Course Name and Number: IS 607 – Data Acquisition and Management
Credits: 3 cr.
Prerequisite(s): none

How is this course relevant for data analytics professionals?

Most data analytics professionals spend *most* of their time getting data and preparing it for analysis. This is the course that teaches these key skills, as we work with both structured and unstructured data.

Course Description:
In this course students will learn about core concepts of contemporary data collection and its management. Topics will include systems for collecting data (real time, sensors, open data sets, etc.) and implications for practice; types of data (textual, quantitative, qualitative, GIS, etc.) and sources; an overview of the use of data, including what and how much should be collected and the distinction between data, information, and knowledge from a data-centric point of view; provenance; managing data with and without databases; computer and data security; data cleaning, fusing, and processing techniques; combining data from different sources; storage techniques including very large data sets; and storing data keeping in mind privacy and security issues.

Students will be required to create a working system for a large volume of data using publicly available data sets.

Course Learning Outcomes:
By the end of the course, students should be able to:

- Load data into R from various data sources, including CSV files, Excel spreadsheets, relational databases, APIs, and web pages.
- Perform various data cleansing and transformation work, including splitting, combining; resampling; variable creation; data aggregation; sorting and filtering data; strategies for working with outliers and missing data; data visualization and analysis in support of data cleansing activities.
- Understand different information architectures, data types, and data structures.
- Understand relational and non-relational database design and querying.
- Provide context for data science

Program Learning Outcomes addressed by the course*:*

- Business Understanding. Apply frameworks and processes to build out data analytics solutions from understanding of business goals.
- Data Culture. Embody and champion the highest standards for the ethical and moral use of data; understand issues related to data privacy and data security.
- Solid foundational data programming skills, using industry standard tools, essential algorithms, and design patterns for working with structured data, unstructured data and big data.
- Data understanding. Collect, describe, model, explore and verify data.
- Data preparation. Selecting, cleaning, constructing, integrating, and formatting data.

Assignments and Grading:

Assignments (6 x 50)	**30%**
Projects (3 x 90)	**27%**
Final Project Proposal (1 x 20)	**2%**
Final Project (1 x 120)	**12%**
Final Project Presentation (1 x 30)	**3%**
Discussion Participation (14 x 10)	14%
Data Science in Context Presentation (1 x 50)	5%
TidyVerse recipes	4%
Quizzes	3%
TOTAL	**100%**

Quality of Performance	Letter Grade	Range %
Excellent - work is of exceptional quality	A	93 - 100
	A-	90 - 92.9
Good - work is above average	B+	87 - 89.9
Satisfactory	B	83 - 86.9
Below Average	B-	80 - 82.9
Poor	C+	77 - 79.9
	C	70 - 76.9
Failure	F	< 70

Notes

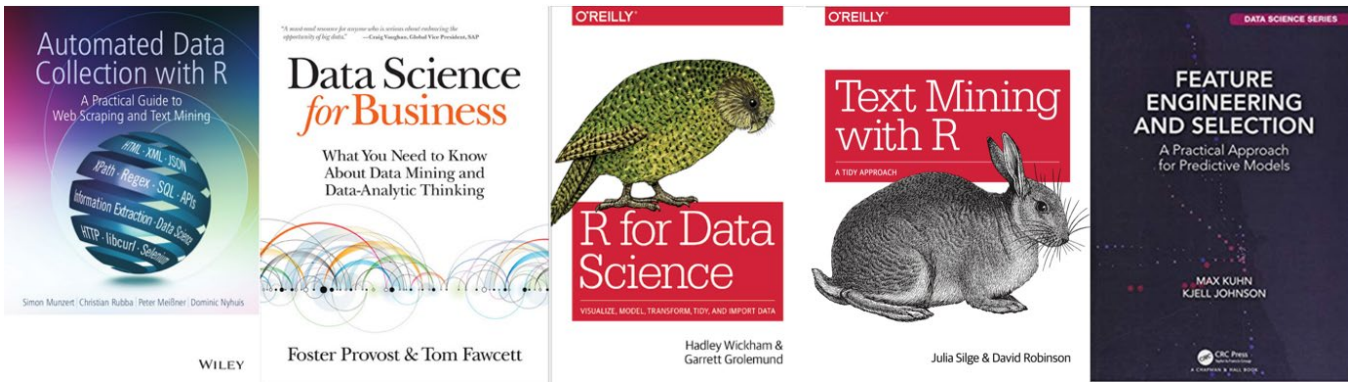
- All projects and assignments, unless otherwise noted, are due end of day on Sundays.

Late projects are not accepted. However, there are eight assignments and four projects assigned, and your final grade is based on your six highest-scoring assignments and your three highest-scoring projects.

