

Course Information	<p>94-881 A1: Managing Analytics Projects (Mini 1, Fall 2023) (will be updated for Sp2024) 6 Units Class sessions: Mondays and Wednesdays, 2 pm – 3:20 pm EST, Hamburg Hall 1202. Instructor</p> <ul style="list-style-type: none"> Professor David Steier (PhD, CMU SCS '89) steier@andrew.cmu.edu Office hours: immediately following class and by appointment on Fridays <p>TAs (office hours TBD)</p> <ul style="list-style-type: none"> Valerie David (vdavid@andrew.cmu.edu)
Prerequisites	<p>Students should have completed a statistics course. Students may wish to review the fundamentals of statistics and probability in the free online learning class at https://oli.cmu.edu/courses/probabilitystatistics-open-free/ . Proficiency with at least one analysis environment (e.g. Excel, Python, R, or SAS) required. Experience with advanced analytics (data science, artificial intelligence) highly desirable.</p>
Description	<p>With the growing demand for data science and AI skills, there are many options for students to learn fundamentals of data and analytics modeling. There are fewer opportunities to learn how to manage analytics projects, which often involve leading teams with diverse skills and interacting with stakeholders in a variety of roles. Using a decision-driven framework, this course offers students practical guidance and experience around the process of initiating, delivering, and evaluating analytics projects. It will draw on experience from a consulting perspective, talking about analytics with clients and delivering analytics related engagements.</p> <p>The course will cover the following topics:</p> <ul style="list-style-type: none"> Starting the analytics conversation: Identifying needs, understanding constraints Planning and executing analytics projects: Sizing, staffing, communication Making choices around data, analytics, visualizations and infrastructure: Sourcing, techniques, technologies, integration, security, pipelines Analytics in the enterprise: Communications, ethics, organizing talent, strategy
Course Materials	<p>There is no textbook covering all the material in this course, so we will be using a selection of material available online, especially</p> <ul style="list-style-type: none"> “The 2022 Executive Guide to Data Science and AI“, Applied Data Science Partners, https://adsp.ai/executive-guide-to-data-science-and-ai/ <i>Building Analytics Teams: Harnessing analytics and artificial intelligence for business improvement</i> J.K. Thompson, 2020, Packt Publishing, \$25.49 at https://www.amazon.com/Building-Analytics-Teams-intelligence-improvement/dp/1800203160 or free from the CMU library (optional) <i>Applied Artificial Intelligence: A Handbook for Business Leaders</i>, M. Yao, Jia, and A. Zhou, 2018 TOPBOTS Inc. \$44.78 at https://www.amazon.com/Applied-Artificial-IntelligenceHandbook-Business/dp/0998289027
Evaluation Method	<p>The grade will be based on three homework assignments, active participation in class discussions including in-class group exercises, and the completion and presentation of an analytical project management case study. The in-class exercises will refine the student skills over time on a variety of case studies taken from analytics practice. The homework assignments, based on the analytics problem chosen for the final project, will cover problem framing, project planning, data, analytic, and visualization techniques. The grades for homework turned in after the deadline will be reduced by 10% per day late.</p> <ul style="list-style-type: none"> Homework (3 times 20%) 60% Class participation 20% Final project <u>20%</u> <p style="text-align: right;">100%</p>

