DATA 601-04: Introduction to Data Science, Fall 2025

**Class Hours:** M 7:10-9:40pm,

**Classroom**: Online, <https://umbc.webex.com/umbc/j.php?MTID=me4a611657a410a8e1407c24660a1bb61>

Instructor: Felix Gonzalez, P.E. Web:[**Course’s Github Page**](https://github.com/fgonzaleumbc/DATA601)

E-mail: [fgonzale@umbc.edu](mailto:fgonzale@umbc.eduO) Office Hours: **Mondays, 6:30 – 7:10pm**

Grader/Tutor: TBD Office Hours: **TBD**

E-mail: TBD

Office: Before/After class, Online (via email request), the USG Adjunct Instructor Room, USG, Building III, Room 4123

* If you want to secure a spot in outside of office hours, please email me 48 hours in advance.
* I try to respond to emails within 24 hours, excluding breaks and weekends.
* If your question is something about your code or something we covered in class, we have tutors available, you can request an appointment and tutors’ schedules are available [here.](https://dil.umbc.edu/)

# Course Description

This class introduces topics to Python programming, data science concepts and prepares students for more advanced topics in data science. It provides an overview of the main tools and notions which are frequently used in the industry. Topics include: a review of Python programming and most fundamental modules; acquisition, handling, and working with different data; exploratory data analysis with statistics; data visualization and web scraping; artificial intelligence, machine learning, and natural language processing; life cycle of data science projects, different roles in a data science team, and ethical issues in data science.

# Student Learning Outcomes

By the end of this course, successful students will be able to:

1. Describe the key activities in a data science project and understand the role of modeling in a data science project.
2. Use popular Python packages for exploratory data analyses, data visualization, and transformations.
3. Create functions and programs that clean, merge, and transform raw data sets and evaluate their quality for a given data science project.
4. Apply basic statistical knowledge in a data science project to test and verify hypotheses.
5. Train and test fundamental machine learning algorithms.
6. Apply best practices of communication for reporting upon completing a data science project.

# Format and Procedures

This will be an in-person course and depending on the pandemic situation there might be online (synchronous) components. Computers with internet connection and working cameras are required for the online lectures. We will also be using a software called Jupyter Notebooks and/or [Google Collaboratory](https://research.google.com/colaboratory/faq.html) as the main medium of delivery for the lecture materials. For more information and to get familiarity with it, [please check this tutorial.](https://colab.research.google.com/notebooks/intro.ipynb) In addition to these:

1. Students will complete assigned homework, readings, quizzes.
2. Students will engage with hands-on labs and practical exercises to prepare them for challenges they may encounter in the workplace.
3. Students will occasionally present their solutions to homework assignments in class.
4. Students who are participating in the class online should be able to share both their video and audio.

# Course Requirements

## Recommended Textbooks

We will not be following one single textbook in this course. Weekly reading materials and relevant course materials will be shared beforehand via Blackboard and/or the course’s Github repository. In addition to this, I will be following the logical structures of the following textbook.

* The Handbook of Data Science and AI: Generate Value from Data with Machine Learning and Data Analytics 2nd Edition; Stefan Papp, Wolfgang Weidinger, Katherine Munro; 2nd edition; 2024.
* Storytelling with Data: A Data Visualization Guide for Business Professionals; Cole Nussbaumer Knaflic; 1st Edition
* [Python Data Science Handbook](https://jakevdp.github.io/PythonDataScienceHandbook/); Jake VanderPlas; O’Reilly.
* [Python for Data Analysis](https://github.com/wesm/pydata-book); Wes McKinney; O’Reilly; 2nd edition; 2017.
* [Python Data Analytics](https://github.com/Apress/python-data-analytics-2e); Fabio Nelli; Apress; 2nd edition; 2018.

## Hardware Requirements

* Web browser capable of running Jupyter Notebooks and/or cloud-based notebooks (e.g., Google Colab, Anaconda Cloud, GitHub Codespaces)
* A computer with sufficient internet speed for online lectures. Make sure that your computer has video and microphone access.