- Each course week will be available on the previous Friday at 5:00 p.m. ET.
- **Course Completion Requirements**. To pass this course, you must complete at least six assignments, three projects, the final, and make the final presentation. If you cannot deliver your presentation in our 05/13 Meetup, you'll need to make available a recorded version of your final presentation before 05/13.
- There will also be **short ungraded hands on labs** most weeks that will help you prepare for your weekly programming assignments and projects.
- **"Discussion", "Data Science in Context Presentations", and "TidyVerse Recipes"**. While this material is important, please note that this work only makes up less than one quarter of your grade. Please do the readings, and participate in the discussions and any discussion-related group assignments, make your Data Science in Context presentations, and participate in the creation and editing of TidyVerse recipes on the shared GitHub site. *If you are participating at a reasonable level and turning in your work on time, you'll receive the full 23% here.* At the same time, if you have limited time for the course, please remember to invest the majority of your efforts in completing the projects and assignments. The assignments merit close attention because they will help you to be successful on the projects.
- **Reproducibility Requirement, Testing Requirement, But Not Perfection!** Students are responsible for providing all code and data so that I can test your work. If you turn in code that does not run, you will not receive credit, unless you also include an explanatory note at the time of submission. At the same time, you don't need to turn in perfect code. Generous partial credit will be given for deliverables that are timely, tested, and reproducible. Cutting corners—as long as they are documented at the time of submission—is also acceptable.
- **Groupwork** is encouraged on most projects and assignments, and required on Project 3. Effective virtual collaboration is highly valued in the data science marketplace; because of its interdisciplinary nature, much of the work that needs to be done requires more than one person, and increasingly often at multiple locations.
- **Earning a Grade of A**. If you complete the course work correctly and on time, you'll comfortably pass the course. A grades will be reserved for students that go above and beyond, such as consistently taking on challenge assignments.

Policy on Sharing and "Stealing" Code. In this course, you may collaborate, and you may take base code from whatever sources you wish. But you must document what you started with, and what you added, so you are graded only on your own contributed work!

Course Learning Materials



Required Texts:

- *R for Data Science* by Garrett Grolemund and Hadley Wickham. O'Reilly, 2017. Freely readable here: http://r4ds.had.co.nz/. Print copies are also available.
- *Text Mining with R: A Tidy Approach*, Julia Silge and David Robinson. O'Reilly, 2017. Freely readable
- *Data Science for Business*, Tom Fawcett and Foster Provost, O'Reilly, 2013.
- *Automated Data Collection with R: A Practical Guide to Web Scraping and Text Mining*, Simon Munzert, Christian Rubba, Peter Meißner, and Dominic Nyhuis. Wiley, 2015. Important errata here: http://www.r-datacollection.com/errata/errata.pdf.
- Max Kuhn and Kjell Johnson, *Feature Engineering and Selection: A Practical Approach for Predictive Models* (Chapman & Hall/CRC Data Science Series) 1st Edition, 2019. Freely readable at https://bookdown.org/max/FES/intro-intro.html

Recommended Texts:

- Any book on SQL, such as *The Language of SQL* by Larry Rockoff. ISBN: 978-1435457515. Alternatively, there are many excellent on-line resources, such as http://sqlzoo.net.
- Another excellent R book with a more statistical bent is *R for Everyone* by Jared Lander. ISBN: 978-0321888037.

Relevant Software, Hardware, or Other Tools:

We will make use of the R programming environment and the RStudio IDE. We will use other open source software, including (your choice of) MySQL or PostgreSQL, MongoDB, Neo4J, Hadoop, and Spark. Details for obtaining and installing the appropriate software will be provided in the course materials. All of the software will work on (or from) both PCs and Macs.

Contact Information:

Dr. Tati Tchoubar Tatiana.Tchoubar@sps.cuny.edu	Andy Catlin andrew.catlin@sps.cuny.edu 616-638-8344

How This Course Works:

Meetups take place every week on Wednesdays from 6:45 p.m. to 7:45 p.m. ET. Please see course site for specific dates. You are strongly encouraged to attend; all meet-ups will be recorded.

Tatiana Tchoubar and Andy Catlin will also each have **Thematic Workshops** most Sunday afternoons. These are optional, ungraded enrichment opportunities for interested students. Students from any section are welcome to participate in either or both of the optional Thematic Workshops.

- **Data Engineering** Workshop, most Sundays 2:00 p.m. – 3:00 p.m ET. In addition to the coverage of SQL in Week 2, Andy Catlin will have additional office hours for students who want to improve their SQL skills, and get practice working with cloud-based database tools on Amazon Web Services, including such as EC2 instances, RDS, DynamoDB, and RedShift. While we will use AWS free tier services as much as possible, interested students will be responsible for their own cloud computing costs. To get the most benefit out of the workshop, you should plan to (optionally) spend an additional 3 to 4 hours per week on related assignments: we'll leverage several of DataCamp's SQL courses, as well as some lab materials provided by AWS.
- **Data Visualization and Storytelling** Workshop, most Sundays 3:00 p.m. – 4:00 p.m ET. Tatiana Tchoubar will provide interested students the opportunity to go deeper with Exploratory Data Analysis. You'll work more with ggplot2, practice using Tableau, and learn about the basics of Data Visualization best practices. Later in the program, you'll learn much more about Data Visualization in your DATA 608 course.

Regular Office Hours can also be scheduled by e-mail appointment. If you need extra help and are willing to invest the time and effort to be successful, I'll make the time to help you. But…you should not be asking for extra help on a project the day before it's due, since this indicates that you're not investing the time and effort to be successful.

