DEPARTMENT OF THE ARMY
DEPARTMENT OF SYSTEMS ENGINEERING
UNITED STATES MILITARY ACADEMY
WEST POINT, NEW YORK 10996

MADN-SE 6 January 2023

INSTRUCTIONAL MEMORANDUM
NO. 384-23-2

ANALYTICAL METHODS FOR ENGINEERING MANAGEMENT

1. **PURPOSE.** The purpose of this memorandum is to provide each cadet with the administrative details necessary to successfully complete EM384, Analytical Methods for Engineering Management.

2. **REFERENCES.**

a. Department of Systems Engineering Administrative Memo l-l, “General Administrative Instructions," July 2022.

b. Department of Systems Engineering Administrative Memo 1-2, "Standards for Written Requirements," July 2022.

c. Department of Systems Engineering Administrative Memo 1-3, "Academic Documentation Policy," July 2022.

d. USMA publication. "Documentation of Academic Work," Office of the Dean, July 2017

e. "Communication Skills Handbook, A Basic Guide to Oral and Written Communications," Department of Systems Engineering, Apr 2000.

f. The Little Brown Handbook, by H. Ramsey Fowler and Jane Aaron, Addison-Wesley, New York, 1998.

3. GENERAL.

a. This memorandum provides each cadet with the course description, course objectives, course texts, lesson assignments, grading plan, practice problem guidance, and criteria for passing the course.

b. Your instructor will inform you in advance of any deviation from the guidance provided in this memorandum.

4. SPECIFIC.

a. Course Scope. EM384 focuses on the application of deterministic and probabilistic models used by analysts to make engineering management decisions. Cadets learn to apply various modeling techniques to represent and solve real-world organizational problems in the military and industry. Topics for the course include: spreadsheet modeling, linear programming, network modeling and integer programming, and Monte Carlo simulation modeling. Cadets apply concepts and tools using Microsoft Excel and Python. The techniques taught in this course have been applied to an increasingly wide variety of complex problems in business, government, military, health care, and education. Ethical responsibilities in describing the results of analyses to decision makers are integrated throughout the course. Cadets make innovative use of spreadsheets to develop and analyze models. Cadets are tested on the application of concepts of the course from the four blocks of instruction during three written partial reviews (WPRs) in the Lab, three course quizzes, ten out-of-class homework sets, and a comprehensive term-end examination. During some class sessions, cadets will use their laptop in the classroom.

b. Course Strategy. This course introduces cadets to the modeling and analysis required to support engineering management decisions. The focus is on the application of deterministic and probabilistic spreadsheet models used by engineering managers to analyze engineering management decisions. Cadets learn to apply various modeling techniques to represent and solve real-world problems in the military and industry. The course is composed of four major blocks of instruction. Block I focus on modeling and spreadsheet engineering. Block II focuses on linear programming models of systems, solving them both graphically and using Excel Solver, and conducting sensitivity analysis on solutions. Block III covers minimum cost network flow models and (binary) integer programming to solve various types of problems (i.e. transportation, assignment, transshipment, and site selection). Block IV focuses on Monte Carlo simulation models. Cadets will learn to analyze data, model random variables, and build simulations of decision problems using python. Cadets apply engineering management tools and use Microsoft Excel and Python software to solve complex problems. A detailed lesson syllabus is included as Enclosure 1.

c. Course Objectives.

1) Understand the need for models and the role of spreadsheet modeling to provide analysis to support engineering management decisions.

2) Given a scenario description, identify problems that can be modeled using linear programming. Build and analyze an appropriate model.

3) Given a scenario description, identify problems that can be modeled using network and integer programming models. Build and analyze an appropriate model.

4) Given a brief scenario description, identify problems that can be modeled using simulation. Build and analyze an appropriate model using a software programming language.

5) Conduct sensitivity analysis on models and make recommendations to decision makers.

6) Communicate in written reports and electronic media the modeling process, results, and recommendations.

