DSCI 318: Advanced Methods in Data Science

Salisbury University · Fall 2026 · Section 001

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Course information

Instructor

Randall E. Cone, Ph.D.

Email

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Office

Henson Science Hall 116

Office hours

2:00–3:30 p.m. Monday, Tuesday, Wednesday, Friday; and by appointment.

Class meetings

10:00–10:50 a.m. Monday, Tuesday, Wednesday, Friday

Room

Devilbiss Hall 127, every session. DH 127 is a dedicated computing lab; Python, Jupyter, and every package used this semester are, or will be, installed on all workstations.

Credits

4 credit hours. Meets 4 hours per week.

Prerequisites

C or better in MATH 216 and DSCI 218

Course description and purpose

An advanced course in data science concepts, focused on synthesizing diverse, possibly unstructured data to better understand and characterize the world. The course covers:

- the data science life cycle;
- advanced data representation;
- data characterization and selection;
- time series analysis;
- numerical optimization and loss functions;
- model comparison;
- visual analytics.

> **What this course is for:**
>
> **DSCI 318 introduces the data science life cycle and builds the mathematical and computational foundation the rest of the major depends on: representing data correctly, choosing and fitting models with an honest understanding of their tradeoffs, and communicating results to audiences who are not already experts. Every weekly challenge and every exam draws directly on that life cycle, asking a real question, exploring real data, building a model that is actually justified, and explaining what it does and does not show.**
>
> This course is also the direct prerequisite for DSCI 470, the department's capstone. The habits built here are the same habits DSCI 470 assumes on day one: choosing a defensible question, handling data honestly, and defending a method under scrutiny.

Recommended resources

There is no required textbook. Every lecture is delivered as instructor-provided Jupyter notebooks, distributed through MyClasses, which are the primary course material.

- James, G., Witten, D., Hastie, T., Tibshirani, R., & Taylor, J. (2023). *An Introduction to Statistical Learning with Applications in Python*. Springer.
  Free PDF available from the authors at statlearning.com. Referenced throughout the semester as ISLP; you will use this same reference again in DSCI 470.

Computing environment

Class meets every session in Devilbiss Hall 127, a dedicated computing lab. Python, Jupyter, and every package used this semester are, or will be, installed on each workstation. All in-class work and all assessments, including Weekly Lab Challenges and exams, are completed on the DH 127 workstations; a personal laptop is never required to fully participate in or complete this course.

> **Installing Python on your own laptop is optional.**
>
> You are encouraged, but not required, to set up the same environment on a personal laptop for your own practice between class sessions. This benefits your own studying and gets you comfortable with an installation process you will rely on in later courses, but it plays no role in how any Weekly Lab Challenge or exam in this course is completed or graded.

Setting up Python on your own laptop, if you choose to

Recommended: Install Miniforge, a free, fully open-source distribution of the conda package manager maintained by the conda-forge community. The installer is a graphical program on Windows and a shell script on macOS and Linux. Full instructions, including troubleshooting, are at the conda-forge/miniforge GitHub repository. These are the identical instructions used in DSCI 470, so setting this up now carries forward directly.

Once installed, use `conda` to install JupyterLab and the packages used throughout the semester, with others added as needed:

- NumPy, pandas
- scikit-learn
- Matplotlib, seaborn, Plotly

If your own installation ever behaves differently than the DH 127 workstations, the workstations are the reference environment for this course; bring the discrepancy to office hours rather than debugging it alone.

Grading

Grade weighting

Component	Weight
Weekly Lab Challenges	40%
Exams	40%
Final project	20%
Total	**100%**

Letter grades. A: 90–100. B: 80–89.9. C: 70–79.9. D: 60–69.9. F: Below 60.

Weekly Lab Challenges, exams, and the final project are described in their own sections below.

Weekly Lab Challenges

Most weeks close with a Challenge Lab, a Jupyter notebook applying that week's methods to a new question or dataset. Each is completed individually during class in DH 127; you may consult your own notebooks from all earlier lectures and challenges.