You are encouraged to ask questions on the "Ask Your Instructor" forum on the course discussion board where other students will be able to benefit from your inquiries. I can set up a GoToMeeting session for screen sharing. For the most part, you can expect me to respond to questions by email within one business day.

Unit	Topic	Core Readings	Deliverables
Week 1 **Jan 27 – Feb 02**	**Building out your Data Science Development Environment;** **R: Data Types and Basic Operations**	*Data Science for Business*, chapter 1	**Meetup on 01/29, 6:45 p.m. EST** **Week 1 Assignment**
Week 2 **Feb 03 – Feb 09**	**R and SQL**	*Data Science for Business*, chapter 2	**Meetup on 02/05, 6:45 p.m. EST** **Week 2 Assignment**
Week 3 **Feb 10 – Feb 16**	**R: Character Manipulation and Date Processing**	*Data Science for Business*, chapter 3	**No Meetup** **Week 3 Assignment**
Week 4 **Feb 17 – Feb 23**	**R: Exploratory Data Analysis; Data Imputation**	*Data Science for Business*, chapter 4	**Meetup on 02/19, 6:45 p.m. EST** **Project 1**
Week 5 **Feb 24 – Mar 01**	**R: Working with Tidy Data**	*Data Science for Business*, chapter 5	**Meetup on 02/26, 6:45 p.m. EST** **Week 5 Assignment**
Week 6 **Mar 02 – Mar 08**	**R: Data Transformations; Feature Engineering**	*Data Science for Business*, chapter 6	**Meetup on 03/04, 6:45 p.m. EST** **Project 2**
Week 7 **Mar 09 – Mar 15**	**Web Technologies; MongoDB**	*Data Science for Business*, chapter 7	**Meetup on 03/11, 6:45 p.m. EDT** **Week 7 Assignment**
Week 8 **Mar 16 – Mar 22**	**Scraping Web Pages**	*Data Science for Business*, chapter 8	**Meetup on 03/18, 6:45 p.m. EDT** **Project 3**
Week 9 **Mar 23 – Mar 29**	**Working with Web APIs**	*Data Science for Business*, chapter 9	**Meetup on 03/25, 6:45 p.m. EDT** **Week 9 Assignment** **Tidyverse Recipes Initial Post due**
Week 10 **Mar 30 – Apr 05**	**Text Mining**	*Data Science for Business*, chapter 10	**Meetup on 04/01, 6:45 p.m. EDT** **Week 10 Assignment** **Tidyverse Recipes Initial Post Peer Grading due**
Week 11 **Apr 06 – Apr 12**	**Spring Break**	No Readings	**No Meetup** No Assignments
Week 12 **Apr 13 – Apr 19**	**Recommender Systems**	*Data Science for Business*, chapter 11	**No Meetup** **Week 12 Assignment** **Tidyverse Recipes Extension due**
Week 13 **Apr 20 – Apr 26**	**Graph Databases**	*Data Science for Business*, chapter 12	**Meetup on 04/22, 6:45 p.m. EDT** **Project 4; Final Project Proposals due** **Data Science in Context presentations due for students opting to make recorded versions**
Week 14 **Apr 27 – May 03**	**Working with Data in the Cloud; Hadoop and Spark**	*Data Science for Business*, chapters 13 and 14	**Meetup on 04/29, 6:45 p.m. EDT** Work on final projects and presentations **Tidyverse Recipes Extension Peer Grading due**
Week 15 **May 04 – May 10**	**Big Data Analytics; Automated Machine Learning**	*Data Science for Business*, Appendices A and B	**Meetup on 05/06, 6:45 p.m. EDT** Work on final projects and presentations
Week 16 **May 11 – May 16**		No readings	**Meetup on 05/13, 6:45 p.m. EDT** **Final Project Presentations**

Accessibility and Accommodations
The CUNY School of Professional Studies is firmly committed to making higher education accessible to students with disabilities by removing architectural barriers and providing programs and support services necessary for them to benefit from the instruction and resources of the University. Early planning is essential for many of the resources and accommodations provided. Please see: http://sps.cuny.edu/student_services/disabilityservices.html

Online Etiquette and Anti-Harassment Policy
The University strictly prohibits the use of University online resources or facilities, including Blackboard, for the purpose of harassment of any individual or for the posting of any material that is scandalous, libelous, offensive or otherwise against the University's policies. Please see:
http://media.sps.cuny.edu/filestore/8/4/9_d018dae29d76f89/849_3c7d075b32c268e.pdf

ACADEMIC INTEGRITY
Academic dishonesty is unacceptable and will not be tolerated. Cheating, forgery, plagiarism and collusion in dishonest acts undermine the educational mission of the City University of New York and the students' personal and intellectual growth. Please see:
http://media.sps.cuny.edu/filestore/8/3/9_dea303d5822ab91/839_1753cee9c9d90e9.pdf

STUDENT SUPPORT SERVICES
If you need any additional help, please visit Student Support Services:
http://sps.cuny.edu/student_resources/