdz09)
- Thursdays 2:30-4pm, Medical Sciences Center room 1217 C

TAs:

- Nabil Awan, nawan2@wisc.edu (mailto:nawan2@wisc.edu)
  - Office hours: **Tuesday 3:30-5:00 p.m.** (Zoom link (https://uwmadison.zoom.us/j/97561597101?pwd=PdbbNbhpBoAqdiVGRuVZ7blqBdR0aH.1&from=addon), Meeting ID: 975 6159 7101, Passcode: 733623), **Wednesday 1:30-3:00 p.m.** (6190 Medical Sciences Center)
- Christian Varner, cvarner@wisc.edu (mailto:cvarner@wisc.edu)
  - Office hours: **Thursday and Friday** from 12:35 – 2:15, location TBA

STAT 240 notes

For your review: 240-notes.zip (https://canvas.wisc.edu/courses/427090/files/40706501?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40706501/download?download_frd=1)

Course Textbooks

Reading for each week is indicated with a 📖, and required reading is highlighted in yellow. Other sources will be individually linked to with a 📚.

- Introduction to Data Science (https://rafalab.github.io/dsbook/) (**IDS**) by Rafael Irizarry
- R for Data Science (https://r4ds.had.co.nz/index.html) (**R4DS**) by Hadley Wickham and Garrett Grolemund
- Introduction to Probability and Statistics (http://ipsur.r-forge.r-project.org/book/download/IPSUR.pdf) Using R (**IPSUR**) by G. Jay Kerns
- Introduction to Probability for Data Science (https://probability4datascience.com/) (**P4DS**) by Stanley H. Chan
- An Introduction to Statistical Learning, 2nd Edition (https://statlearning.com/) (**ISLR**) by Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani

Practice Problems

This document contains a plethora of practice problems you can work on throughout the course. They have been collected from various sources. They are purely for personal practice. Solutions are included

- STAT340_Practice.html (https://canvas.wisc.edu/courses/427090/files/40541627?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541627/download?download_frd=1) (source (https://canvas.wisc.edu/courses/427090/files/40541628?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541628/download?download_frd=1)) updated 1/23/2024

Class Discord

Post all general questions, and questions regarding hw, discussion and exams here; if it's of a private nature you should email me or your TA

- link forthcoming

Weekly Lecture Notes

(future topic dates are tentative)

Week & Topics	Tuesday	Th
0. **Course Introduction** • L00_motivation.html (https://canvas.wisc.edu/courses/427090/files/40541623?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541623/download?download_frd=1)		9/5 S0 (ht (ht do

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1. **Random Variables** • lecture notes (https://canvas.wisc.edu/courses/427090/files/40541620?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541620/download?download_frd=1) (source (https://canvas.wisc.edu/courses/427090/files/40541621?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541621/download?download_frd=1)) • slides (https://canvas.wisc.edu/courses/427090/files/40667751?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40667751/download?download_frd=1) • IDS ch 2,3,8 • R4DS ch 19-21 • IPSUR ch 5,6 • P4DS ch 3,4 • RV Summary (https://canvas.wisc.edu/courses/427090/files/40772512?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40772512/download?download_frd=1)	9/10 S01_randomvariables_annotated-1.pdf (https://canvas.wisc.edu/courses/427090/files/40812432?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40812432/download?download_frd=1)	9/1
2. **Independence, Conditional Probability, Bayes Theorem** • lecture notes (https://canvas.wisc.edu/courses/427090/files/40541584?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541584/download?download_frd=1) (source (https://canvas.wisc.edu/courses/427090/files/40541585?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541585/download?download_frd=1)) (slides (https://canvas.wisc.edu/courses/427090/files/40772223?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40772223/download?download_frd=1)) • P4DS sec 2.4 • An Introduction to Bayes' Rule (https://jamesstone.sites.sheffield.ac.uk/books/bayes-rule/an-introduction-to-bayes-rule-chapter-1) by James Stone • Think Bayes (https://greenteapress.com/wp/think-bayes/) ch 1&2	9/17	9/1
3. **Monte Carlo Methods** • lecture notes (https://canvas.wisc.edu/courses/427090/files/40541598?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541598/download?download_frd=1) • Introduction to Monte Carlo Simulation (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2924739/) by R.L. Harrison	9/24	9/2
4. **Testing (part 1)** ◦ Lecture Notes (https://canvas.wisc.edu/courses/427090/files/40541589?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541589/download?download_frd=1) (source (https://canvas.wisc.edu/courses/427090/files/40541590?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541590/download?download_frd=1)) • P4DS Sec 9.3, 9.4, 9.5 • IPSUR sec 10.1, 10.2, 10.4 • There is only one test! (http://allendowney.blogspot.com/2016/06/there-is-still-only-one-test.html) by Allen Downey • Permutation Test: Visual Explanation (https://www.jwilber.me/permutationtest/) by Jared Wilber	10/1	10/
5. **Testing (part 2)**	10/8	10/

