# Course Syllabus: Data Mining for Business – Revised August 28, 2022

CSCI E-96 – *although this course includes business topics at its heart it is a computer science course. Please be mindful of this. Please take the skills assessment (ungraded) to ensure you have a basic knowledge foundation.*

Harvard Extension Fall 2022

Dates: August 29 – December 17, 2022

Time: Monday 8pm-10pm in [1 Story Street 304](https://map.harvard.edu/) (8/29 to 12/17)

Participation Option: On Campus, Live via Web Conference, On Demand Online

Instructor: Ted Kwartler, MBA

Email:

[edwardkwartler@fas.harvard.edu](mailto:edwardkwartler@fas.harvard.edu)

Office Hrs: Available upon request

*Optional* Lab: TBD – First lab is Sept 30, Friday at 2pm EST. You can also request help on the forum, or directly from the TA’s beforehand.

## Important URLs:

**Canvas** (homework submissions and grading)  
<https://canvas.harvard.edu/courses/111146>

**Class Question Forum Ed** **Discussion** forum access through canvas.

<https://edstem.org/us/courses/24311/discussion/>

This term we will be using an online forum for class discussion. The enables fast and efficient help from classmates and your teaching staff. Rather than emailing questions to the teaching staff directly, I encourage you to post your questions on the forum to benefit everyone when appropriate.

Keep in mind, the class forum is used to benefit distance learning, but it is never intended to be a customer service center, social networking website or the channel for sharing evaluations of teammates, staff or topics (save that for your course evaluations). Further, teaching staff responses are not expected within any given timeframe. In fact, your teaching staff may not respond at all for some topics so that students have to help each other, research and explore on their own and ultimately learn rather than be explicitly told. While some students find this problematic the course goal is to facilitate self-learning and improve confidence as much as direct instruction.

**Github** repository allows you to get all scripts, PowerPoints and data sets throughout the semester. For those not familiar with github, think of it like a shared drive similar to SharePoint or Dropbox but with added functionality for data and computer science.

*The following link has underscores not spaces (“\_”)*

<https://github.com/kwartler/Harvard_DataMining_Business_Student>

## Streaming & Video Information:

* Lectures will be streamed via zoom, with link in the canvas site.
* Students will be able to access the recordings to watch on demand. Recordings are usually posted within 24-48hours after the lecture.

**All lecture video links will be available from the Course Canvas site.**

## Prerequisites:

* Textbook: Data Mining for Business Analytics: Concepts, Techniques, and Applications in R

ISBN-10: 1118879368

* Software: R & R-Studio
  1. If you are not familiar with R Studio please take a short introduction to R course at Lynda.com, DataQuest.com or DataCamp.com.
  2. *Be sure you have permissions to install R, & R-Studio on your laptop. It is mandatory.*
* Access to git software to download data sets and class material or ability to download directly from the Internet
  1. *Be sure you have permissions to install Git on your laptop. It is mandatory.*
* A webcam or other method to record case presentations & upload to the University’s approved site as well as interact with live class sessions if that is your mode of attendance. If you prefer you can share videos directly with teaching staff for privacy.
* Be prepared to obtain a free zoom account to record case presentations

## Course Learning Objectives:

If you stay engaged in the course and complete the suggested readings and assignments:

You will be able to think systematically about how data is used to make business decisions. This objective will be accomplished through the use of ideas from statistics, economics and computer technology and using business related case studies.

Students will learn how to implement a variety of popular data mining algorithms in R (a free and open-source software) to tackle business problems and identify opportunities. This course will help introduce the basics of R in data mining.

**As a business leader, you will acquire the skill of applying data science concepts within business domains to improve decisions and learn how data scientists approach projects.**

**As a data scientist, you will acquire practical applications of data mining methods that are used in many of today’s most successful organizations as well understanding what business stakeholders expect of data scientists.**

## Attendance & Participation:

Regular attendance and remote, asynchronous, participation on the class forum is essential to the successful completion of this course. Attendance and participation on the class forum helps deepen learning outcomes for the entire cohort. While no grade is given based on participation, students identified as slanderous, or unsupportive of a collaborative learning environment may be subjected to disciplinary action. The teaching staff encourages thoughtful constructive dialog but does not condone online misbehavior. In a supportive learning environment “kindness > cleverness” and thus, productive participation is expected and encouraged.

## Code of conduct:

This course expects you to uphold and report violations of the Extension School code of conduct found [here](https://www.extension.harvard.edu/resources-policies/student-conduct). Further, all assignments are the responsibility of each *individual* pupil unless assigned as a group assignment. Utilizing the class forum, online resources, teaching assistants, and the class professor to ask questions is (of course) acceptable but copying another peer’s work is considered a violation of the University code of conduct.