## Quizzes

There will be some quizzes in the beginning of the lectures to assess students’ understanding of the reading assignments. Also, at the end of some lectures, students might be given quizzes to assess their understanding of the covered material.

## Homework

There will be homework assigned to students roughly every two weeks. Depending on the scale of the homework, students will be given one or two weeks to submit their homework and other than exceptional circumstances this homework will be graded within a week. Please return your solution notebooks in Blackboard with the following filename convention: Lastname\_HWXY.ipynb (e.g. Gonzalez\_HW02.ipynb). If there is someone with the same last name in the class, please add the initial of your first name between your last name and HWXY.

## Attendance

In every lecture, I will take attendance at some point during the lecture. Students who miss this part of the lecture will be considered as absent and except for medical situations (or some other formal/written excuse) no excuse will be accepted for missing a class. Attendance will contribute to 5 percent of the final grade.

# Grading

In the final grade, the assignments will have the following weights:

|  |  |  |
| --- | --- | --- |
| Attendance (14 Lectures) | — | 5% |
| Quizzes (4 quizzes total) | — | 13% |
| Homework (7 HW total) | — | 50% |
| Projects (2 Projects total) | — | 32% |

## Grading Distribution

Final letter grades will be assigned as follows: (Grades will be rounded upwards.)

|  |  |  |
| --- | --- | --- |
| 94-100 | — | A |
| 93 - 90 | — | A- |
| 87 - 89 | — | B+ |
| 83 - 86 | — | B |
| 80 - 82 | — | B- |
| 77 - 79 | — | C+ |
| 73 - 76 | — | C |
| 70 - 72 | — | C- |
| 67 - 69 | — | D+ |
| 0 - 59 | — | F |

# Schedule and weekly learning goals

A detailed schedule of the weekly topics, learning goals, homework and projects can be found under the Class GitHub page in the file named “Data\_Science\_Introduction\_Syllabus\_Topics\_Index.xlsx”. The schedule is tentative and subject to change.

**Week 01, 9/2:** NO Classes, Labord Day Holiday

**Week 02, 9/9:**

* Class Logistics, requirements, and expectations
* Fundamental data science concepts and workflows
* Fundamental Python and Programming Concepts

**Week 03, 9/16:**

* Jupyter Notebook Development Environment Overview
* Introduction to Python and Built-in Functions

**Week 04, 9/23:**

* Python variables and data Structures (lists, tuples, set and dictionaries)
* Conditional statements and outputs
* While and For Loops
* Defining custom functions

**Week 05, 9/30:**

* Object oriented programming
* Jupyter Notebook Markdown Language
* Text and Regular Expressions (Regex)

**Week 06, 10/7:**

* Math with Numpy Library
* Introduction to Pandas

**Week 07, 10/14:**

* Working with Datetime
* Introduction to Data Analysis and Transformation with Pandas

**Week 08, 10/21:**

* Data Visualization with MatPlotLib
* Data Science Example: Story Telling and Data Cleaning

**Week 09, 10/28:**

* Data cleaning/wrangling/preparation for analysis
* Introduction to Exploratory Data Analysis (EDA)

**Week 10, 11/4:**

* Working with Files and Data Parsing
* Webservices, Application Programming Interface (API) and Web Scraping
* Relational Databases

**Week 11, 11/11:**

* Statistics: Fundamental of Statistics for Data Science
* Statistics: Hypothesis Testing

**Week 12, 11/18:**

* Introduction to Machine Learning and Regression
* Supervised ML Classification
* Classification Feature Selection

**Week 13, 11/25:**

* Introduction to Ethics in Data Science
* AI Example Demo Discussion Supervised and Unsupervised ML

