

Course Syllabus - Spring A 2024

CSE 578: Data Visualization

Course Description

Visual representations generated by statistical models help us to make sense of large, complex datasets through interactive exploration, thereby enabling big data to realize its potential for informing decisions. This course covers techniques and algorithms for creating effective visualizations based on principles from graphic design, visual art, perceptual psychology, and cognitive science to enhance the understanding of complex data.

Specific topics covered include:

- Data transformations
- Exploratory querying
- Statistical graphics
- Time series analysis
- Exploratory spatial data analysis

Technologies covered include:

- Tableau

Learning Outcomes

Learners completing this course will be able to:

- Develop exploratory data analysis and visualization tools using Python and Jupyter notebooks
- Apply design principles for a variety of statistical graphics and visualizations including scatterplots, line charts, histograms, and choropleth maps
- Combine exploratory queries, graphics, and interaction to develop functional tools for exploratory data analysis and visualization

Estimated Workload/ Time Commitment Per Week

Average of 18 - 20 hours per week

Required Prior Knowledge and Skills

This course will be very challenging, and learners are expected to learn the necessary technologies on their own time.

Proficient Mathematical Skills and Theoretical Understanding

- Basic statistics
- Discrete mathematics
- Computer organization
- Architecture
- Data structures
- Algorithms in computer science

Strong Application Skills

- Apply high-level programming languages (e.g., C++, Java) and scripting languages (e.g., Python) to complete tasks

Proficient Experience

- High-level programming languages (e.g., C++, Java) and scripting languages (e.g., Python)

Technology Requirements

Honorlock Proctoring System Requirements

- Operating System: Windows 10, macOS 10.14+, Chrome OS
- Browser: Google Chrome (93+)
- Internet Speed: Speed: 1.5 Mbps download, 750 Kbps upload

Hardware

- Standard personal computer with major operating system
 - Personal computer with 8 GB RAM or higher and an x86-64 CPU. Must be able to install virtual machines on this computer. Computers with ARM processors (or any other architecture) will not work.
- Reliable, strong Internet connection
- Webcam
- Microphone

Software/Other

- To complete coursework (e.g., assignments and projects), these applications/languages are required:
 - Jupyter Notebooks
 - Python

Textbook and Readings

At the graduate level, inquiry, research, and critical reading are part of the learning experience; however, this course does not have a required textbook. Any required readings are provided within or are accessible through the course of the [ASU Library](#).

Course Schedule and Important Dates

Course teams will not be working on ASU's days off* and those are listed in the Course Schedule. Please review the [ASU Days Off](#) for more details.

Module/Title	Begins at 12:01 AM Arizona (AZ) Time	Ends at 11:59 PM Arizona (AZ) Time
Module 0: Welcome and Start Here	January 4	January 14
Module 1: Introduction to Data Visualization	January 8	January 14
Module 2: Introduction to Statistical Graphics <i>January 15: ASU day off*</i>	January 15	January 21
Module 3: Multivariate Analysis	January 22	January 28

Module 4: Temporal Analysis	January 29	February 4
Module 5: Geographical Data Analysis	February 5	February 11
Module 6: Hierarchical Data Analysis	February 12	February 18
Course Evaluation	February 16	February 26
Module 7: Additional Tools Used for Data Visualization	February 19	February 25
Final Exam	February 21	February 28
Request for Faculty Review: MCS Portfolio Project Report Inclusion Request Optional, degree-seeking learner degree requirement	February 19	March 15
Faculty Feedback for the Review: MCS Portfolio Project Report Inclusion Request Optional, degree-seeking learner degree requirement	February 19	March 29
Course Closes Once the course closes, you will no longer be able to access coursework you have submitted, so please download copies of what you would like from the course (e.g., Request for Faculty Review: MCS Portfolio Project Report Inclusion Request)		April 12

Grades are due Friday, March 1, 2024. Please see the [ASU Academic Calendar](#) for additional information.

