

# Manhattan College

Department of Mathematics

MATG 511 Section 01

*Computational Methods for Analytics*

Fall 2021

*Class Time:* Monday

6:30 pm -7:20 pm

*Class Room:* RLC 104

**Note:** This course will be taught in hybrid remote format with an in-person component on Monday night and the remaining content will be delivered using asynchronous instruction. At this moment Manhattan College does not have this type of course so it will appear with a schedule of MR 6:30 pm – 7:45 pm in Self Service.

*Instructor:* Angel R. Pineda, Ph.D.

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*Office Hours:* Monday 3:30-4:20 pm, Thursday 2:00-2:50 pm, or by appointment.

## Course Texts

Title	Author	Edition	ISBN
MATLAB An Introduction with Applications	Amos Gilat	6 <sup>th</sup>	ISBN-13: 978-1119385134 ISBN-10: 111938513X
Introductory Statistics with R	Peter Dalgaard	2 <sup>nd</sup>	ISBN-13: 978-0387790534 ISBN-10: 9780387790534 (PDF Available through MC Library)
Python Data Science Handbook	Jake VanderPlas	1 <sup>st</sup>	<a href="https://jakevdp.github.io/PythonDataScienceHandbook/">https://jakevdp.github.io/PythonDataScienceHandbook/</a>
<b>Optional</b>			
Numerical Computing with MATLAB	Cleve Moler	2 <sup>nd</sup>	ISBN-13: 978-0898716603 ISBN-10: 0898716608 Available online: <a href="https://www.mathworks.com/moler/chapters.html">https://www.mathworks.com/moler/chapters.html</a>
R for Data Science	Hadley Wickham & Garrett Grolemund	1 <sup>st</sup>	ISBN-13: 978-1491910399 ISBN-10: 1491910399 Available online: <a href="https://r4ds.had.co.nz/">https://r4ds.had.co.nz/</a>
A Practical Introduction to Python Programming	Brian Heinold	1 <sup>st</sup>	Available online: <a href="https://www.brianheinold.net/python/A_Practical_Introduction_to_Python_Programming_Heinold.pdf">https://www.brianheinold.net/python/A_Practical_Introduction_to_Python_Programming_Heinold.pdf</a>

## Course Software

Title	Publisher	Link
MATLAB	MathWorks	Manhattan College Portal (Site License):

		<a href="https://www.mathworks.com/academia/tah-portal/manhattan-college-40634592.html">https://www.mathworks.com/academia/tah-portal/manhattan-college-40634592.html</a>
LaTeX (overleaf online editor)	The LaTeX Project	<a href="https://www.overleaf.com/">https://www.overleaf.com/</a>
R	R Foundation	<a href="https://www.r-project.org/">https://www.r-project.org/</a>
R Studio (IDE for R)	R Studio	<a href="https://rstudio.com/">https://rstudio.com/</a>
Anaconda Distribution of Python (Including Spyder & Jupyter Notebooks)	Anaconda	<a href="https://www.anaconda.com/distribution/">https://www.anaconda.com/distribution/</a>

*Catalog Course Description:*

This course is a survey of programming tools used in solving problems in applied mathematics and data analytics. The course material comprises the following broad areas: programming techniques in scientific languages such as MATLAB, Python, and R; and an overview of selected topics in data handling, data visualization, and introductory predictive analytics. Additional topics may include analytics-related topics in linear algebra and numerical analysis. A final project is required for this course.

*Prerequisites:* CMPT 101 and MATH 285 or MATH 287 and MATH 372 or MATH 351, acceptance into the master’s program in applied mathematics – data analytics or consent by instructor.

**Student Learning Outcomes:**

A student who successfully completes this course will know the following:

- Write, document and debug basic programs in MATLAB, R and Python
- Wrangle and clean data in preparation for data analysis
- Use appropriate data visualization methods for data sets
- Use computation for solving problems in data science including descriptive and predictive analytics
- Understand the types of problems where MATLAB, R and Python are most appropriate
- Communicate their results in writing and presentations using LaTeX, Word and PowerPoint

*Course Homepage (Moodle):*

Here you will find four features that will be used in this course:

- *Email:* make sure that your email on Moodle is one that you check regularly.
- *Course Information and Documents:* material covered each week, video lectures, quizzes, assignments, and solution keys.
- *Student Discussion Board:* this online forum allows for students and faculty to communicate about the course. It is like an online study group.
- *Grades:* students will be able to keep track of their grades online.

