



**Important dates:**

1. Classes Begin – January 15<sup>th</sup>.
2. Holiday – January 20<sup>th</sup>.
3. Holiday – March 15<sup>th</sup>–23<sup>rd</sup>.
4. No Classes – April 21<sup>st</sup>.
5. WCOE Job Fair Day – February 11<sup>th</sup> & 12<sup>th</sup>.
6. Last day to drop without academic penalty – January 31<sup>st</sup>.
7. Last day to drop with academic penalty (counts toward state drop limit) – April 22<sup>nd</sup>.
8. Last Day of classes – May 6<sup>th</sup>.

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**Instructor**

Dr. Seyed Mahdi Ghamkhari

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Office: Electrical Engineering Department Room 231

Office Hours: Mondays 11 a.m. to 12 p.m.

**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.

- 3 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 prerequisites**

- No technical/programming background is required.

**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 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.

### Text

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>

### Resources/Tools

#### Platforms for Python Programming



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.

### Modules for Python Programming

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`.

### Python Modules for Data Science

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.

### 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 ideas, 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."



**Assessment Methods & Grading Criteria:**

A grade of zero is assigned to late submissions.

Assessment methods	Weight (%)
Exam -1	10
Exam -2	10
Exam -3	10
Quizzes	10
Lab Exercises	20
Assignments	25
Projects	15
<b>Overall total</b>	<b>100</b>

**Questions about Grading:** If there are questions regarding grading, a written memo describing the concern(s) should be prepared and the assignment in question resubmitted with the memo within two days of the class meeting in which it was returned.

**Grading Scale**

At the end of the semester, the points will be tallied and converted to a percentage. Based on the percentage obtained, the following scale will be used to assign grade:

A	90 — 100
B	80 — 90
C	70 — 80
D	60 — 70
F	00 — 60

**Class Schedule**

Tentative and Subject to change and Lectures may be recorded.

Date	Lesson
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January 17	Introduction to Computational Thinking, Problem Solving
<b>January 20</b>	<b>Holiday</b>
January 22	Problem Solving, Expressions
January 24	Data Types, Variables
January 27	Data Structures
January 29	Algorithm Building Blocks
January 31	Sequential Structures
February 3	Selection Structures
February 5	Count Controlled Repetition
February 7	Sentinel Controlled Repetition
February 10	Using AI as a Learning Tool
<b>February 12</b>	<b>JOB FAIR NO CLASS</b>
February 14	Ethics of AI
February 17	Functions
February 19	External Modules <b>Quiz 1</b>
February 21	Review for Exam 1 <b>Quiz 2</b>
<b>February 24</b>	<b>EXAM 1</b>
February 26	Working with Numpy (Arrays, Vectors and Matrices)



February 28	Vector/Matrix Addition/Multiplication Solving Linear Systems of Equations
March 3	Numerical Computation with Numpy
March 5	Working with Pandas (Data frames)
March 7	Plotting- Plot types- Plot uses- Graphing conventions
March 10	Working with Matplotlib (Visualization)
March 12	Numerical Methods
March 14	Simulations, Causality <b>Quiz 3</b>
<b>March 15-23</b>	<b>SPRING BREAK</b>
March 24	Review for Exam 2 <b>Quiz 4</b>
<b>March 26</b>	<b>EXAM 2</b>
March 28	Probability & Randomness
March 31	Sampling and empirical distributions
April 2	Descriptive Statistics
April 4	Distributions
April 7	Confidence Intervals
April 9	Interpreting confidence intervals - Center and spread <b>Quiz 5</b>
April 11	Bootstrapping <b>Quiz 6</b>
April 14	Review for Exam 3



<b>April 16</b>	<b>EXAM 3</b>
April 18	Data Modeling: Machine Learning Approach
<b>April 21</b>	<b>NO CLASS DAY</b>
April 23	Correlation
April 25	Linear Regression: Evaluation and Intervals
April 28	Least squares <b>Quiz 7</b>
April 30	Residuals Regression inference <b>Quiz 8</b>
May 2	Classification with Logistic Regression Models and Evaluation
May 5	Review

