

ENGR 1330
Computational Thinking with Data Science
Fall 2025
Syllabus

Instructor: Dr. Seyed Mahdi Ghamkhari

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Class Location: Livermore Center Room 104 Labs will be online on Microsoft Teams.

Prerequisites: No technical/programming background is required.

Office Hours: Wednesday from 12:00 p.m. to 1:00 p.m.

Office Location: Electrical Engineering Department Room 223, or online by appointment.

Dates

Classes begin: 08/25

Holidays: 09/01, 11/26 to 11/30

WCOE job fair day: 09/16 and 09/17

Last day to drop a course without academic penalty: 09/10

Last day to drop a course with academic penalty: 11/17

Last day of classes: 12/03

Course Description

Introduces Python programming, its relevant modules and libraries, and computational thinking for solving problems in Data Science. Students will learn data science approaches to importing, manipulating, and analyzing data as well as modeling and visualizing real-world data sets in various science and engineering disciplines.

- Three credit hours comprising of lectures and hands-on lab sessions.
- This course provides a hands-on learning of principles of programming and data science by introducing Python programming, its relevant modules and libraries, and computational thinking for solving problems in data science. Students will learn data science approaches to importing data, manipulating data, and analyzing it as well as modeling and visualizing real-world data sets in various science and engineering disciplines.

Course Objectives

- Computational thinking for problem-solving: Logical problem solving, decomposition, pattern recognition, abstraction, representation, algorithm design, and generalization.
- Python Programming: Variables, constants, data types, data structures, strings, math Operators, boolean operators, expressions, program constructs, functions, loop, I/O files, modules, and database.
- Data science fundamentals:
 - Experimental setup: Importing and formatting data sets, displaying data, data pre-processing.
 - Introductory statistical analysis with Python: Elementary statistics, randomness, Sampling, probability distribution, confidence intervals,

- Basic data analysis, visualization, and machine learning: Data pre-processing, basic, basic supervised/unsupervised learning, performance evaluation metrics.

Expected Learning Outcomes

On completion of the course, students should

- Be able to implement basic Python programs using computational thinking concepts.
- Know basic Python programming constructs and libraries relevant to data science.
- Be able to write Python scripts to perform fundamental data analytics and basic visualization

ABET Student Outcomes

Engineering:

- An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Computer Science:

- Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
- Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program’s discipline

Textbooks

Ani Adhikari and John DeNero, Computational and Inferential Thinking, The Foundations of Data Science, Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0). Link: <https://www.inferentialthinking.com/chapters/intro>.

Theodore G. Cleveland, Farhang Forghanparast, Dinesh Sundaravadivelu Devarajan, Turgut Batuhan Baturalp (Batu), Tanja Karp, Long Nguyen, and Mona Rizvi. (2021) Computational Thinking and Data Science: A WebBook to Accompany ENGR 1330 at TTU, Whitacre College of Engineering, DOI (pending) Link: http://54.243.252.9/engr-1330-webroot/engr1330jb/_build/html/intro.html

Course Components

Assessment methods	Weight (%)
Exam -1	10
Exam -2	10
Exam -3	10
Quizzes	10

Lab Exercises	20
Assignments	25
Projects	15
Overall total	100

Conversion of the numerical grade to letter grade

A: 90 – 100%

B: 80 – 90%

C: 70 – 80%

D: 60 – 70%

F: 0 – 60%

Guideline

- The course materials, quizzes, projects and assignments are uploaded on Canvas platform. Students' responses to the assignments should be uploaded on the same platform.
- Requests for re-grading of an assignment must be received within one week from the time the assignment is graded.
- Students should check Canvas for the announcements regarding the course. It is recommended that you set up your Canvas account to receive notification Emails immediately when a new announcement is made or a new assignment is uploaded.
- A response to quizzes, projects, assignments and exams that is submitted after the deadlines is not accepted and receives a grade of zero.
- Students should take notes from the materials presented in the class.
- Students should use their university email address when communicating with the instructor.
- Students should be present in the exam sessions. Makeup exams are not provided to the students who miss the exams.

Texas Tech University Student Code of Conduct

<https://www.depts.ttu.edu/dos/docs/1819PARTI.pdf>

Attendance

Attendance in class is required.

Generative AI Tools

Generative artificial intelligence tools—software that creates new text, computer code, and other content—have become widely available. Well-known examples include ChatGPT, Copilot and Gemini. This policy governs all such tools, including those released during our semester together.

Understanding how and when to use generative AI tools is quickly emerging as an important skill for future professions. To that end, you are welcome to use generative AI tools in this class as long as it aligns with the learning outcomes or goals associated with assignments. You are fully responsible for the information you submit based on a generative AI query (such that it does not violate academic honesty standards, intellectual property laws, or standards of non-public research you are conducting through coursework). Your use of generative AI tools must be properly documented and cited for any work submitted in this course."