A typical Weekly Lab Challenge asks you to:

- reproduce a core result from that week's lectures on new data, confirming your own understanding before extending it;
- extend that result to answer a genuinely new question, not just repeat the lecture's own example;
- write a short reflection connecting what you found back to the week's concepts, in your own words.

Each Weekly Lab Challenge includes its own grading rubric, distributed with the assignment, so you know exactly what is being assessed before you begin.

Exams

Three exams are given this semester, each called an Exam Challenge, completed individually on the DH 127 workstations:

1. **Exam Challenge 1** (October 14 and 16), cumulative over Lectures and Challenges 1.1–5.3.
2. **Exam Challenge 2** (November 20), cumulative over Lectures and Challenges 6.1–9.3.
3. **Comprehensive Final Challenge**, cumulative over the entire semester, given during the University's final assessment period.

Each Exam Challenge follows the same format as a Weekly Lab Challenge, a Jupyter notebook applying course methods to data, completed individually, but drawing on a wider span of material and weighted accordingly.

Final project

You will use the knowledge developed throughout the semester to investigate a dataset and tell its story. This is your first experience with an open-ended data science project in this program, and it is deliberately structured to prepare you for DSCI 470's own, larger capstone project next year.

The project proceeds in three stages:

1. **Proposal** (due Monday, November 30). A short written proposal naming your dataset, your research question, and your planned approach, submitted for approval before substantial work begins.
2. **Development** (November 30 through December 4, in and outside of class). Analysis, modeling, and visualization work, carried out primarily during the dedicated final project sessions.
3. **Written report and in-class presentation** (report due Monday, December 7, at 10:00 a.m.; presentations during class, December 7–9). A written report telling your dataset's story, defended in a short in-class presentation.

Full instructions and the grading rubric are distributed on Monday, November 23, with the Data Story-Telling lecture.

Late work

Weekly Lab Challenges and exams. Work submitted late without a reasonable excuse receives a 10% reduction in grade for each class day it is late.

Excused work. If illness, a family emergency, a university-sponsored activity, or a religious observance affects a deadline, contact me as early as you can, ideally before the deadline itself. Documentation with a proper signature may be required for any reschedule.

Attendance and classroom conduct

Plan to attend class every day. Come prepared: you are expected to ask and answer questions at least once during most sessions. When classmates are presenting, pay attention and ask questions if you have them.

Devices. DH 127's own workstations are used for all coursework, so a personal laptop is not needed in class. If you bring one, use it in a way that does not distract your classmates, and keep phones in your bag or pocket during class.

Academic integrity and collaboration

Weekly Lab Challenges and exams. Individual work. Do not collaborate.

Course materials. Course notes and materials are for the use of students enrolled in this section. Ask me before sharing them with anyone outside the course; sharing them without permission also violates copyright law.

The Salisbury University Academic Misconduct Policy is available from the Office of the Provost.

Course schedule

The schedule is tentative and subject to change. Changes are announced in class and in MyClasses as early as possible. Calendar dates below (semester start, holidays, and the final assessment) are confirmed against the department's Fall 2026 course schedule.

Class meets every session in Devilbiss Hall 127.

Key dates

- Semester begins: Monday, August 31, 2026
- Labor Day, no class: Monday, September 7, 2026
- Exam Challenge 1: Wednesday and Friday, October 14 and 16, 2026
- Fall Break, no class: Monday–Tuesday, October 19–20, 2026
- Exam Challenge 2: Friday, November 20, 2026
- Thanksgiving recess, no class: Wednesday–Friday, November 25–27, 2026
- Final Project Proposal and Dataset due: Monday, November 30, 2026

- Final Project written report due: Monday, December 7, 2026, 10:00 a.m.
- Last day of classes: Wednesday, December 9, 2026
- DSCI 318 Comprehensive Final Challenge: Tuesday, December 15, 2026, 8:00–10:30 a.m.