**Policies and Comments**

1. The way work presented can be just as important as its substance. Be sure to clearly discuss work presented, methods used, and underlying assumptions. Use standard professional formats and be sure that your work is grammatically correct, neat and easily read. Such practices make it possible to fairly assess work submitted and are simply basic practices for documenting work in industry. For example, emails are expected to have a descriptive subject, be well written, and have a salutation and closing. When giving presentations students are expected to dress and act professionally.
2. **There will be no Make-up on Homework Assignments or lab assignments. Late submissions will receive a grade of zero.**
3. **Individual effort must be demonstrated on all exams and assignments. Also considered inappropriate is the use of, in any fashion, a solution manual of any kind. It is the aim of the faculty of Texas Tech University to foster a spirit of complete honesty and a high standard of integrity. The attempt of students to present as their own any work that they have not honestly performed is regarded by the faculty and administration as a serious offense and renders the offenders liable to serious consequences, possibly suspension. Academic Dishonesty: “At minimum, the first instance of academic dishonesty will be submitted to Student Judicial Services and the student will receive a zero for the assignment. The second instance of academic dishonesty will be submitted to Student Judicial Services and the student will receive an F in the course and be expelled from the program”.**
4. Attendance: Students enrolled in this class are required to be present the entire class period each class day. Please let the instructor know in advance if you have a planned absence from recitation.

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. (<http://www.depts.ttu.edu/opmanual/OP34.19.pdf>)



For University Approved Trips, you may refer to: <http://www.depts.ttu.edu/opmanual/OP34.04.pdf>

5. Students are expected to come to class alert and ready to participate. Sleeping, reading newspapers, using a cell phone and doing homework for other classes is not allowed during class. Students are expected to assist in maintaining a classroom environment that is conducive to learning. Inappropriate behavior in the classroom shall result, minimally, in a request to leave the classroom.
6. It is the aim of the faculty of Texas Tech University to foster a spirit of complete honesty and a high standard of integrity. The attempt of students to present as their own any work that they have not honestly performed is regarded by the faculty and administration as a serious offense and renders the offenders liable to serious consequences, possibly suspension. **Plagiarism or cheating will result in 0 points for the assignment, failing the course, or possibly suspension from the university. (See the Operating Policy/Procedure 34.12 of Texas Tech University for more details.)**
7. The instructor reserves the right to change the content of this syllabus depending upon their assessment of the class performance and due to changes in the subject material and other extenuating factors. The changes are not limited to the content and coverage but also include deadlines for assignments, project reports and exams. Any changes will be announced to the class via the Blackboard learning management system by the instructor.

## **Class Policies:**

My classrooms are safe spaces. I am fully committed to fostering learning environments that support all students. If you're not sure of where or how to find information about resources to support your success here at TTU, please don't hesitate to reach out to me.

### **AI USE STATEMENT:**

You may use generative artificial intelligence (AI) tools (such as ChatGPT) in this class, as doing so aligns with our course learning goals. Your use of AI tools must be properly documented and cited. You are responsible for ensuring the information you submit based on an AI query does not contain misinformation, unethical content, or violate intellectual property laws. Submission of AI-generated content as your own work is a violation of academic integrity and may result in referral to the Office of Student Conduct. Please contact your instructor if you have questions regarding this course policy.

### **ADA STATEMENT:**

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 West Hall or call 806-742-2405.

### **STUDENT SUPPORT STATEMENT:**

The Office of Campus Access and Engagement works across Texas Tech University to foster, affirm, celebrate, engage, and strengthen all student communities. For more information about services, opportunities for participation, and ways in which Texas Tech can support your success in college, please contact (806) 742-7025.