**Week 14, 12/2:**

* Dashboarding
* Data Science Example: Dashboarding

**Week 15, 12/9:** **LAST DAY OF CLASSES**

* Project 2 Due
* Optional Lectures

**Optional Lectures as time Permits:**

* Introduction to Unsupervised ML: Clustering Algorithms
* Introduction to Natural Language Processing
* Other Special and Advanced Topics (e.g., Generative AI)

# UMBC Career Center and Other Resources

The [UMBC Career Center](https://careers.umbc.edu/) is a student resource dedicated to helping students and alumni explore career paths, develop professional skills, and connect with opportunities. It provides individualized career advising, resume and interview preparation, networking events, and internship and job placement support. The center partners with employers across industries to create pathways for experiential learning, including internships, research, and co-op programs, while also hosting career fairs and on-campus recruiting. Other resources include:

* [Assistantships, Scholarships, and Financial Aid – Graduate Data Science Programs: Information Hub – UMBC](https://dil.umbc.edu/resources/assistantships-aid-and-internships/)
* [Online Teaching – Planning Instructional Variety for Online Teaching – UMBC](https://pivot.umbc.edu/online-teaching/)

# USG Student Engagement Resources

The Universities at Shady Grove (USG), in partnership with our Montgomery County educational partners Montgomery County Public Schools and Montgomery College, are committed to supporting students in their journey to become prepared for the world of work. We have collaborated with Montgomery County educators to develop an initiative called**Hire U**that contains a shared set of [career readiness competencies](https://shadygrove.umd.edu/student-affairs/career-development/https%3A/shadygrove.umd.edu/student-services/CISC/Employers) which reflect the key behaviors that employers, across all industries and functional areas, are seeking in graduates entering the world of work.

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These nine career competencies are adapted from best practices developed by the National Association of Colleges & Employers (NACE), in addition other sources, including employers. Employer involvement was key to the development of these national best-practice models, and including employer priorities is central to our approach in Montgomery County.

Complementing the skills and experiences students receive in the classroom, students must seek experiences out of the classroom, which will help to develop these competencies over time. The development of these competencies, in addition to completion of a college degree and participation in meaningful experiential learning experiences, will help students become prepared, competitive, and ready to thrive.

# Course Policies

## During Class

Please be mindful that everyone has different levels of concerns with COVID-19. This is why UMBC policies constitutes a common denominator that I expect everyone to follow in my classes. I ask everyone to be proactive about this and do their fair share in order to keep our community safe and protected. Moreover, if you have any concerns about this topic, please don’t hesitate to share it with me immediately.

I understand that the electronic recording of notes will be important for class and computers will be allowed in class. Please refrain from using computers for anything but activities related to the class. Phones are prohibited as they are rarely useful for anything in the course. Eating and drinking are allowed in class but please refrain from it affecting the course. Try not to eat your lunch in class as the classes are typically active.

## Policies on Incomplete Grades and Late Assignments

Late/incomplete assignments will be accepted if an extension has been agreed to in advance. Emergency situations will be handled on a case-by-case basis with appropriate justification or documentation. Incomplete grades are granted only for extenuating circumstances, and your request is made before the last week of class.

# Institutional Policies

## OPP Student Success Resources

The Student Success team will help you manage your program from the time you are admitted until you graduate. Throughout your time, the team will provide you with information and assistance regarding registration, class scheduling, graduation and any other program logistics that may come up along the way. The team will also notify you of events and webinars throughout the year and you are encouraged to utilize this valuable resource. Please contact the Student Success team with any questions you have during your academic journey and be sure to visit their [website](https://professionalprograms.umbc.edu/student-success/) for additional information.

## Academic Integrity

Use of

1. any artificial technical assistance (i.e., ChatGPT or other generative technologies) outside of onboard spellcheck and things like Google Scholar, academic library databases, or reference managers and
2. solutions/projects found on the internet are considered academic misconducts and strictly forbidden.