You may use generative AI tools on assignments in this course, within the following limitations:

- Using it as a learning tool rather than copying and pasting.
- Note that all large language models still have a tendency to make up incorrect facts and fake citations, code generation models have a tendency to produce inaccurate outputs.
- You will be responsible for any inaccurate, biased, or unethical content you submit, regardless of whether it originally comes from you or a foundation model. If you use a foundation model, its contribution must be acknowledged in the handing; you will be penalized for using a foundation model without citing.
- The university's policy on plagiarism still applies to any uncited or improperly cited use of work by other human beings, or submission of work by other human beings as your own. If you do use generative AI tools on assignments in this class, you must properly document and credit the tools themselves. Cite the tool you used, following the pattern for computer software given in the specified style guide.
- If you choose to use generative AI tools, please remember that they are typically trained on limited datasets that may be out of date. Additionally, generative AI datasets are trained on pre-existing material, including copyrighted material; therefore, relying on a generative AI tool may result in plagiarism or copyright violations. Finally, keep in mind that the goal of generative AI tools is to produce content that seems to have been produced by a human, not to produce accurate or reliable content; therefore, relying on a generative AI tool may result in your submission of inaccurate content. It is your responsibility—not the tool's—to assure the quality, integrity, and accuracy of work you submit in any college course.
- Debugging code is an application where programmers, especially novices, could benefit from Generative artificial intelligence tools. Note that once a bug is pointed out, it is generally easy to verify, so the fact that the bot's answers might sometimes be wrong isn't as much of a concern.

To ensure all students have an equal opportunity to succeed and to preserve the integrity of the course, students are not permitted to submit text that is generated by artificial intelligence (AI) systems such as ChatGPT, Bing Chat, Claude, Google Bard, or any other automated assistance for any classwork or assessments. This includes using AI to generate answers to assignments, exams, or projects, or using AI to complete any other course-related tasks. Using AI in this way undermines your ability to develop critical thinking, writing, or research skills that are essential for this course and your academic success. Students may use AI as part of their research and preparation for assignments, or as a text editor, but text that is submitted must be written by the student. For example, students may use AI to generate ide-as, questions, or summaries that they

then revise, expand, or cite properly. Students should also be aware of the potential benefits and limitations of using AI as a tool for learning and research. AI systems can provide helpful information or suggestions, but they are not always reliable or accurate. Students should critically evaluate the sources, methods, and outputs of AI systems. Violations of this policy will be treated as academic misconduct. If you have any questions about this policy or if you are unsure whether a particular use of AI is acceptable, please do not hesitate to ask for clarification."

Tentative Schedule

Date	Lesson
August 25	Introduction to Class, ANACONDA and Syllabus
August 27	Introduction to Computational Thinking, Problem Solving
August 29	Problem Solving, Expressions
September 1	Holiday
September 3	Data Types, Variables
September 5	Data Structures
September 8	Algorithm Building Blocks
September 10	Sequential Structures
September 12	Selection Structures
September 15	Count Controlled Repetition
September 17	JOB FAIR NO CLASS
September 19	Sentinel Controlled Repetition
September 22	Functions
September 24	External Modules
September 26	Using AI as a Learning Tool Quiz 1
September 29	Ethics of AI / Review for Exam 1 Quiz 2

October 1	EXAM 1
October 3	Working with Numpy (Arrays, Vectors and Matrices)
October 6	Vector/Matrix Addition/Multiplication Solving Linear Systems of Equations
October 8	Numerical Computation with Numpy
October 10	Working with Pandas (Data frames)
October 13	Plotting- Plot types- Plot uses- Graphing conventions
October 15	Working with Matplotlib (Visualization)
October 17	Numerical Methods - 1
October 20	Numerical Methods - 2
October 22	Simulations
October 24	Causality Quiz 3
October 27	Review for Exam 2 Quiz 4
October 29	EXAM 2
October 31	Probability & Randomness
November 3	Sampling and empirical distributions
November 5	Descriptive Statistics
November 7	Distributions
November 10	Confidence Intervals
November 12	Interpreting confidence intervals - Center and spread Quiz 5
November 14	Bootstrapping / Review for Exam 3 Quiz 6

November 17	Correlation
November 19	EXAM 3
November 21	Linear Regression: Evaluation and Intervals
November 24	Least squares Quiz 7
November 26	THANKSGIVING HOLIDAY
November 28	THANKSGIVING HOLIDAY
December 1	Residuals Regression inference Quiz 8
December 3	Final Project Discussion
December 10	Deadline for submitting the final project

Resources/Tools

1. Anaconda platform (<https://www.anaconda.com/>): Anaconda distribution is an open-source Data Science Distribution Development Platform. It includes Python 3 with over 1,500 data science packages making it easy to manage libraries and dependencies. Available in Linux, Windows, and Mac OS X.
2. Jupyter (<https://jupyter.org/>): JupyterLab is a web-based interactive development environment for Jupyter notebooks, code, and data. JupyterLab is flexible: Configure and arrange the user interface to support a wide range of workflows in data science, scientific computing, and machine learning.
3. Math module (<https://docs.python.org/3/library/math.html>): Gives access to the mathematical functions defined by the C standard e.g. factorial, gcd, exponential, logarithm.
4. Operator module (<https://docs.python.org/3/library/operator.html>): Helps in exporting a set of efficient functions corresponding to the intrinsic operators of Python. For example, the operator `add(x,y)` is equivalent to the expression `x+y`.
5. Scipy module (<https://www.scipy.org/>): A Python-based ecosystem of open-source software for mathematics, science, and engineering. Some of the core packages are:
 - Numpy: Provides n-dimensional array package