### **PLAGIARISM STATEMENT:**

Texas Tech University expects students to "understand the principles of academic integrity and abide by them in all class and/or course work at the University" (OP 34.12.5). Plagiarism is a form of academic misconduct that involves (1) the representation of words, ideas, illustrations, structure, computer code, other expression, or media of another as one's own and/or failing to properly cite direct, paraphrased, or summarized materials; or (2) self-plagiarism, which involves the submission of the same academic work more than once without the prior permission of the instructor and/or failure to correctly cite previous work written by the same student. This video, retrieved from the University of Kansas Libraries website, provides an example of a plagiarism definition as well as examples of plagiarism and how to avoid it. Please review Section B of the TTU Student Handbook for more information related to other forms of academic misconduct and contact your instructor if you have questions about plagiarism or other academic concerns in your courses. To learn more about the importance of academic integrity and practical tips for avoiding plagiarism, explore the resources provided by the TTU Library and the School of Law.

### **ACADEMIC INTEGRITY STATEMENT:**

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 HOLY DAY STATEMENT:**

"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.

**DISCRIMINATION, HARASSMENT, AND SEXUAL VIOLENCE STATEMENT:**

Texas Tech University is committed to providing and strengthening an educational, working, and living environment where students, faculty, staff, and visitors are free from gender and/or sex discrimination of any kind. Sexual assault, discrimination, harassment, and other Title IX violations are not tolerated by the University. Report any incidents to the Office for Student Rights & Resolution, (806)-742-SAFE (7233) or file a report online at [titleix.ttu.edu/students](https://www.depts.ttu.edu/titleix/students). Faculty and staff members at TTU are committed to connecting you to resources on campus. Some of these available resources are: TTU Student Counseling Center, 806-742-3674, <https://www.depts.ttu.edu/scc/> (Provides confidential support on campus.) TTU 24-hour Crisis Helpline, 806-742-5555, (Assists students who are experiencing a mental health or interpersonal violence crisis. If you call the helpline, you will speak with a mental health counselor.) Voice of Hope Lubbock Rape Crisis Center, 806-763-7273, [voiceofhopelubbock.org](http://voiceofhopelubbock.org) (24-hour hotline that provides support for survivors of sexual violence.) The Risk, Intervention, Safety and Education (RISE) Office, 806-742-2110, <https://www.depts.ttu.edu/rise/> (Provides a range of resources and support options focused on prevention education and student wellness.) Texas Tech Police Department, 806-742- 3931, <http://www.depts.ttu.edu/tpd/> (To report criminal activity that occurs on or near Texas Tech campus.)

**STATEMENT OF 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](mailto: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](mailto:alfaris@ttu.edu) | 806.834.3420) or visit <https://www.depts.ttu.edu/titleix/PregnancyandParenting/>. You can also visit <https://www.depts.ttu.edu/titleix/PregnancyandParenting/> to submit a request to Alex Faris for assistance.

**CIVILITY IN THE CLASSROOM STATEMENT:**

Texas Tech University is a community of faculty, students, and staff that enjoys an expectation of cooperation, professionalism, and civility during the conduct of all forms of university business, including the conduct of student–student and student–faculty interactions in and out of the classroom. Further, the classroom is a setting in which an exchange of ideas and creative thinking should be encouraged and where intellectual growth and development are fostered. Students who disrupt this classroom mission by rude, sarcastic, threatening, abusive or obscene language and/or behavior will be subject to appropriate sanctions according to university policy. Likewise, faculty members are expected to maintain the highest standards of professionalism in all interactions with all constituents of the university ([www.depts.ttu.edu/ethics/mataдорchallenge/ethicalprinciples.php](http://www.depts.ttu.edu/ethics/mataдорchallenge/ethicalprinciples.php)).

**STATEMENT ABOUT FOOD INSECURITY:**



**ENGR 1330**

**Computational Thinking with Data Science**

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. Furthermore, please notify the professor if you are comfortable in doing so. Raider Red's Food Pantry (located in Doak 117) supplies personal care items and a selection of nonperishable food to students. The Raider Relief Advocacy and Resource Center (RR- ARC) is a centralized hub of resources and support for students facing hardships with their basic needs. Through a comprehensive network of campus and community partnerships, we strive to alleviate the burden of financial, physical, and emotional hardships and promote the well-being and academic success of all students. Please fill out our form to get connected: <https://www.depts.ttu.edu/raiderrelief/>.

**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