Assignment Deadlines and Late Penalties

Unless otherwise noted, all graded work is due on **Sundays at 11:59 PM Arizona (AZ) time**. Review specific due dates directly in your course. For learners with accommodations through [Student Accessibility and Inclusive Learning Services \(SAILS\)](#) and/or the [Pat Tillman Veterans Center \(PTVC\)](#), please work with your SAILS consultant and/or PTVC Advocacy Team, Connect, and your instructor.

Exams

A single-automatic late penalty of 100% is applied after the scheduled due date and time.

- **Final Exam** - available from Wednesday, February 21, 2024 at 12:01 AM AZ Time until Wednesday, February 28, 2024 at 11:59 PM AZ Time.

Course Content

Each course in the MCS program is uniquely designed by expert faculty, so learners can best master the learning outcomes. As a result, course features and experiences are not the same across all MCS courses. Learners are expected to plan accordingly to accommodate for these differences.

Content and Assessment Details

If you have specific questions related to instructional and assessment items in this course that you would like to be considered to be addressed in the weekly Zoom event hosted by the instructor, please clearly indicate your request in your Ed Discussion thread.

PlayPosit Lecture Playlists

The course content is presented through a collection of Playposit Playlists embedded in each module. Playposit is a video platform that prompts interaction and note-taking while viewing course content. The playlists launch automatically and you can playback the course content by selecting the video titles in the playlist. The videos can be rewatched, but playlist videos cannot be downloaded. The playlist pages will include the downloadable video transcripts and any applicable supplementary material. Other course materials that accompany the lectures will be found in the media guides.

A media guide is included at the beginning of each module in the Overview section. These guides are designed to give you a snapshot description of each week's media components and to provide the week's PDF lecture slides or note-taking materials where available, so you can plan your learning and quickly go back and review material as you prepare for your coursework.

In-Video Questions/Playposit Interactions

Playposit provides opportunities for interaction and reflection as you study the course content. Videos may have interactions designed to support your learning, highlight specific content, encourage active viewing and/or note-taking and provide practice opportunities. The interactions are short, ungraded quizzes to test your knowledge of the concepts presented during the lecture videos. You may take

your time, review your notes, and learn at your own pace because in-video questions are untimed. With unlimited attempts, you may retake these as often as you would like at any point in the course. You can toggle the clipboard on the left of the screen and select a review to see all the questions.

There are no late penalties. Interactives are not counted toward your final grade in the class.

Knowledge Checks

Knowledge checks are short, ungraded quizzes placed after a lecture video or at the end of lecture playlists. The Knowledge Checks are designed to provide frequent practice as you actively study your course content. You may take your time, review your notes, and learn at your own pace because knowledge checks are untimed. With unlimited attempts, you may retake these as often as you would like at any point in the course. You are encouraged to read the full feedback, review your answer choices, and compare them to the correct answers. With the feedback as your guide, you may use these as opportunities to study for other assessments and tasks in the course.

There are no late penalties. Knowledge Checks are not counted toward your final grade in the class.

Readings

Suggested readings may accompany topics. They are supplementary or enrichment materials for you to further understand the course topics.

Recommended Resources

Please explore the recommended resources to deepen your knowledge and enhance your skills on the topics covered each week. Although the content in these resources will not be explicitly assessed, they may support your learning and successful completion of coursework.

Discussions

Ed Discussion

Ed Discussion (Ed) is being used in place of Canvas Discussion Forums. The purpose of Ed Discussion is to provide a place for learners to ask questions and receive answers from course staff and peers about course content and course work. The course team is engaged in discussions, but it is also a space to clarify, support, and enrich learner-to-learner communication and learning. There are designated categories for course items. You must select a category and subcategory to start a thread.

Discussions in Ed are designed to provide:

- Clarification
- Feedback
- Enrichment and deeper learning
- Connections between concepts or key ideas
- Reflection opportunities of real-world experiences
- Respectful debate and perspective building
- Resource sharing
- Networking

There are no late penalties. Ed is not counted toward your final grade in the course.