Scipy: Fundamental for scientific computing (e.g. linear algorithm, optimization)
Matplotlib: Visualizations/2D plotting
IPython: Enhanced interactive console
Pandas: Data structures and data analysis

6. Scikit-learn module (<https://scikit-learn.org/stable/>): A library for machine learning in Python. It is a simple and efficient tool for predictive data analysis. It is built on NumPy, SciPy, and matplotlib modules.

Texas Tech University Policy

- **Students with Disabilities**

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note: instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, please contact Student Disability Services in Weeks Hall or call 806-742-2405.

- **Academic Integrity**

Academic integrity is taking responsibility for one's own class and/or course work, being individually accountable, and demonstrating intellectual honesty and ethical behavior. Academic integrity is a personal choice to abide by the standards of intellectual honesty and responsibility. Because education is a shared effort to achieve learning through the exchange of ideas, students, faculty, and staff have the collective responsibility to build mutual trust and respect. Ethical behavior and independent thought are essential for the highest level of academic achievement, which then must be measured. Academic achievement includes scholarship, teaching, and learning, all of which are shared endeavors. Grades are a device used to quantify the successful accumulation of knowledge through learning. Adhering to the standards of academic integrity ensures grades are earned honestly. Academic integrity is the foundation upon which students, faculty, and staff build their educational and professional careers. [Texas Tech University ("University") Quality Enhancement Plan, Academic Integrity Task Force, 2010].

- **Religious Holiday**

"Religious holy day" means a holy day observed by a religion whose places of worship are exempt from property taxation under Texas Tax Code §11.20. A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. A student who is absent from classes for the observance of a religious holy day shall be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence. A student who is

excused under section 2 may not be penalized for the absence; however, the instructor may respond appropriately if the student fails to complete the assignment satisfactorily.

- **Accommodation for Pregnant Students**

To support the academic success of pregnant and parenting students and students with pregnancy related conditions, the University offers reasonable modifications based on the student's particular needs. Any student who is pregnant or parenting a child up to age 18 or has conditions related to pregnancy may contact Alex Faris, the Texas Tech University designated Pregnancy and Parenting Liaison, to discuss support available through the University. The Liaison can be reached by emailing alfaris@ttu.edu. Should a student communicate with the instructor that they are pregnant or have a pregnancy related condition or may need additional resources related to pregnancy or parenting, the instructor will communicate that student's information to the Title IX Coordinator, who will work with the student and others, as needed, to ensure equal access to the University's education program or activity.

For more information regarding supportive measures, please contact pregnancy & parenting liaison Alex Faris (alfaris@ttu.edu | 806.834.3420) or visit <https://www.depts.ttu.edu/titleix/PregnacnyandParenting/index.php>. You can also visit <https://www.depts.ttu.edu/titleix/PregnacnyandParenting/index.php> to submit a request to Alex Faris for assistance.

- **Safety and Wellness**

The Texas Tech University (TTU) and Edward E. Whitacre Jr. College of Engineering are committed to the safety and wellness of our students by providing various services and resources.

Make sure you register with [Tech Alert](#) to get emergency notifications by phone call, text, or email. You are encouraged to review the [Emergency Action Plans \(EAPs\)](#) and watch the videos of [Know What To Do In Emergency Events](#) and [Surviving an Active Shooter Event Training](#) to be prepared for those emergency situations. Additionally, due to the nature of laboratory or design courses, it is mandatory for you to follow the [university safety policies](#) and any additional safety training and protocols required by the course instructor(s).

For your wellbeing, various services are available at [Student Counseling Center](#) and [Student Health Services](#). The Student Wellness Center provides convenient walk-in services M-F from 8 AM to 5 PM. Furthermore, the Texas Tech Crisis HelpLine (806-742-5555) provides 24/7/365 assistance for students experiencing a crisis or distress.

Emergency/Crisis Phone Number

TTU Police (UPD) Emergency	911
TTU Police (UPD) Non-Emergency	806.742.3931
TTU Emergency Maintenance	806.742.4OPS (4677)

TTU EHS (M-F, 8 am – 5 pm)	806.742.3876
SafeRide	806.742.RIDE (7433)
TTU Crisis HelpLine	806.742.5555
Student Wellness Center (From Urgent Care to a Full-Service Pharmacy on site)	806.742.2848
Title IX Reporting	806.742.7233
The Dean of Students	806.742.2984

Disclaimer: The subject matter and dates for the course may evolve slightly and should be considered tentative. Updates will be announced.

Version

08/22/2025