

Instructor Information:

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Course Logistics:

Credit Hours: 3
 Days: Online
 Time: Online
 Location: Online

Prerequisites: None

Required Textbook:

Parnell, Gregory S. Editor, *Trade-off Analytics: Creating and Exploring the System Tradespace*. John Wiley & Sons, 2016.

Course Description:

Explore the use of trade-off analytics as a tool to assist with infrastructure development and preservation efforts, with integrated examples investigating maritime and multimodal infrastructure. (While the course examples will be on infrastructure, course projects can include any engineering management domain.) Learn sound methodology to identify stakeholders, stakeholder objectives, and measures of performance for infrastructure improvement programs. Apply descriptive, predictive, and prescriptive data, models, and analytics to evaluate current infrastructure status and identify potential improvements. Develop and implement an Excel™ based decision support tool to provide trade-off analytics insights and assess best value-per-dollar infrastructure decisions.

Course Topics:

Topics	Hours
Introduction to Trade-Off Analytics and Decision Analysis	3
Introduction to Maritime and Multimodal Infrastructure and Life Cycles	3
Conceptual framework for Infrastructure Trade-Off Analysis	3
Framing the Decision	3
Identifying Improvement Opportunities	2
Developing and Evaluating Alternatives	3
Overview of Benefit Cost Analysis	2
Identifying Benefits and Measures	2
Developing Benefit-Cost Models	2
Developing an Integrated Model for Benefit and Cost Trade-Off Analytics	3
Exploring and Evaluating the Decision Space	3
Understanding Sources of Uncertainty and Analyzing Uncertainty	4
Communicating Analysis Results to Decision-Makers	3
Project Presentations	3
Exams	3

Course Outcomes: Upon completion of the course the student will be able to

1. Examine the role of trade-off analyses to support system decisions in each stage of the maritime and multimodal infrastructure life cycle.
2. Identify and define a decision opportunity that requires a trade-off analysis.
3. Explain the advantages and disadvantages of tradespace exploration techniques for trade-off analysis of concepts, architectures, designs, operations, and retirement.
4. Recognize and avoid the mistakes of omission and commission in trade-off analysis.
5. Identify and structure stakeholder objectives and develop single objective and multiobjective decision analysis models to evaluate alternatives.
6. Describe the advantages and disadvantages of common engineering approaches used to generate and evaluate system alternatives.
7. Determine the sources of uncertainty in the life cycle and be able to assess and model uncertainty using probability.
8. Use decision analysis as the mathematical foundation for trade-off analysis.
9. Develop an integrated decision model using Model-Based Engineering that incorporates system performance, value, cost, and risk.
10. Perform a trade-off analysis using both deterministic and probabilistic techniques.
11. Communicate the insights of an analysis and the important trade-offs to senior stakeholders and decision makers.

Grade	Grading Scale
Exam 1:	25%
Exam 2:	25%
Project 1:	15%
Project 2:	25%
Homework & class participation:	10%
TOTAL	100%

Weekly Assignments: Assignments are due weekly. Your assignments must be submitted to Blackboard. E-mailed assignments will be accepted only for valid reasons (e.g., course web page inaccessible due to down time or software problems).

Exams: Exams will consist of problems, short answer questions and multiple choice. Exams are closed book with one page of notes on both sides. Collaboration is not permitted on exams.

Project 1 (major professional decision): The first project is an individual analysis of a real life engineering decision in any engineering domain that is of interest to you. Project 1 deliverable is a 10 minute presentation and an Excel decision model. Grades will be based on the quality of your problem definition, value model (Net-Present Value model or multiple objective model with 5-10 value measures), life cycle cost model, deterministic analysis, insights, and presentation.

Project 2 (major professional decision): The second project is an individual analysis of a real life engineering decision. Project 2 deliverables are a ten page type-written report (including an executive summary), submission of an integrated (value and cost) Excel decision model that uses Monte Carlo simulation, 10 min presentation. Grades will be based on the quality of your problem definition, decision model, deterministic/probabilistic analysis, insights, and presentation.

Assignments: Please treat the due dates in this class as professional obligations. An assignment will receive a 10% deduction from the total point count for each day it is late.

- Late assignments will not be accepted more than three days after the original due date/time.
- Deviations from this policy will be made only if the student receives approval from me at least 24 hours prior to the homework due date/time.

I understand there are emergencies and extenuating circumstances, which I will certainly consider. I just expect you to plan ahead, if possible.

Grading Questions: All graded material will be returned to students. Once a graded item has been returned, you have 48 hours to challenge the grade. **To challenge a grade, you must submit a typed description of the grading error (attached to the graded item) to me.** Your description must include your name and e-mail address. I will respond to your challenge within 48 hours of its receipt.

Course Policies

Communication:

Students should check their University e-mail on a daily basis. Class announcements including unexpected cancellations will be e-mailed to you. A course web page is located on UA's Blackboard (<https://learn.uark.edu/>). This web page will be used for course-related email, dissemination of materials and access to on-line grades.

Family Educational Rights and Privacy Act (FERPA):

The *Family Educational Rights and Privacy Act* (FERPA) protects a student's academic and other educational records from unauthorized access. This protection extends to email correspondence between a student and the University of Arkansas faculty and staff.

To provide reasonable assurance that emails are from the student, all university or class related emails must be sent from the student's uark.edu email account. Additionally, university or class related emails must be sent to the student's uark.edu email account.

This means that I cannot acknowledge emails sent from your personal or work email accounts, and I cannot send emails to your personal or work email accounts.

Academic Honesty Policy:

- As a core part of its mission, the University of Arkansas provides students with the opportunity to further their educational goals through programs of study and research in an environment that promotes freedom of inquiry and academic responsibility. Accomplishing this mission is only possible when intellectual honesty and individual integrity prevail. Each University of Arkansas student is required to be familiar with and abide by the University's '[Academic Integrity Policy](#)' at honesty.uark.edu. Students with questions about how these policies apply to a particular course or assignment should immediately contact their instructor
- Plagiarism is often misunderstood. It can be defined as submitting someone else's work as your own. It is not permissible to "cut and paste" and then just cite another's work. In writing for homework or projects, you should read and learn, process through your mind, relate ideas, and then express what you learned **in your own words**. Cite the references where you found your information. If you do use someone else's words, you must use quotation marks **and** cite. You should not overuse quotes – save them for a rare occurrence.

A complete statement of the U of A's Academic Honesty Policy is available in the UA Student Handbook and the UA Graduate Catalog.

University of Arkansas Academic Policy Series 1520.10

University of Arkansas Academic Policy Series 1520.10 requires that students with disabilities are provided reasonable accommodations to ensure their equal access to course content. If you have a documented disability and require accommodations, please contact me privately at the beginning of the semester to make arrangements for necessary classroom adjustments. Please note, you must first verify your eligibility for these through the Center for Educational Access (contact 479-575-3104 or visit <http://cea.uark.edu> for more information on registration procedures).