7) Recognize the ethical considerations involved with gathering and analyzing data, using quantitative models, validating assumptions, and reporting results.

d. Text. Hillier, Frederick S., Lieberman, Gerald., Introduction to Operations Research, 11th Edition, McGraw Hill Education, 2021**.**

e. Additional References. Additional reading/ course material will be posted in the appropriate folder on the course website.

f. Lesson Assignments. See Enclosure 1 (Syllabus) for specific readings and practice problems.

g. Performance Assessment.

1) The course consists of 1000 points. All graded work is individual work unless otherwise noted.

a) Written Partial Reviews. (Three at 150 points each). The intent is to test your understanding of key course concepts in each respective block. WPRs will be conducted in a lab environment using both paper and computer-based testing (Excel, Python) to test both conceptual and applied lesson and course objectives.

b) Quizzes. (Three at 20 points each, in blocks 1, 2 and 4, for 60 points total). Quizzes are intended to test conceptual understanding of course material prior to WPRs.

c) Homework Sets. (Ten at 20 points each, for 200 points total). Homework sets will be assigned and collected by the instructor throughout the course. The assignments will be submitted via TEAMS on the due date per the Syllabus (unless otherwise stated by the instructor).

d) Instructor Points. (40 points total). Points will be allocated by each instructor for smaller assignments, pop-quizzes, and class participation/engagement.

e) Term End Examination. (250 points). The purpose of this exercise is to reinforce those concepts taught during the entire course.

2) Student performance assessment summary:

Graded Event	Quantity	Points	Total Points	% of Course
Written Partial Reviews	3	150	450	45.0%
Homework Sets	10	20	200	20.0%
Course Quizzes	3	20	60	6.0%
Instructor Points	Various	Various	40	4.0%
Term End Examination	1	250	250	25.0%
Course Total	16	-	1000	100.00%

5. ADMINISTRATIVE GUIDANCE.

a. Minimum Requirements. Score at least 50% on the TEE and complete the course with at least 65%.

b. Graded Events. Unless there are exceptional circumstances, cadets will take all WPRs, and complete all graded events. Cadets who will miss an event must contact the instructor as soon as they know about the conflict. It is the cadet's responsibility to coordinate with the instructor to make up any material/requirements missed.

c. Late Submissions. Failure to submit a graded event on time for other than legitimate, compelling reasons will result in a reduced grade (5% of maximum points available per day, to include weekends) and may result in disciplinary action. Cadets are required to submit *all* graded events regardless of how late it is.

d. Final Grades. Final grades will be awarded IAW with reference 2.a (Department of Systems Engineering Admin Memo 1-1).

e. Documentation. Cadets may use any available reference material in preparing course work but use of any references MUST BE PROPERLY DOCUMENTED. Documentation procedures are outlined in references 2a through 2e.

f. Additional Instruction. AI is available at mutually agreed upon times between the cadet and their instructor. Prior to visiting an instructor for additional instruction (AI), cadets are expected to make a legitimate attempt to complete the daily assignments and practice problems to standard and bring those assignments with them to the AI session. Cadets are expected to have specific questions for any AI session. No AI is given after the first version of a WPR or graded lab has been given, whether that version is the primary or a special make-ahead exam. The last AI session for the TEE is the last day of classes.

g. Assignments: Assignments consist of both problem sets and smaller assigned items. Your instructor will dictate which assignments count as graded homework. Practice problems are intended to enhance understanding of text material. Although these problems will not be graded, you are expected to work them.

h. Class. You are expected to bring your textbooks and laptop to each class. Ensure you

bring your textbook to Lesson 1. If you are not going to be at a class, please have the professional courtesy to let your instructor know *prior to the class* in person or via email.

FOR THE HEAD OF THE DEPARTMENT:

//Original Signed//
MATTHEW D. MOGENSEN
LTC, AV/49A
EM384 Course Director

Enclosures (1): Syllabus

DISTRIBUTION: 1 each instructor, EM384
1 each cadet, EM384