*Assessment of Student Learning:*

Assignments (15%)

Weekly Assignments are meant for students to put into practice the material covered each week.

Quizzes and Discussion (5%)

Weekly provide a quick way to use the material from the video lectures and readings. The online discussion forum will be a venue to ask questions about the material in the course and share ideas with other students.

Midterm Exams: (20 % each)

Exam I	Exam II	Exam III
Monday September 27	Monday October 25	Monday November 22

Exams in each of the three languages introduced in this class provide a deeper assessment and the opportunity to apply the material to realistic problems in data analytics. All of the exams in this class will be take-home exams and will have an interview.

Final Project (20 %)

In the course project, the student will write a paper and give a presentation on a topic of their choice with the instructor’s approval. The project will use computation to solve a data science problem. Details for the course project will be given after Exam I. The Final Project will be presented on *Monday December 13 from 6:30-8:30 pm*.

Tentative Grading Scale

Percent	90-100	85-89	80-84	75-79	70-74	65-69	60-64	50-59	0-49
Grade	A	A-	B+	B	B-	C+	C	D	F

The exact grading scale will be determined after the final exam. The numerical scores in the tentative grading scale guarantee the associated letter grade but the instructor may change the scale to the student’s benefit.

*Dates to Remember:*

- August 30: First Day of Classes
- September 3: Late Registration & Add/Drop Ends
- September 6: Labor Day – No Classes
- September 27: Exam 1
- October 11: Fall Break – No Classes
- October 12: Monday Schedule
- October 19: Midterm Grades Due
- October 25: Exam 2
- November 19: Last Day to Withdraw from Courses
- November 22: Exam 3
- November 24-26: Thanksgiving Holiday – No Classes
- December 10: Last Day of Classes
- December 13-18: Final Exam Period

*Class Policies*

- **Attendance:** The official College Attendance Policy, as published in the College Catalog, is: “Students are required to fulfill all course requirements as detailed in the course syllabi for their registered courses. Implicit in these requirements is completion of all course assignments and attendance in all classes. A student who is absent from class cannot expect the course instructor to provide notes or allow makeup tests, quizzes, or laboratories. The student may incur an appropriate grading penalty for such absences if the penalty was described in the syllabus.

Reasonable accommodations for absences are recommended, but are solely at the discretion of the course instructor. If the instructor believes that a student's failure to attend class is substantially affecting the student's course grade, then the instructor is strongly encouraged to report the situation to the dean of the school in which the student is matriculated. It is recommended that the dean be contacted by the course instructor after the student incurs four hours of absences in a course. The dean will address the situation with the student."

- **Time-on-Task:** Whether this course is taught online, remotely, or face-to-face, the total amount of time that you spend on this course is equivalent to that which you would spend in the face-to-face version of the course and is consistent with the Federal Credit Hour Definition. For each 3-credit fifteen-week course, you are expected to complete a minimum of nine hours (each academic hour is 50 minutes) of work each week on average, where 9 academic hours is equivalent to 7.5 real hours. This includes studying, working on projects, homework, reading, and any other activities that you must do to be successful in this class. Every student will work at his or her own pace, so you might take more or less than this average amount of time.
- **Late work:** Late assignments, quizzes or exams will not be accepted after the solutions are distributed. In case assignments are handed in before the solutions are posted it will be marked 20% off for every day (or part thereof) it is late.

### *Suggestions for Success*

- The course requires a time commitment of about 8 hours outside of class time per week (2 per class hour). The material builds on itself, so it is very important not to fall behind.
- Find a study partner or group.
- Treat your homework, quizzes, and labs as a study guide for future exams. Write solutions to problems in a neat and organized fashion.
- Review your notes from the previous lecture before each class.
- Read the textbook. It will complement the presentation in lecture and help give you the big picture of the material.
- I encourage you to come to office hours regularly. I will do my best to help you. Even virtually, this is the best one-on-one tutoring possible.