Designated Assignment and/or Project Discussions in Ed Discussion

Use Ed to discuss items relating to the course assignments and/or projects. Questions/Threads should be categorized by their designated title in Ed. Please check for questions already asked and answered, or marked as resolved.

There are no late penalties. Responses in Ed are not counted toward your final grade in the course.

Practice Quizzes

There is a practice quiz to help prepare you for each graded quiz. You may retake these as often as you like at any point in the course. You are encouraged to read the full feedback, review your answer choices, and compare them to the correct answers. With the feedback as your guide, you may use these as opportunities to study for other assessments and tasks in the course.

There are no late penalties. Practice quizzes are not counted toward your final grade in the class.

Graded Quizzes

Modules 1-6 each include one (1) graded quiz for a total of six (6) graded quizzes in the course. Each graded quiz includes ten (10) multiple choice questions. You will be allowed one (1) attempt for each of these quizzes. There is no time limit on how long you can take to complete each graded quiz. Once you open a graded quiz, the timer will start and you are to complete the assessment in a single session. Graded quizzes in this course include partial feedback. Read the Graded Quiz and Exam Policy for your course for more information.

Graded quizzes count toward your final grade in the class.

Individual Programming Assignments

This course includes six (6) individual assignments. All assignments are provided in the *Welcome and Start Here* section, so you can preview what is expected and design your own learning schedules to complete these on time.

Assignments count toward your final grade in the class.

Ed Lessons

All individual programming assignments for this course will use Ed Lessons. You must complete and then submit your work in Ed Lessons. Carefully review submission directions outlined in the assignment overview documents in order to correctly earn credit.

Individual Project

This course includes one (1) individual project. All projects are provided in the *Welcome and Start Here* section, so you can preview what is expected and design your own learning schedules to complete these on time. As a set of one (1), the project may be included in the Request for Faculty Review: MCS Portfolio Project Report Inclusion Request, which is optional and for degree-seeking learners only.

The project counts toward your final grade in the class.

Practice Peer Reviews

There are three (3) optional peer reviews in this course, each associated with an activity so you can receive feedback on the deliverables you create for these practice assessments. Although optional, you are encouraged to complete these peer reviews so that everyone can benefit from feedback on their work. You are expected to review your peers' work in a professional and respectful manner. Although there are no late penalties, it is important to submit your work as close to the due date as you can because classmates grade most of the assignments within three (3) days of the due date, and if you submit yours too late, there may not be anyone to review your work.

Graded Peer Reviews

There are five (5) required peer reviews in this course, each associated with an individual programming assignment so you can receive feedback on the deliverables you create for these graded assessments. Although they are worth 0% of your grade, you are required to complete these peer reviews so that everyone can benefit from feedback on their work. You are expected to review

your peers' work in a professional and respectful manner. Although there are no late penalties, it is important to submit your work as close to the due date as you can because classmates grade most of the assignments within three (3) days of the due date, and if you submit yours too late, there may not be anyone to review your work.

Request for Faculty Review: MCS Portfolio Project Report Inclusion Request

This is an optional task for degree students wanting to use this course's project(s) as part of their portfolio degree requirement/specialization requirements. Review your onboarding course and the Welcome and Start Here section of your course for more details. The submission space is towards the end of the course.

Your Request for Faculty Review: MCS Portfolio Project Report Inclusion Request will be evaluated only if you meet the criteria (see your MCS Handbook for more details):

- Final course letter grade of a B or higher
- Degree-seeking students with course letter grades that are lower than a B will not have their submissions reviewed.

Although there are no late penalties, these requests must be submitted by the designated deadline. The Request for Faculty Review: MCS Portfolio Project Report Inclusion Request does not count toward your final grade in the class.