Learning/Course Objectives	Learning Objective	How Assessed																		
	Recognize analytics opportunities and converse with stakeholders to elicit project requirements	Class participation, homework, presentation																		
	Identify data sources, analytics and visualization techniques relevant to an analytics problem	Homework, class participation, projects and presentations																		
	Create and evaluate analytics project plans	Class participation, homework, projects and presentation																		
	Anticipate and address common challenges in analytics projects	Class participation, projects and presentation																		
Grading Scale	<p>Everyone taking the class should expect to register for a letter grade. Auditing the class or taking the class Pass/Fail are intended for extremely rare circumstances and only with consent of the instructor.</p> <table> <tr> <td>A+</td> <td>98.0-100%</td> <td>B+</td> <td>88.0-89.9%</td> <td>C+</td> <td>78.0-79.9%</td> </tr> <tr> <td>A</td> <td>92.0-97.9%</td> <td>B</td> <td>82.0-87.9%</td> <td>C</td> <td>72.0-77.9%</td> </tr> <tr> <td>A-</td> <td>90.0-91.9%</td> <td>B-</td> <td>80.0-81.9%</td> <td>C-</td> <td>70.0-71.9%</td> </tr> </table>		A+	98.0-100%	B+	88.0-89.9%	C+	78.0-79.9%	A	92.0-97.9%	B	82.0-87.9%	C	72.0-77.9%	A-	90.0-91.9%	B-	80.0-81.9%	C-	70.0-71.9%
A+	98.0-100%	B+	88.0-89.9%	C+	78.0-79.9%															
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Course/Topical Outline:	Week 1 – Aug 28 & 30, 2023	
	Topic	Motivation and overview of managing analytics projects ; A decision driven framework for managing analytics projects <ul style="list-style-type: none"> • Class structure and policies • Attrition analytics case study • A decision-driven framework for managing analytics projects
	Required Readings	<ul style="list-style-type: none"> • N. Hotz, “Why Big Data Science and Data Analytics Projects Fail,” February 13, 2021, https://www.datascience-pm.com/project-failures/ • (Optional) Chapters 1-5 “What Business Leaders Need to Know about Artificial Intelligence” pp. 1-50 in <i>Applied Artificial Intelligence</i>
	Deliverable	<ul style="list-style-type: none"> • In-class group exercise: Customer attrition analytics case (Aug 28) • 2-minute presentation on one analytic opportunity (Aug 30)
	Week 2 – Sep 6, 2023	
	Topic	Starting analytics conversations <ul style="list-style-type: none"> • Identifying organizational needs addressable by analytics • Understanding decision-maker needs and project constraints (e.g. timeliness, accuracy, and budget)
	Required Readings	<ul style="list-style-type: none"> • Davenport and J. Kim” Chapter 2: Framing the Problem” in <i>Keeping up with the Quants</i>, 2013, available on Canvas
	Deliverable	<ul style="list-style-type: none"> • Analytic opportunity presentation, second round (Sep 6) • Homework #1: Opportunities for analytics (Sep 8)
	Week 3 – Sep 11 & 13, 2023	
	Topic	Making choices around data and analytics <ul style="list-style-type: none"> • Understanding available internally and externally sourced data • Profiling to assess data quality • Exploratory data analysis • Understanding analytics problem types and tool/technology options • Choosing analytic techniques
	Required Readings	<ul style="list-style-type: none"> • Mawer et al. “The value of exploratory data analysis.” March 2017 • https://svds.com/value-exploratory-data-analysis/ • N. Zumel and J. Mount, <i>Practical Data Science with R</i>, Manning Publications, 2nd edition, 2019, Chapter 3: “Exploring Data” available on Canvas • (Optional) Chapter 9 “Collect and Prepare Data” pp. 121-128 in <i>Applied Artificial Intelligence</i> • Applied Data Science Partners, “The 2022 Executive Guide to Data Science and AI“, https://adsp.ai/executive-guide-to-data-science-and-ai/ • (Optional) “Taking off the Training Wheels” (especially “The Analytic Selection Process”) and “Life in the Trenches” p. 47-101 in <i>Field Guide to Data Science</i>, https://www.boozallen.com/s/insight/publication/field-guide-to-data-science.html
	Deliverable	<ul style="list-style-type: none"> • Form project teams (by Sep 11)

