

Course Information	<p>94-881: Managing Analytics Projects 6 Units Class sessions: Mondays and Wednesdays, 1:25 pm – 2:45 pm EST, Hamburg Hall 2008 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 TA: Luke Gallagher lukegallagher@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"> <i>The Field Guide to Data Science</i>, Booz Allen Hamilton, 2015, available online at https://www.boozallen.com/content/dam/boozallen_site/sig/pdf/publications/2015-field-guide-todata-science.pdf <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>Python for Data Analysis</i>, W. McKinney, 2013. O' Reilly available from Amazon or for 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> 100%

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	<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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A-	90.0-91.9%	B-	80.0-81.9%	C-	70.0-71.9%															

Course/Topical Outline:*	Week 1 – Aug 30 & Sep 1, 2021	
	Topic	Motivation and overview of managing analytics projects ; Starting the analytics conversation <ul style="list-style-type: none"> • Class structure and policies • Attrition analytics case study • A decision-driven framework for managing analytics projects • 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"> • 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 30) • 2-minute presentation on one analytic opportunity (Sep 1)
	Week 2 – Sep 8, 2021	
	Topic	Making choices around data <ul style="list-style-type: none"> • Understanding available internally and externally sourced data • Profiling to assess data quality • Exploratory data analysis
	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” • (Optional) Chapter 9 “Collect and Prepare Data” pp. 121-128 in <i>Applied Artificial Intelligence</i>
	Deliverable	<ul style="list-style-type: none"> • Analytic opportunity presentation, second round (Sep 8) • Homework #1: Opportunities for analytics (Sep 10)
	Week 3 – Sep 13 & 15, 2021	
	Topic	Making choices around analytics and visualization <ul style="list-style-type: none"> • Understanding analytics problem types and tool/technology options • Choosing analytic and visualization techniques
	Required Readings	<ul style="list-style-type: none"> • “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>
	Deliverable	<ul style="list-style-type: none"> • Form project teams (by Sep 15)

Week 4 – Sep 20 & 22, 2021	
Topic	Making choices around infrastructure <ul style="list-style-type: none"> • Parallel and distributed computing for scalability • Resolving technical tradeoffs • Analytics pipelines

Required Readings	<ul style="list-style-type: none"> Robinson, J. “How Facebook Scales Machine Learning,” Feb 3, 2019, https://medium.com/@jamal.robinson/how-facebook-scales-artificialintelligence-machine-learning-693706ae296f Wong, P and Bennett, R. , “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
Deliverable • Homework #2: Data for analytics (Sep 22)	
Week 5 – Sep 27 & 29, 2021	
Topic	Planning and delivering analytics projects <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"> D. Steier and M. Greene, “Managing Analytics Projects,” in <i>Proceedings of the Joint Statistical Meeting</i>, 2015 (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>.
Deliverable	• Homework #3: Making choices around analytic and visualization (due Sep 29)
Week 6 – Oct 4 & 6, 2021	
Topic	Ethical considerations; Analytics in the enterprise <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"> Courtland, R, “Bias detectives: the researchers striving to make algorithms fair”, <i>Nature</i>, June 20, 2018, https://www.nature.com/articles/d41586-018-05469-3 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, 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	• In-class summaries of project lessons learned so far (Oct 6)
Week 7 – Oct 11 & Oct 13 (if needed), 2021	
Topic	Final project presentations
Deliverable	• Final project presentations Oct 11 & 13, final reports due Oct 13

<p>Course Policies & Expectations</p>	<p>In-person class participation, especially in the group exercises and in the presentations is mandatory. While one excused absence is permitted, missing more classes will affect the class participation grade in proportion to the number of classes missed.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
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