- Address these project components in your Request for Faculty Review: MCS Portfolio Project Report Inclusion Request:
 - Course Project Progress Report
 - Course Project Final Report

Practice Exams

In order to help you prepare for your proctored exam, you have three (3) practice exams. Since they are intended to be practice opportunities and to help you learn, they are untimed, ungraded, and include feedback. You may engage with your peers in Ed Discussion to address questions, share resources and strategies, and provide feedback to help one another learn. You are encouraged to read the full feedback, review your answer choices, and compare them to the correct answers. You are encouraged to submit questions in Ed Discussion for the course team to address during Live Sessions. Use the feedback to guide your learning and to study for the proctored exam.

There are no late penalties. Practice exams are not counted toward your final grade in the class.

Proctored Exam

You have one (1) proctored exam. This consists of a Final Exam. Proctored exams include limited feedback. Read the Graded Quiz and Exam Policy for your course for more information.

No late exams will be permitted or accepted and will result in a score of zero (0) points. This does not include established accommodations for learners receiving accommodations through [Student Accessibility and Inclusive Learning Services \(SAILS\)](#) and and/or the [Pat Tillman Veterans Center \(PTVC\)](#). Proctored exams count toward your final grade in the class.

Exam Details	Final Exam
Content Covered	Modules 1, 2, 3, 4, 5, and 6
Question Type	Single-answer and multiple-answer multiple choice questions
Number of Questions	31 total questions (30 content questions + 1 academic integrity question)
Availability Start	Wednesday, February 21, 2024 at 12:01 AM AZ Time
Availability End	Wednesday, February 28, 2024 at 11:59 PM AZ Time
Scheduling Reminder In order to have enough time to complete the exam, you should start your exam no later than the listed date and time to ensure you have enough time to complete it before the due date.	Wednesday, February 28, 2024 at 9:01 PM AZ Time
Duration	120 minutes + plan for at least 15 minutes for proctoring set up

Exam Allowances

- Any resources not included in this list are **not** allowed during the exam or in your exam space.

- All resources must be organized prior to proctoring and may not be opened for the first time (including being downloaded) during the exam.
- **Hard copy and/or soft copy texts, books, and/or other reference materials downloaded on your device or on a website:** None
- **Calculators:** Yes
 - Four Function Calculator
 - Scientific Calculator
 - Computer's Calculator (basic or scientific mode only)
- **Notes:** Yes, please read the specifications and plan ahead accordingly.
 - Handwritten notes: Hard copy; two (2) sheets; 8.5"x 11" or international A4 paper; double-sided.
 - Digital and typed/word processed hard copy notes will **not** be allowed unless there is an accommodation on file with SAILS.
- **Web:** Yes
 - Course websiteCourse website (to access exam only)
- **Software:** None
- **Other technologies, devices, and means of communication:** None
- **Whiteboard, scratch paper, writing utensils, erasing resources:** Learners are *strongly* encouraged to use the whiteboard option instead of scratch paper.
 - If using a whiteboard, learners may have erasable whiteboard markers and what is needed to erase writing on the whiteboard; please have extra whiteboard markers and eraser resources in your testing area.
 - If using scratch paper, learners may have an unlimited amount of blank scratch paper of any size, writing utensils (e.g., pens, pencils, markers, and/or highlighters) and erasers; please have extra ones in your testing area should you run out of ink, the pencil breaks, etc.
 - Before the exam concludes and the proctoring session ends, all scratch paper must be destroyed and all whiteboard markings must be erased. The last question in the exam will be a confirmation of learners executing these ASU academic integrity actions.

- **Other:**
 - If you anticipate needing bathroom breaks during your exam, prior to opening the exam, please post a private thread to your instructor in Ed. If you take bathroom breaks during the exam, and you have not already notified your instructor, please post a private thread, so your instructor is aware.
 - Learners are to independently take the exam in a single session without leaving the testing space (e.g., no bathroom breaks) to ensure proctoring of the entire session. Once you open the exam, your testing session begins.
 - You will be allowed one (1) attempt to take and complete each exam.
 - Learners are to stay within a clear view of the proctor throughout the duration of the proctored exam session.
 - Your exam will automatically be submitted if it is not completed before the deadline.
- **Reminder:** All virtual machines must be closed *prior* to starting proctoring.