Week 4 – Sep 18 & 20, 2023	
Topic	<p>Making choices around visualizations and infrastructure</p> <ul style="list-style-type: none"> • Choosing visualization techniques • Parallel and distributed computing for scalability • Resolving technical tradeoffs • Analytics pipelines
Required Readings	<ul style="list-style-type: none"> • Netquest, “Visualize It: A comprehensive guide to data visualization,” available on Canvas and from https://www.netquest.com/en/download-ebook-data-visualization • P. Wong and R. Bennett , “Everything a Data Scientist Should Know About Data Management”, August 28, 2019, https://towardsdatascience.com/everything-a-data-scientist-should-know-about-data-management-6877788c6a42 • M. Greene and D. Steier, “Managing Analytics Projects,” in <i>Proceedings of the Joint Statistical Meeting</i>, 2015
Deliverable	Homework #2: Data for analytics (Sep 20)
Week 5 – Sep 25 & 27, 2023	
Topic	<p>Planning and delivering analytics projects</p> <ul style="list-style-type: none"> • Assessing an organization’s analytics maturity • Sizing an analytics project in terms of time, resources, infrastructure, expenses • Assembling (and retaining) an analytics team • Anticipating and reacting to early warning signs in analytics projects • Evaluating impacts from analytics projects; identifying future opportunities
Required Readings	<ul style="list-style-type: none"> • J.K. Thompson,, Chapters 5-6, "Managing executive expectations" "Ensuring engagement with business professionals," <i>Building Analytics Teams: Harnessing analytics and artificial intelligence for business improvement</i> 2020, • (Optional) Chapter 8, “Planning the Implementation,” Chapter 10 and 11 (“Build Machine Learning Models” and “Experiment and Iterate”), p. p. 89-120, 129-150 in <i>Applied Artificial Intelligence in Applied Artificial Intelligence</i>.
Week 6 – Oct 2 & 4, 2023	
Topic	<p>Ethical considerations; Analytics in the enterprise</p> <ul style="list-style-type: none"> • Privacy, algorithmic bias and appropriate applications of analytics • Managing executive expectations • Ensuring engagement with business professionals • Organizing analytics talent • Creating an enterprise analytics strategy
Required Readings	<ul style="list-style-type: none"> • R. Courtland, “Bias detectives: the researchers striving to make algorithms fair”, <i>Nature</i>, June 20, 2018, https://www.nature.com/articles/d41586-018-05469-3 • Z. Balaporia, et. al., INFORMS, “How Organizations Can Get Started With Analytics”, 2020, https://www.informs.org/Explore/Building-Successful-O.R.and-Analytics-Teams
Deliverable	• Homework #3: Making choices around analytics and visualizations (due Oct 4)
Week 7 – Oct 9 & 11, 2023	
Topic	Final project presentations
Deliverable	• Final project presentations Oct 9 & 11, final reports due Oct 15

Course Policies & Expectations

In-person attendance at all sessions of this class in Hamburg 1202 is expected. While one excused absence is permitted, missing more classes will affect the class participation grade in proportion to the number of classes missed.

Students are expected to strictly follow Carnegie Mellon University rules of academic integrity in this course. This means in particular that unless otherwise specified, homework are to be the work of the individual student using only permitted material and without any cooperation of other students or third parties. It also means that usage of work by others is only permitted in the form of quotations and any such quotation must be distinctively marked to enable identification of the student's own work and own ideas. All external sources used must be properly cited, including author name(s), publication title, year of publication, and a complete reference needed for retrieval. Violations will be penalized to the full extent mandated by the CMU policies. There will be no exceptions.

You may use generative AI programs like ChatGPT during the brainstorming and idea generation phase for assignments. However, doing so cannot be considered a substitute for traditional research. Generative AI programs rely on predictive models to generate content that may appear correct, but has been shown to sometimes be incomplete, inaccurate, taken without attribution from other sources, and / or biased. Any information generated by an AI program should be cited like any other reference material. You are ultimately responsible for the content of the information you submit. However, you may not attempt to pass off any work generated by an AI program as your own.

Homework assignments will often cover material before it has been covered in class, with the goal of motivating students to use the readings and other resources and bring their questions to class. The homework assignments are a chance to apply best efforts to the problem at hand, and feedback from the class discussion can be incorporated into the final project paper and presentation. In many instances, especially on the case studies, there may not be a single right answer: students are encouraged to explore a topic from a variety of perspectives and techniques and engage in respectful and open-minded discussion of alternatives.

It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups.

If you have a disability and have an accommodations letter from the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at access@andrew.cmu.edu.

As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. CMU services are available, and treatment does work. You can learn more about confidential mental health services available on campus at <http://www.cmu.edu/counseling/> . Support is always available (24/7) from Counseling and Psychological Services: 412-268-2922.