If your solutions or reports are determined to be in this category, you will receive 0 (zero) for that assignment. The faculty member will notify the student in writing within five calendar days, if feasible, of the initial determination and provide a copy of this document to the student. The student shall have an opportunity within five calendar days of notification to respond and give an explanation to the faculty member. The faculty member then will make a decision as to whether an infraction has occurred. If it has, the faculty member will make a decision as to whether the infraction is less serious or more serious and follow either of the procedures outlined in the following link: [UMBC Graduate School Policy and Procedures for Student Academic Misconduct](https://www2.umbc.edu/policies/pdfs/UMBC%20III%201.10.02%20Policy%20and%20Procedures%20for%20Graduate%20Student%20Academic%20Misconduct.pdf)

## Accessibility and Disability Accommodations, Guidance and Resources (required)

Accommodations for students with disabilities are provided for all students with a qualified disability under the Americans with Disabilities Act (ADA & ADAAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student Disability Services (SDS) is the UMBC department designated to coordinate accommodation that creates equal access for students when barriers to participation exist in university courses, programs, or activities.

If you have a documented disability and need to request academic accommodation in your courses, please refer to the SDS website at[sds.umbc.edu](http://sds.umbc.edu/) for registration information and office procedures.

SDS email: [disAbility@umbc.edu](mailto:disability@umbc.edu)

SDS phone: [410-455-2459](tel:410-455-2459)

If you will be using SDS approved accommodations in this class, please contact the instructor to discuss implementation of the accommodations. During remote instruction requirements due to COVID, communication and flexibility will be essential for success.

## Sexual Assault, Sexual Harassment, and Gender Based Violence and Discrimination (required)

[UMBC Policy](https://ecr.umbc.edu/gender-discrimination-sexual-misconduct/) in addition to federal and state law (to include Title IX) prohibits discrimination and harassment on the basis of sex, sexual orientation, and gender identity in University programs and activities. Any student who is impacted by sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based harassment, or related retaliation should contact the University’s Title IX Coordinator to make a report and/or access support and resources. The Title IX Coordinator can be reached at [titleixcoordinator@umbc.edu](mailto:titleixcoordinator@umbc.edu) or 410-455-1717.

You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety of the community.

If you are interested in making a report, please use the [Online Reporting/Referral Form](https://umbc-advocate.symplicity.com/titleix_report/index.php/pid364290?).  Please note that, if you report anonymously, the University’s ability to respond will be limited.

## Notice that Faculty and Teaching Assistants are Responsible Employees with Mandatory Reporting Obligations

All faculty members and teaching assistants are considered Responsible Employees, per UMBC’s [Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination](https://ecr.umbc.edu/policy-on-sexual-misconduct-sexual-harassment-and-gender-discrimination/). Faculty and teaching assistants therefore required to report all known information regarding alleged conduct that may be a violation of the Policy to the Title IX Coordinator, even if a student discloses an experience that occurred before attending UMBC and/or an incident that only involves people not affiliated with UMBC.  Reports are required regardless of the amount of detail provided and even in instances where support has already been offered or received.

While faculty members want to encourage you to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report past and present sexual harassment, sexual assault, domestic and dating violence, stalking, and gender discrimination that is shared with them to the Title IX Coordinator so that the University can inform students of their [rights, resources, and support](https://ecr.umbc.edu/rights-and-resources/).  While you are encouraged to do so, you are not obligated to respond to outreach conducted as a result of a report to the Title IX Coordinator.

If you need to speak with someone in confidence, who does not have an obligation to report to the Title IX Coordinator, UMBC has a number of[Confidential Resources](https://ecr.umbc.edu/policy-on-sexual-misconduct-sexual-harassment-and-gender-discrimination/#confidential-resources) available to support you:

[Retriever Integrated Health](https://health.umbc.edu/) (Main Campus): 410-455-2472; Monday – Friday 8:30 a.m. – 5 p.m.; For After-Hours Support, Call 988.