You are responsible for understanding Harvard Extension School policies on academic integrity ([www.extension.harvard.edu/resources-policies/student-conduct/academic-integrity](http://www.extension.harvard.edu/resources-policies/student-conduct/academic-integrity)) and how to use sources responsibly. Not knowing the rules, misunderstanding the rules, running out of time, submitting "the wrong draft", or being overwhelmed with multiple demands are not acceptable excuses. There are no excuses for failure to uphold academic integrity. To support your learning about academic citation rules, please visit the Harvard Extension School Tips to Avoid Plagiarism ([www.extension.harvard.edu/resources-policies/resources/tips-avoid-plagiarism](http://www.extension.harvard.edu/resources-policies/resources/tips-avoid-plagiarism)), where you'll find links to the Harvard Guide to Using Sources and two, free, online 15-minute tutorials to test your knowledge of academic citation policy. The tutorials are anonymous open-learning tools.  
  
Accessibility  
The Extension School is committed to providing an accessible academic community. The Disability Services Office offers a variety of accommodations and services to students with documented disabilities. Please visit [www.extension.harvard.edu/resources-policies/resources/disability-services-accessibility](http://www.extension.harvard.edu/resources-policies/resources/disability-services-accessibility) for more information.

## Grading:

A course grade will be assigned based on student performance on case studies, applicable homework assignments and a written assignment.

Assignments are accepted up to 12 hours late. Any work submitted after the deadline but before 12 additional hours will be penalized 10% of the total weight of the assignment. After 12 hours no late submissions will be accepted under ANY circumstances. Pupils are expected to manage their own time and submit their work accordingly. Failure to submit submissions through the University approved portal by the assignment deadline will be considered late and not accepted. Submissions to any other location will not be accepted.

**Graduate Student Grading**

* Case I 25% of final grade: **EDA Case**
* Case II 25% of the final grade: **Banking Case**
* Case III 25% of the final grade: **TBD**
* Written assignment 25% of final grade
* **Extra Credit: Homework II Visualization in R 1% of total grade**

**Undergraduate Student Grading (no case II)**

* Homework Assignment I 10%
* Homework Assignment II 10%
* Homework Assignment III 10%
* Case I 20% of final grade: **EDA Case**
* Case III 30% of the final grade: **TBD (note no Case II for Undergraduate)**
* Written assignment 20% of final grade

## Writing Assignment

Twenty-five percent of the final grade (for graduate students) will be determined by the quality and completeness of a 900-to-1200-word ***essay concerning ethical implications of data mining within a business context***. Approximately, no more than 25% of the essay should comprise a summary and synthesis of the data science ethics articles covered in class. The balance of the essay can incorporate new literary sources and student reflections for how business is affected by the rise of cheap computing, large scale creation and storage of data and development of new algorithms. Example questions to spur creative reflection include (but are not limited to):

* Is it ok to have a “black box” algorithm where users do not know how it functions?
* Should AI/ML use cases be regulated?
* Should those impacted for high risk ML use cases have a way to escalate to a human?

For additional inspiration, check out the [AI Incident Database](https://incidentdatabase.ai/).

While defining an ethical framework can be a personal matter, the organization and robustness of your argument along with supporting statements to the argument are subject to evaluation. It is not the case that all ethical actions are relative or that ethical considerations are incapable of objective evaluation. Further the level of sophistication you demonstrate in understanding the issue discussed, addressing applicable opposing viewpoints, actions stakeholders can take to mitigate issues and the logical structure of your essay will impact your grade. Lastly, primary source philosophical paradigms, not mere opinions should be used as a foundation for your logical construction of what is ethical in a data mining and business context.

Each page should have a header with a clear label including the author, date, page number and title. As a personal reflection paper concerning ethics, APA or similar citation method is *not* necessary.

## Case Presentations

Each student will work on four case studies individually (or 3 as an undergraduate). Cases will involve business related data driven decision making. Each case will have the following work artifacts:

* Maximum 10min recorded slide presentation uploaded to youtube, embedded as a voiceover in the slides or shared in a similarly appropriate manner.
  + The presentation will outline the business problem, the insights identified and the outcomes/recommendations satisfying the case
* Slide presentation uploaded to canvas
* R Script(s) supporting the creation of any visuals, models or recommendations made during the presentation.

