CUNY The City University of New York | School of Professional Studies

Course Name and Number: Fundamentals of Computational Math IS 605 Spring 2019
Credits: 3
Prerequisites: None

Course Description:
The course will provide an overview of the commonly used mathematical techniques in Data Analytics & Statistics. A lot of emphasis will be given to computational techniques and implementing math in programs. Students will be expected to do a fair bit of hands-on programming. We'll be primarily using R as our programming environment. All assignments will need to be submitted in as R-Markdown documents. Students can expect to walk away with a good under- standing of the kinds of math they'll need to be successful in the exciting area of Data Analytics.

Program Learning Outcomes/Competencies addressed by the course:

1. Business Understanding. Apply frameworks and processes to build data-analytic solutions from an understanding of business goals.
2. Data Programming. Use industry standard statistical tools and simulation packages.
3. Foundational Math and Statistics. Emphasis on probability, statistics, and computational methods.
4. Data Understanding. Collect, describe, model, explore and verify data.
5. Prescriptive Modeling. Selecting prescriptive modeling techniques, generating test designs, building and assessing models.
6. Model Implementation and Deployment. Students will learn to implement mathematical models.
7. Presentation. Students will deliver presentations of their project results.

Learning Objectives

1. Apply linear algebra to solve data science problems.
2. Apply probability and statistics to solve data science problems.
3. Apply univariate and multivariate calculus to solve data science problems.

Assignments and grading:

1. Assignments: During the course, you will be completing a series of individual assignments, participating in forum discussions, and completing a final examination.

2. Examinations: This course has a single examination, a comprehensive final.

3. Grade Evaluation: Grades in this course are determined by the percentage of points obtained.

Assignment	Percentage
Homework	15 x 3% = 45%
Discussion Contribution	15 x 1% = 15%
Examination	1 x 40%=40%
Total	100%

4. Grading Rubric: The grading rubrics follow.

a) Each homework will be graded as {zero, check minus, check, and check plus}. The associated grades are {0%, 1%, 2%, 3%}.

b) Discussions are applied analysis from the texts. You must post a response by Wednesday at midnight (ET) and respond to at least one of your colleagues' contributions by Saturday at midnight (ET), providing meaningful feedback on the analysis.

5. Late Policy for Homework: Late work is penalized 20% per day. All assignment due dates and times are shown in Blackboard.

6. Grades: I assign grades based on the following table.

Quality of Performance	Letter Grade	Range %	GPA/ Quality Pts.
Excellent - work is of exceptional quality	A	93 - 100	4
	A-	90 - 92.9	3.7
Good - work is above average	B+	87 - 89.9	3.3
Satisfactory	B	83 - 86.9	3
Below Average	B-	80 - 82.9	2.7
Poor	C+	77 - 79.9	2.3
	C	70 - 76.9	2
Failure	F	< 70	0

Course Materials (All Open Source)
https://open.umn.edu/opentextbooks/BookDetail.aspx?bookId=21
Introduction to Probability, Grinstead,C. Snell, J., 1997

https://open.umn.edu/opentextbooks/BookDetail.aspx?bookId=5
A First Course in Linear Algebra, Beezer, R., 2008

https://conservancy.umn.edu/handle/11299/189222
Linear Regression Using R: An Introduction to Data Modeling, Lilja, D., 2016

https://open.umn.edu/opentextbooks/BookDetail.aspx?bookId=198
APEX Calculus, Hartman, G. 2014

Relevant Software and Other Tools:

Students should have R Studio & R installed in their computers. Relevant libraries that are re- quired will be posted in the assignments and course materials. Students are expected to submit R-Markdown files for their assignments.

Course Meeting Time:

See the course website.

The Course schedule follows. (L=Linear Algebra text, P=Probability Text, C=Calculus Text, R=Regression)

Week of	Topics	Reading	Assignment (due Sunday at 11:59 PM ET)
28 Jan	**Vectors, Matrices & Systems of Equations**	L, Chapters SLE, V, M	HW1
4 Feb	**Trace, Determinant, Factorization of Matrices**	L, Chapters T, VS, D	HW2
11 Feb	**Eigenvalues & Eigenvectors**	L, Chapters E	HW3

18 Feb	**Linear Transformations, Representations**	L, Chapters LT, R	HW4
25 Feb	**Discrete and Continuous Probability Distributions**	P, Chapters 1 and 2	HW5
4 Mar	**Combinatorics and Conditional Probability**	P, Chapters 3 and 4	HW6
11 Mar	**Important Distributions / Densities, Expected Value & Variance**	P, Chapters 5 and 6	HW7
18 Mar	**Sums of Random Variables, Law of Large Numbers**	P, Chapters 7 and 8	HW8
25 Mar	**Central Limit Theorem & Generating Functions**	P, Chapters 9 and 10	HW9
1 Apr	**Markov Chains & Random Walks**	P, Chapters 11 and 12	HW10
8 Apr	**Regression Analysis in R**	R, Chapters 1-3	HW11
15 Apr	**Regression Analysis in R**	R, Chapters 4-6	HW12
29 Apr	**Univariate & Multivariate Calculus**	C, As Needed	HW13
6 May	**Taylor Series Approximations**	C, Chapter 8	HW14
13 May	**Functions of Several Variables**	C, Chapter 12	HW15
20 May	**Final Examination**	All	**Final Exam: Due 26 May**

Quality of Performance	Letter Grade	Range %	GPA
Excellent - work is above and beyond class expectations	A	93-100	4
Excellent - work is above and beyond class expectations	A-	90-92.9	3.7
Good - work is above average	B+	87 - 89.9	3.3
Satisfactory	B	83 - 86.9	3
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