

**Important Guidelines:**

- If Texas Tech University campus operations are required to change because of health concerns related to the COVID-19 pandemic, it is possible that this course will move to a fully online delivery format. Should that be necessary, students will be advised of technical and/or equipment requirements, including remote proctoring software.
- Policy on absences resulting from illness: We anticipate that some students may have extended absences. To avoid students feeling compelled to attend in-person class periods when having symptoms or feeling unwell, a standard policy is provided that holds students harmless for illness-related absences (see **ILLNESS-BASED ABSENCE POLICY** below).
- The Texas Tech University System has implemented a mandatory Facial Covering Policy to ensure a safe and healthy classroom experience. Current research on the COVID-19 virus suggests that there is a significant reduction in the potential for transmission of the virus from person to person by wearing a mask/facial covering that covers the nose and mouth areas. Because of the potential for transmission of the virus, and to be consistent with the University's requirement, students in this class are to wear a mask/facial covering before, during, and after class. Observing safe distancing practices within the classroom by spacing out and wearing a mask/facial covering will greatly improve our odds of having a safe and healthy in-person class experience. Any student choosing not to wear a mask/facial covering during class will be directed to leave the class and will be responsible to make up any missed class content or work.
- Some useful links: [Student Health Services](#), [Student Affairs COVID-19](#), [Student COVID-19 Protocol](#), [Texas Tech Commitment](#), [Mask wearing video](#).

Instructor

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Office Hours: MWF- 11:00 AM- 1:00 PM and T TH – 9:30 AM– 11:00 AM or by appointments, take appointments via email (I usually respond in less than 1 hour) or call me, then we can meet in Blackboard Collaborate Ultra. We can also use Microsoft Teams my account is b.baturalp@ttu.edu .

Teaching Assistant

Ghazanfar Ali

Lab sections: D57, Online, Tuesdays, Thursdays 12:30 PM- 1:50 PM

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Office: Online through BlackBoard Collaborate Ultra. (Use the CourseRoom session), Zoom or Microsoft Teams (use the email address to find Teams account)

Office Hours: During tutoring hours



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.

Class Meeting Time and Room

The face to face lectures will also be online and recorded, thus, physical attendance is optional.

Lectures will be face to face: Tuesdays & Thursdays - 11:00 AM - 12:20 PM, Chemistry Building Room: 113.

Labs will be online: Tuesdays & Thursdays - 12:30 PM - 1:50 PM,

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, hypothesis testing, and A/B testing .
 - ✓ *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>.

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.

Assessment Methods & Grading Criteria:

There will be three midterm exams and one comprehensive final project for the course. In addition, lab participation, quizzes, and assignments will also be given credits that will contribute to the final grade. **If the assignments and the final project are submitted late, they will not receive any credit.** Students will be assessed based on the following criteria:

Assessment methods	Weight (%)
Midterm-1	14
Midterm-2	14
Midterm-3	14
Lab participation	6
Quizzes	12
Lab assignments	25
Final project	15
Overall total	100

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- Lectures might be recorded)

Week	Lecture
1	<u>Introduction to Computational Thinking with Data Science:</u> <ul style="list-style-type: none"> - Computational thinking - Programming principles - Data science
	<u>Programming Principles:</u> <ul style="list-style-type: none"> - Data types (int, float, string, bool) - Variables, operators, expressions, basic I/O - String operations
	<u>Programming Principles:</u> <ul style="list-style-type: none"> - Data structures: Array, list, tuple, set, dictionary - Conditional statements
2	<u>Programming Principles:</u> <ul style="list-style-type: none"> - Loops
	<u>Programming Principles:</u> <ul style="list-style-type: none"> - Functions - Variable scope
	<u>Programming Principles:</u> <ul style="list-style-type: none"> - Class and objects - File handling
3 Holiday on 09/07	Quiz 1 Review – Python programming principles
	<u>Data Representation and Operations:</u> Python library: NumPy <ul style="list-style-type: none"> - Data representation: Arrays, vectors, matrices - Data operations: Indexing, math functions
4	<u>Data Query and Manipulation:</u> Python Library: Pandas <ul style="list-style-type: none"> - Data frame: Create, index, read/write to file, summarize statistics, and fill and drop values
	<u>Data Display:</u> Python Libraries: Matplotlib <ul style="list-style-type: none"> - Data Display for line charts, bar charts, box plot, scatter plot, and histograms