Daily schedule, Fall 2026

Date	Session	Topic	Due
Week 1: Aug 31–Sep 4			
Mon 8/31	1.1	What Is Data Science? (Life Cycle + real-world pivot)	
Tue 9/1	1.2	Vectors, Matrices, and Norms	
Wed 9/2	1.3	SQL/SQLite + First Look at Learning Algorithms	
Fri 9/4	1.4	Challenge Lab: Weighted Estimators	
Week 2: Sep 7–11			
Mon 9/7		**No class: Labor Day.**	
Tue 9/8	1.4	Challenge Lab: Weighted Estimators, continued	Weekly Lab Challenge due
Wed 9/9	2.1	EDA & Data Transformation	
Fri 9/11	2.2	EDA & Data Transformation	
Week 3: Sep 14–18			
Mon 9/14	2.3	Challenge Lab: Confounding Variables	
Tue 9/15	2.3	Challenge Lab: Confounding Variables, continued	Weekly Lab Challenge due
Wed 9/16	3.1	EDA & Data Transformation	
Fri 9/18	3.2	EDA & Data Transformation	
Week 4: Sep 21–25			
Mon 9/21	3.3	EDA & Data Transformation	
Tue 9/22	3.4	Challenge Lab: Rescaling, Log Transformation & Outlier Judgment	
Wed 9/23	3.4	Challenge Lab: Rescaling, Log Transformation & Outlier Judgment, continued	
Fri 9/25	3.4	Challenge Lab: Rescaling, Log Transformation & Outlier Judgment, continued	Weekly Lab Challenge due
Week 5: Sep 28–Oct 2			
Mon 9/28	4.1	EDA & Data Transformation (wrap-up)	

Date	Session	Topic	Due
Tue 9/29	4.2	EDA & Data Transformation (wrap-up)	
Wed 9/30	4.3	Time Series Analysis (begins)	
Fri 10/2		Extra-Credit Lab: Quartets Lab	
Week 6: Oct 5–9			
Mon 10/5		Extra-Credit Lab: Quartets Lab, continued	
Tue 10/6	5.1	Time Series Analysis	
Wed 10/7	5.2	Time Series Analysis	
Fri 10/9	5.2	Time Series Analysis, continued	
Week 7: Oct 12–16			
Mon 10/12	5.3	Time Series Analysis	
Tue 10/13	5.3	Time Series Analysis, continued	
Wed 10/14	5.4	EXAM CHALLENGE 1 (cumulative, Lectures and Challenges 1.1–5.3)	
Fri 10/16	5.4	EXAM CHALLENGE 1 (cumulative, Lectures and Challenges 1.1–5.3), continued	Exam Challenge 1 due
Week 8: Oct 19–23			
Mon 10/19		**No class: Fall Break.**	
Tue 10/20		**No class: Fall Break.**	
Wed 10/21	6.1	Time Series Analysis (wrap-up)	
Fri 10/23	6.1	Time Series Analysis (wrap-up), continued	
Week 9: Oct 26–30			
Mon 10/26	6.2	Time Series Analysis (wrap-up)	
Tue 10/27	6.2	Time Series Analysis (wrap-up), continued	
Wed 10/28	6.3	Challenge Lab: Stationarity and Differencing	
Fri 10/30	6.3	Challenge Lab: Stationarity and Differencing, continued	Weekly Lab Challenge due
Week 10: Nov 2–6			
Mon 11/2	7.1	Numerical Optimization & Loss Functions: Squared and Absolute Error	
Tue 11/3	7.2	Numerical Optimization & Loss Functions: Gradient Descent	