Proctoring

Honorlock will proctor your exams this semester. Honorlock is an online proctoring service that allows you to take your exam from the comfort of your home. You do **not** need to create an account or schedule an appointment in advance. Honorlock is available twenty-four hours a day and seven days a week (24 hours/7 days), and all that is required is a computer, a working webcam/microphone, your ID, and a stable internet connection. Review your onboarding course for more information about Honorlock and the Syllabus section in your course for what is allowed during proctoring and how to schedule and take your proctored exam.

Course Grade Breakdown

Course Work	Quantity	Team or Individual	Points
Graded Quizzes	6	Individual	100
Programming Assignments	6	Individual	300
Assignment Peer Reviews	5	Individual	0

Required Checkpoint: Project Preparation	1	Individual	0
Course Project Progress Report	1	Individual	150
Course Project Final Report	1	Individual	250
Final Exam	1	Individual	200
Total Course Points			1000

*The project(s) count for 30% or more of the overall course grade, so this is a portfolio eligible course. See the [MCS Graduate Handbook](#) for more information about the portfolio requirement if you are a degree student.

Grade Scale

You must earn a cumulative grade of 70% to earn a “C” in this course. You must earn at least a “C” to receive graduate credit. This course has no grade curving. All graded coursework will be included to calculate grades (i.e., no graded items will be dropped). Grades will be/not be rounded. Grades in this course will not include pluses or minuses.

The instructor reserves the right to adjust individual grades based on, but not limited to: violations of academic integrity.

Range of Points	Percentage	Letter Grade
900 - 1000	90 - 100	A
800 - 899.99	80 - 89.99	B
700 - 799.99	70 - 79.99	C
600 - 699.99	60 - 69.99	D
0 - 599.99	0 - 59.99	E

Zoom Meetings

This course has three (3) types of Zoom meetings:

- Instructor Zoom Events
- Instructional Assistant (IA) Zoom Support Sessions
- Grader Zoom Support Sessions

Check the Zoom tab in the navigation menu of your course. Although we try to be consistent for our learners' planning purposes, the schedule is subject to change throughout the course, so stay up-to-date on the event details by checking your Ed and course announcements.

Read about the specific policies related to Zoom meetings directly in your onboarding course and your course pages: Syllabus, ASU Course Policies, and any additional course-specific policy information in the Welcome and Start Here area of this course. You are responsible for adhering to all policies.

Instructor Zoom Events will be recorded and shared through the "Zoom" navigation link in your course. These can be found by going to the "Cloud Recordings" tab. These recordings will be unavailable after 120 days.

Policies

This section refers to course-specific policies. Please refer to the ASU Course Policies section in your course, your onboarding course, and the Welcome and Start Here section of your course in addition to the policies listed in this section.

Use of Generative AI

TBD - Check your course in Canvas for these details.

Disclaimer

The information in this syllabus may be subject to change without advance notice. Stay informed by checking course announcements and the syllabus section of your course.

Course Creators



Ross Maciejewski

Ross Maciejewski (Dr. Ross) is an Associate Professor at Arizona State University in the School of Computing, Informatics & Decision Systems Engineering and Director of the Center for Accelerating Operational Efficiency, a Department of Homeland Security Center of Excellence. His primary research interests are in the areas of geographical visualization and visual analytics focusing on public health, dietary analysis, social media, criminal incident reports, and the food-energy-water nexus.



Huan Liu

Professor Huan Liu joined ASU in 2000 after conducting research in Telecom (Telstra) Australia Research labs and teaching at the National University of Singapore. He has extensive experience in research and development. Liu's research and teaching focuses on machine learning, data mining, and real world applications.



Selcuk Candan

K. Selcuk Candan is a professor of computer science and engineering at Arizona State University and the director of ASU's Center for Assured and Scalable Data Engineering (CASCADE). His primary research interest is in the area of management and analysis of non-traditional, heterogeneous, and imprecise (such as multimedia, web, and scientific) data.