	Review – NumPy, Pandas, Matplotlib
	Midterm-1
5	<u>Data Modeling: Statistical Approach:</u> - Establishing causality - Randomness: Iteration, simulation
	Randomness: Probabilities
6	Sampling and empirical distributions
	Hypothesis testing: General concept and examples of assessing models.
	Hypothesis testing: Comparing proportions, type1 & type2 errors, p-value.
7	Comparing two samples: A/B Testing
	Comparing two samples: A/B Testing
	Quiz 2
	Confidence intervals
8	Interpreting confidence intervals
	Center and spread
	Normal distribution
9	Sample means
	Review – Statistical analysis
	Midterm-2
10	<u>Data Modeling: Machine Learning Approach:</u> Correlation; Issue final projects + presentation template
	Linear regression
	Least squares
11	Residuals
	Regression inference
	Quiz 3
	Evaluation metrics: Accuracy, error
12	<u>Classification:</u> - Supervised learning - Nearest neighbor
	<u>Classification Evaluation and Making Decisions:</u> - Confusion matrix, precision, recall, accuracy, F-score. - Making decisions
	Review – Machine learning
13	Midterm-3



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. Work submitted after its due date will not be accepted.
3. **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>
4. 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.
5. 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.)***
6. I reserve the right to amend this syllabus as needed.

Class Policies:

ADA:

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.

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. 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 (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.)

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/matadorchallenge/ethicalprinciples.php).

LGBTQIA SUPPORT STATEMENT*:

I identify as an ally to the lesbian, gay, bisexual, transgender, queer, intersex, and asexual (LGBTQIA) community, and I am available to listen and support you in an affirming manner. I can assist in connecting you with resources on campus to address problems you may face pertaining to sexual orientation and/or gender identity that could interfere with your success at Texas Tech. Please note that additional resources are available through the Office of LGBTQIA within the Center for Campus Life, Student Union Building Room 201, www.lgbtqia.ttu.edu, 806.742.5433.

*If you prefer to list campus resources rather than a statement about ally status, you might include the following among other campus resources you wish to share:

Office of LGBTQIA, Student Union Building Room 201, www.lgbtqia.ttu.edu, 806.742.5433 within the Center for Campus Life, the Office serves the Texas Tech community through facilitation and leadership of programming and advocacy efforts. This work is aimed at strengthening the lesbian, gay, bisexual, transgender, queer, intersex, and asexual (LGBTQIA) community and sustaining an inclusive campus that welcomes people of all sexual orientations, gender identities, and gender expressions.

ILLNESS-BASED ABSENCE POLICY

If at any time during this semester you feel ill, in the interest of your own health and safety as well as the health and safety of your instructors and classmates, you are encouraged not to attend face-to-face class meetings or events. Please review the steps outlined below that you should follow to ensure your absence for illness will be excused. These steps also apply to not participating in synchronous online class meetings if you feel too ill to do so and missing specified assignment due dates in asynchronous online classes because of illness.



1. If you are ill and think the symptoms might be COVID-19-related:
 - a. Call Student Health Services at 806.743.2848 or your health care provider. During after-hours and on weekends, contact TTU COVID-19 Helpline at (806) 743-2911.
 - b. Self-report as soon as possible using the Dean of Students COVID-19 webpage (<https://www.depts.ttu.edu/dos/COVID-19Absence.php>). This website has specific directions about how to upload documentation from a medical provider and what will happen if your illness renders you unable to participate in classes for more than one week.
 - c. If your illness is determined to be COVID-19-related, all remaining documentation and communication will be handled through the Office of the Dean of Students, including notification of your instructors of the time you may be absent from and may return to classes.
 - d. If your illness is determined not to be COVID-19-related, please follow steps 2.a-d below.

2. If you are ill and can attribute your symptoms to something other than COVID-19:

If your illness renders you unable to attend face-to-face classes, participate in synchronous online classes, or miss specified assignment due dates in asynchronous online classes, you are encouraged to contact either Student Health Services at 806.743.2848 or your health care provider. Note that Student Health Services and your own and other health care providers may arrange virtual visits.

During the health provider visit, request a “return to school” note.

E-mail the instructor a picture of that note.

Return to class by the next class period after the date indicated on your note.

Following the steps outlined above helps to keep your instructors informed about your absences and ensures your absence or missing an assignment due date because of illness will be marked excused. You will still be responsible to complete within a week of returning to class any assignments, quizzes, or exams you miss because of illness.