**Essentially all supporting material including scripts, visuals and/or presentation slides will need to be turned in for review.**

## Classes

**Tasks in BOLD are considered assignments and/or extra credit.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date | 8-9pm | 9-10pm | Reading Due | **Tasks & Assignments in BOLD**  Suggested Book Exercises -unbolded |
| Aug 29 | Introduction & Administrative | Intro to R | NA | 1. Skillset Assessment:    1. Install R & R-Studio    2. Connect to Git Student Repository    3. Chapter1: [Free Intro to R Course](https://campus.datacamp.com/courses/free-introduction-to-r/chapter-1-intro-to-basics-1?ex=1) (1-2hr for chapter1) |
| Sep 5 | Labor Day | | | |
| Sep 12 | Intro to Data Mining | Basic EDA | Chapter 1  Chapter 2 | **Forum introduction post** |
| Sep 19 | More R Practice &Visualization | Exploratory Data Analysis | Chapter 3 | **HOMEWORK I (undergraduate):**  **Intro\_To\_R\_Homework.R** |
| Sep 26 | Data Mining in a Business Workflow | Data Preprocessing  Donor Bureau Case | Chapter 6 | -C2.1 Data Mining Techniques  -C2.2 Data Partition  -C2.3 Data Sample  -C2.4 Modeling Steps |
| Sept 30 | **OPTIONAL: 2pm EST Lab Session to help prep HW and Case work; link will be posted to Ed Discussion** | | | |
| Oct 3 | Regression & Logistic Regression | | Chapter 7  Chapter 10 | **HOMEWORK II (undergraduate assignment or extra credit graduate):**  **Visualization in R**  -C6.1 Predicting Boston Housing Prices  Only do a, & b |
| Oct 10 | Indigenous Peoples’ Day | | | |
| Oct 17 | Decision Tree | Random Forest | Chapter 9 | **CASE I. EDA Case**  -C10.3 Sales of Riding Mowers  Only do a, b,c & d  -C7.2 Personal Loan Acceptance |
| Oct 22 | **OPTIONAL: 2pm EST Lab Session to help prep Case work; link will be posted to Ed Discussion** | | | |
| Oct 24 | Time Series Forecasting | Equity Trading | Chapter 16, 17, & 18 | -C9.3 Predicting Prices of Used Cars  Only do “a” |
| Oct 31 | Consumer Credit Risk Modeling | Non-Traditional Investment Modeling |  | **HOMEWORK III (undergraduate):**  **- C16.1 Impact of 9/11 on Air Travel**  **\*use Sept11Travel\_REVISED.csv**  **-C18.9 Australia Wine Sales**  **Only do “a”, & “b”** |
| Nov 7 | Quant Real Estate Investing | LP Solve for optimal selection | NA | **CASE II (Graduate only) Banking Case Upload** |
| Nov 14 | Natural Language Processing (NLP) | | NA |  |
| Nov 19 | **OPTIONAL: 2pm EST Lab Session to help prep Case work; link will be posted to Ed Discussion** | | | |
| Nov 21 | NLP Document Classification | | 20 |  |
| Nov 28 | Data Sources with R – APIs & Webscraping | Growth Models |  |  |
| Dec 5 | Ethics | | NA |  |
| Dec 12 | Guest Speakers, *awaiting confirmation*   * Ross Leav, Presidio Ventures * Rachel Switchenko, VP Customer Care Plymouth Rock Assurance * James Liu, Product Manager Amazon Web Services | | Chapter 14 | **Case III TBD**  **-** C14.2 Identifying Course Combinations |
| Dec 16 (Friday) | NA- not a class session | | | **Writing Assignment** |

## Graduate Credit Students

This course is open to non-credit, graduate and undergraduate students. As a result, the course experience will vary for each cohort.

Noncredit students may submit case presentations, extra credit homework, and the ethics paper. Your assignments will receive feedback to improve your acumen. However noncredit student may not receive letter grades.

Graduate credit students are expected to do more work and perform at higher standards than undergraduate credit students. As a result, a graduate credit student’s written assignment should incorporate an additional 3 sources of information beyond the covered text. Similarly a graduate writing paper needs to demonstrate nuanced sophistication of the ethical considerations presented along with appropriate counter arguments using a philosophical paradigm not opinion. Graduate students must complete all 3 case studies while undergraduate credit students are assigned 2.

## Grading Scale

You earn the grade based on assignments according to the scale below. Grades are not curved to fit a predetermined distribution. A student’s degree, certificate candidacy, or funding status will not have any impact on a course grade. “Needing an A” for any reason is not sufficient to earn an A grade. *Note there are no “minus” grades given in the course.* It is the belief of the instructor that minus grades constitute a false precision in many academic courses and further penalize frequent “A-“ students since there is no way to obtain an “A+” to rebalance a GPA. To the student’s benefit, one can still earn a “plus” on their final grade according to the scale below.

|  |  |  |
| --- | --- | --- |
| Max | Min | Grade |
| 100 | 90 | A |
| 89.9 | 87 | B+ |
| 86.9 | 80 | B |
| 79.9 | 77 | C+ |
| 76.9 | 70 | C |
| 69.9 | 67 | D+ |
| 66.9 | 60 | D |
| 59.9 | 0 | F |