Date	Session	Topic	Due
Wed 11/4	7.3	Numerical Optimization & Loss Functions: Gradient Descent in Practice	
Fri 11/6	7.4	Challenge Lab: Loss Functions and Gradient Descent	Weekly Lab Challenge due
Week 11: Nov 9–13			
Mon 11/9	8.1	Ensemble & Aggregation: Decision Trees	
Tue 11/10	8.2	Ensemble & Aggregation: Bagging and Random Forests	
Wed 11/11	8.3	Ensemble & Aggregation: Gradient Boosting	
Fri 11/13	8.4	Challenge Lab: Trees and Ensembles	Weekly Lab Challenge due
Week 12: Nov 16–20			
Mon 11/16	9.1	Model Assessment: Training Error, Test Error, and Overfitting	
Tue 11/17	9.2	Model Assessment: Cross-Validation and Tuning	
Wed 11/18	9.3	Model Assessment: Comparing Models	
Fri 11/20	9.4	EXAM CHALLENGE 2 (cumulative, Lectures and Challenges 6.1–9.3)	Exam Challenge 2 due
Week 13: Nov 23–27			
Mon 11/23	10.1	Data Story-Telling	
Tue 11/24		Open Lab Time	
Wed 11/25		**No class: Thanksgiving.**	
Fri 11/27		**No class: Thanksgiving.**	
Week 14: Nov 30–Dec 4			
Mon 11/30		Final Project: development/work session	Final Project Proposal and Dataset due
Tue 12/1		Final Project: development/work session	
Wed 12/2		Final Project: development/work session	
Fri 12/4		Final Project: development/work session	
Week 15: Dec 7–9			
Mon 12/7		Final Project: presentations	Final Project written report due, 10:00 a.m.

Date	Session	Topic	Due
Tue 12/8		Final Project: presentations	
Wed 12/9		Final Project: presentations	
Final Exam			
Tue 12/15	Final Exam	COMPREHENSIVE FINAL CHALLENGE, 8:00–10:30 a.m.	Comprehensive Final Challenge due

Accessibility and accommodations

Any student registered with the Office of Access & Accommodations (OAA) who would like to use approved accommodations in this course should contact me as soon as possible to arrange a meeting to coordinate them.

Students with disabilities can request reasonable accommodations, auxiliary aids and services, and modifications to University policies through the OAA by following the OAA's procedures for Requesting Accommodations, Modifications, Aids, and Services.

For more information, see the Office of Access & Accommodations page, email accommodations@salisbury.edu, or visit the office at Guerrieri Student Union, Room 229.

If any course material is inaccessible to you, tell me and I will fix it. Examples include a notebook that does not work with your screen reader, a figure without a usable description, or a workstation setup that does not suit your needs. You do not need to be registered with the OAA to raise this.

Student support resources

Communication. MyClasses and email are used extensively for announcements and course material. Check your SU email at least once a day.

Office hours. Office hours exist for your benefit. If you have questions about the course, about a Weekly Lab Challenge, or about anything else, come by. You do not need a specific question prepared.

Writing support. The University Writing Center works with students at any stage of a draft, including technical writing. Bringing a report or reflection there is a good use of your time.

Basic needs. If you have difficulty affording food or lack a stable place to live, SU has resources that can help. Contact the Dean of Students, or talk to me and I will help you find them.

Writing across the curriculum

Students are expected to communicate mathematics and mathematical ideas effectively in speech and writing. At the University Writing Center, trained consultants are ready to help at any stage of the writing process. In addition to the writing instruction that occurs in the classroom and during office hours, the Center offers another site for learning about writing. All students are encouraged to make use of these services.

Learning outcomes

By the end of this course you will be able to:

1. Perform exploratory data analysis to guide the development of associated predictive models.
2. Expand computational and mathematical skills to include contemporary, industry-standard methods in data science.
3. Effectively communicate the results of a data science project using data and model visualizations, dashboards, professional writing, and professional presentations.
4. Generate complex models in solution to real-world problems, and understand the tradeoffs of adopting different model strategies.

DSCI 318, Section 001, Fall 2026. Salisbury University. This syllabus is subject to change; changes will be announced in class and posted in MyClasses.