[Center for Counseling and Well-Being](https://shadygrove.umd.edu/student-affairs/counseling-well-being) (Shady Grove Campus): 301-738-6273; Monday-Thursday 10:00a.m. – 7:00 p.m. and Friday 10:00 a.m. – 2:00 p.m. (virtual) [Online Appointment Request Form](https://shadygrove.titaniumhwc.com/)

Pastoral Counseling via [The Gathering Space for Spiritual Well-Being](https://i3b.umbc.edu/spaces/the-gathering-space-for-spiritual-well-being/): 410-455-6795; [i3b@umbc.edu](mailto:i3b@umbc.edu); Monday – Friday 8:00 a.m. – 10:00 p.m.

## Other Resources

[Women’s Center](https://womenscenter.umbc.edu/) (open to students of all genders): [410-455-2714](tel:410-455-2714); [womenscenter@umbc.edu](mailto:womenscenter@umbc.edu); Monday – Thursday 9:30 a.m. – 5:00 p.m. and Friday 10:00 a.m. – 4 p.m. [Shady Grove Student Resources](https://ecr.umbc.edu/shady-grove-title-ix-resources/), [Maryland Resources](https://ecr.umbc.edu/maryland-resources/), [National Resources](https://ecr.umbc.edu/national-resources/). [**Child Abuse and Neglect**](https://ecr.umbc.edu/child-protection/). Please note that Maryland law and [UMBC policy](https://education.umbc.edu/child-abuse-reporting-policy/) require that faculty report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and*/*or the police even if the person who experienced the abuse or neglect is now over 18.

[**Pregnant and Parenting Students**](https://www2.ed.gov/about/offices/list/ocr/docs/pregnancy.html) UMBC’s [Policy on Sexual Misconduct, Sexual Harassment and Gender Discrimination](https://ecr.umbc.edu/policy-on-sexual-misconduct-sexual-harassment-and-gender-discrimination/) expressly prohibits all forms of discrimination and harassment on the basis of sex, including pregnancy. Resources for pregnant, parenting and breastfeeding students are available through the University’s [Office of Equity and Civil Rights](https://ecr.umbc.edu/students/).  Pregnant and parenting students are encouraged to contact the Title IX Coordinator to discuss plans and ensure ongoing access to their academic program with respect to a leave of absence – returning following leave, or any other accommodation that may be needed related to pregnancy, childbirth, adoption, breastfeeding, and/or the early months of parenting.

In addition, students who are pregnant and have an impairment related to their pregnancy that qualifies as disability under the ADA may be entitled to accommodations through the [Office of Student Disability Services](https://sds.umbc.edu/accommodations/registering-with-sds/).

**Religious Observances & Accommodations**

UMBC [Policy](https://provost.umbc.edu/wp-content/uploads/sites/46/2022/08/Religious-Observance-Academic-Policy-2022_2023.pdf) provides that students should not be penalized because of observances of their religious beliefs, and that students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. It is the responsibility of the student to inform the instructor of any intended absences or requested modifications for religious observances in advance, and as early as possible. For questions or guidance regarding religious observances and accommodations, please contact the Office of Equity and Civil Rights at [ecr@umbc.edu](mailto:ecr@umbc.edu).

**Hate, Bias, Discrimination and Harassment**

UMBC values safety, cultural and ethnic diversity, social responsibility, lifelong learning, equity, and civic engagement. Consistent with these principles, [UMBC Policy](https://ecr.umbc.edu/discrimination-and-bias/) prohibits discrimination and harassment in its educational programs and activities or with respect to employment terms and conditions based on race, creed, color, religion, sex, gender, pregnancy, ancestry, age, gender identity or expression, national origin, veterans status, marital status, sexual orientation, physical or mental disability, or genetic information.

Students (and faculty and staff) who experience discrimination, harassment, hate, or bias based upon a protected status or who have such matters reported to them should use the [online reporting/referral form](https://umbc-advocate.symplicity.com/titleix_report/index.php/pid954154?) to report discrimination, hate, or bias incidents. You may report incidents that happen to you anonymously*.*Please note that, if you report anonymously, the University’s ability to respond may be limited.