• lecture notes (https://canvas.wisc.edu/courses/427090/files/40541617?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541617/download?download_frd=1) (source (https://canvas.wisc.edu/courses/427090/files/40541609?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541609/download?download_frd=1)) • • Additional Examples (https://canvas.wisc.edu/courses/427090/files/40541610?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541610/download?download_frd=1)		
6. **Estimation (part 1)** ◦ lecture notes (https://canvas.wisc.edu/courses/427090/files/40541613?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541613/download?download_frd=1) (RMD (https://canvas.wisc.edu/courses/427090/files/40541614?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541614/download?download_frd=1)) • 📖 IDS Section 15.1, 15.2, 15.4, 15.6 • 📖 IPSUR 8.1, 8.2, Ch 9	10/15	10/
Midterm Week Topic Review (https://canvas.wisc.edu/courses/427090/pages/ge2ee7837a8aea2bb175ee5f181067dff)	10/22 review	10/ in-c
7. **Estimation (part 2)** • lecture notes (https://canvas.wisc.edu/courses/427090/files/40541630?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541630/download?download_frd=1) (RMD (https://canvas.wisc.edu/courses/427090/files/40541631?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541631/download?download_frd=1)) • • Additional Examples (https://canvas.wisc.edu/courses/427090/files/40541632?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541632/download?download_frd=1)	10/29	10/
8. **Prediction** • lecture notes (https://canvas.wisc.edu/courses/427090/files/40541636?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541636/download?download_frd=1) • • 📖 ISLR 3.1-3.3 • Overview of simple linear regression (https://www.colorado.edu/amath/sites/default/files/attached-files/ch12_0.pdf) • 📖 IPSUR Ch 11	11/5	11/
9. Multiple Linear Regression • lecture notes (https://canvas.wisc.edu/courses/427090/files/40541634?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541634/download?download_frd=1) • • 📖 ISLR 3.1-3.3, and 3.6 • 📖 IPSUR Ch 12 • 📖 P4DS Ch 7 • 📖 ISLR Sec 18.7	11/12	11/
10. Logistic Regression	11/19	11/

• Lecture Notes (https://canvas.wisc.edu/courses/427090/files/40541649?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541649/download?download_frd=1) (RMD (https://canvas.wisc.edu/courses/427090/files/40541648?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541648/download?download_frd=1)) • Lecture Notes Extended (https://canvas.wisc.edu/courses/427090/files/40541650?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541650/download?download_frd=1) (RMD (https://canvas.wisc.edu/courses/427090/files/40541582?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541582/download?download_frd=1)) • 📖 ISLR Sec 4.1-4.3 • Overview of logistic regression (https://towardsdatascience.com/what-is-logistic-regression-60a273e6bd91) by Ashutosh Tripathi • Pima rshiny app (https://bwu62.shinyapps.io/Pima_logistic/)		
11. Cross Validation and Model Selection ◦ lecture notes (https://canvas.wisc.edu/courses/427090/files/40541656?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541656/download?download_frd=1) • cv-extra.html (https://canvas.wisc.edu/courses/427090/files/40541657?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541657/download?download_frd=1) (RMD (https://canvas.wisc.edu/courses/427090/files/40541658?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541658/download?download_frd=1)) • R11_Model_Selection.Rmd (https://canvas.wisc.edu/courses/427090/files/40541659?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541659/download?download_frd=1) • R11_Ridge_LASSO.Rmd (https://canvas.wisc.edu/courses/427090/files/40541660?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541660/download?download_frd=1) • 📖 ISLR Sec 5.1,6.1,6.2	11/26	11/ no
12. Bootstrapping • lecture notes (https://canvas.wisc.edu/courses/427090/files/40541663?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541663/download?download_frd=1) (rmd (https://canvas.wisc.edu/courses/427090/files/40541665?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541665/download?download_frd=1)) • More examples (https://canvas.wisc.edu/courses/427090/files/40541666?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541666/download?download_frd=1) • boot_demo.R (https://canvas.wisc.edu/courses/427090/files/40541664?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541664/download?download_frd=1) • • 📖 ISLR Sec 5.2, 5.3	12/3	12/
Practice for Final Exam: STAT340-Topic-Overview.html (https://canvas.wisc.edu/courses/427090/files/40541669?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541669/download?download_frd=1) • Practice Quiz 1 ($CANVAS_OBJECT_REFERENCE$/quizzes/g5b387daf66f4337ae30bf28afbaaf780) • More Practice ($CANVAS_OBJECT_REFERENCE$/quizzes/g1c568c391a70c1f3e3062e536c5ea475) • Extra Practice ($CANVAS_OBJECT_REFERENCE$/quizzes/ga3eeb3ef81d631695d8459742b89c9d9)	12/10 last class review for final	

• **Final_s23** (https://canvas.wisc.edu/courses/427090/files/40541646?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541646/download?download_frd=1) (**solutions** (https://canvas.wisc.edu/courses/427090/files/40541647?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541647/download?download_frd=1)) • **Final_f23** (https://canvas.wisc.edu/courses/427090/files/40541654?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541654/download?download_frd=1) (**solutions** (https://canvas.wisc.edu/courses/427090/files/40541668?wrap=1) (https://canvas.wisc.edu/courses/427090/files/40541668/download?download_frd=1)) • Final s24 (solutions)		

Final Exam

Friday Dec 18, 12:15-2:15, location TBD