### **Student Academic Support Services | Center for Academic Success**

The [Center for Academic Success](#) (CAS) is committed to providing student-centered programs and initiatives designed to enhance learning and promote success and persistence for all Manhattan College students. Students will work collaboratively with qualified peers and professionals to develop knowledge, skills and strategies needed for success in the classroom and beyond. The CAS has two locations; the Learning Commons in Thomas Hall 3.10 and the Leo Learning Center in Leo 117/118. Services include online and in-person individual tutoring, online small group peer tutoring (select courses), student academic success coaching, and online and in-person writing center services. All services are free of charge and available to all Manhattan College students. Appointments are preferred but walk-ins are welcome. To make an appointment, students can log into their [Jasper Connect](#) account or visit the CAS in Thomas Hall, 3.10. Students can also contact [success@manhattan.edu](mailto:success@manhattan.edu) with any questions. For more information about these services please visit the CAS webpage [here](#).

### **Academic Integrity:**

Recall that as students of Manhattan College, you have each signed The Manhattan College Honor Pledge as a part of the Honor Code:

*As a Manhattan College student, I will not lie, cheat, or steal in my academic endeavors, nor will I accept the actions of those who do. I will conduct myself responsibly and honorably in all my activities as a Manhattan College student. I am accountable to the Manhattan College community and dedicate myself to a life of honor.*

Whenever you put your name on work to be handed in for grading in this class, you are reaffirming the above pledge. Violations of the Honor Code include, but are not limited to, cheating, plagiarism, fabrication, and other forms of academic misconduct. Please see the Manhattan College Code of Conduct and Academic Polices for a detailed description: <https://inside.manhattan.edu/student-life/dean-of-students/code-conduct.php>

*Special Accommodations:*

- Students with special needs should bring appropriate documentation to the Specialized Resource Center, Thomas Hall 3.15, <https://inside.manhattan.edu/academic-resources/specialized-resource-center/>, to obtain an Academic Adjustment/Auxiliary Aid form. Bring the completed form to me as soon as possible, and together we will decide on how best to fulfill the adjustments and/or aids listed on the form.
- Student athletes should bring their event schedules to me as soon as possible.

**Copyright Materials:** Copyright in educational materials prepared by the College faculty member is owned by the faculty member, and may not be shared without his or her permission.

*The material in this syllabus may be changed at the instructor's discretion. Any changes will be communicated to the students. During these challenging times, we need to be particularly flexible.*

**Course Content:**

MATLAB will be used to review the principles of programming and for applied mathematics. LaTeX will be used for mathematical typesetting.

- 1.1 Install and Run MATLAB
- 1.2 Use MATLAB as a calculator
- 1.3 Write scripts and functions in MATLAB
- 1.4 Document code and use a programming convention
- 1.5 Write Loops with MATLAB
- 1.6 Import Data into MATLAB
- 1.7 Typeset a simple document in LaTeX
- 1.8 Apply Numerical Analysis Methods in Data Analysis using MATLAB
- 1.9 Visualize Data using MATLAB
- 1.10 Profile and Speed up MATLAB code (time permitting)

R syntax and structure will be presented and used primarily for statistical applications and data cleaning.

- 2.1 Install and Run R & RStudio
- 2.2 Use R as a calculator
- 2.3 Write scripts and functions in R

- 2.4 Document code and use a programming convention
- 2.5 Write Loops with R
- 2.6 Import Data into R
- 2.7 Create and summarize data frames in R
- 2.8 Wrangle and Clean Data using R
- 2.9 Visualize Data using R
- 2.10 Apply statistical methods using R
- 2.11 Use SQL within R (time permitting)
- 2.12 Scrape data from online sources (time permitting)
- 2.13 Apply R Markdown for publishing results (time permitting)

Python syntax and structure will be presented and used primarily for machine learning applications.

- 3.1 Install and Run Python & Spyder and Jupyter Notebooks
- 3.2 Use Python as a calculator
- 3.3 Write scripts and functions in Python
- 3.4 Document code and use a programming convention
- 3.5 Write Loops with Python
- 3.6 Import Data into Python
- 3.7 Create objects with Python
- 3.8 Wrangle and Clean Data using Python
- 3.9 Manage data using Pandas
- 3.10 Visualize data using Matplotlib
- 3.11 Apply Machine Learning methods using Python and SciKitLearn