MGS 4120 – Optimal Resource Allocation
Spring 2011, Course Syllabus - Jim Shi

Class CRN: 15817; Section: 005
Instructor: Junmin (Jim) Shi
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Classroom: Sparks Hall 303
Meeting time: 7:15 – 9:45PM, Monday
Office Hour: 4:00-5:00PM, Wednesday (Other times by appointment)
Class Website: myRobinson.gsu.edu

Special Requirement: *Critical Thinking through Writing*
Professor: Dr. William C. Bogner
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Course Overview
This course focuses on optimization modeling and sensitivity analysis to help managers craft well-formed, well-justified decisions. Students design optimization models for realistic cases, implement them using Excel spreadsheets, and write the results in the form of a nontechnical recommendation to management backed up by clearly organized technical appendices.

Prerequisites:
MGS 3100. CSP: 1, 3, 4, 7, with. 2.5 GSU GPA and 45 semester hours
It also requires a good background with Excel Spreadsheet.
You must meet these prerequisites and the course will be taught assuming you have sound background in those topics.

Text:
An Introduction to Management Science, 13th Edition, South-Western (August 18, 2010), by Anderson, Sweeney, Williams, Camm and Martin;
(ISBN-13: 978-1-4390-4327-1; ISBN-10: 1-4390-4327-2).

Cognitive Objectives:
To receive a grade of "A', you should develop theoretical knowledge, modeling know-how, and computer skills and be able to:

- Understand and explain in your own words ways in which model-based resource allocation are needed and can be utilized in managerial decision processes.
- Explain how and why optimization modeling is used in the resource allocation environment.
- Understand and explain the modeling process and be able to apply it in a variety of different business situations.
- Evaluate resource optimization models applying good modeling and validation techniques.
- Implement model-based resource allocation using Excel and some other software packages.
- Develop and demonstrate critical thinking skills in resource allocation management.
- Perform and demonstrate sensitivity analysis by Excel spreadsheet base on critical thinking.
- Develop a nontechnical recommendation to management backed up by technical appendices.
- Use Internet (e.g., Web) and its tools to access necessary information for resource allocation management.

Learning Outcomes/Course Objectives
At the conclusion of this course, the student should be able to:

- Determine whether a particular business case or situation calls for an optimization model
- Choose an appropriate linear, nonlinear, or dynamic optimization technique
- Implement an optimization model to inform the business decision making process
- Generate an optimal business solution with the aid of Excel Spreadsheet
- Write a complete cogent presentation of the results of a optimization programming analysis
- Organize, develop and advance a paper (3 pages the most, not including Appendix), using *Critical Thinking through Writing* at a business level, as opposed to an academic level.

Detailed Course Description
The course begins by considering a very simple linear resource allocation problem to introduce linear programming, dimensional analysis, and sensitivity analysis in a simple setting. Progressively more complex resource allocation problems illustrate slack and surplus variables, allocating financial resources and formulation issues

The next section considers blending problems, especially problems in which there is some flexibility in the ingredients of two or more products.

Personnel shift coverage problems and assignment problems are important in themselves and also provide an introduction to the use of matrices in linear programming. Next come multi-period inventory, single & multi-period Finance, and production, inventory, and finance all together.

Linear transportation models lead into a section on capacitated transshipment, shortest route & maximal flow problems. These are presented in a context of supply chain management. The problem of warehouse location in two-stage supply chain optimization provides an introduction to integer programming.

Quadratic programming (a part of non-linear optimization) is introduced in a context of financial portfolios, and a synthesis of quadratic and integer programming is presented in the context of price determination. General nonlinear programming is introduces in the context of optimal order quantity (which is mathematically the same as optimal production runs).

The course concludes with a unit on goal programming to balance conflicting objectives.

Methods of Instruction
Instruction is by lecture and discussion, paired with in-class exercises. Homework and projects are also integral to the instruction, and students are strongly encouraged to use the internet, library and instructor as a resource throughout these projects.

CTW Project
The project for MGS 4120 is a part of the University's "*Critical Thinking through Writing*" initiative. By the University's definition, assignments that focus on critical thinking as demonstrated through writing are assignments that use writing to help students develop the "wide range of cognitive skills and intellectual dispositions needed to effectively identify, analyze, and evaluate arguments and truth claims; to discover and overcome ill-founded presuppositions ["personal prejudices" in the original]; to formulate and present convincing reasons in support of conclusions; and to make reasonable, intelligent decisions about what to believe and what to do." [Bassham, Irwin, Nardone & Wallace, *Critical Thinking: A Student's Introduction* (McGraw-Hill, 2005).)]

Your project is in three parts. I will provide a cover sheet for each part, which you should turn in as the first page of each submission; it has a place for your name and the details of how I will grade the work. (In education jargon, this is called a "rubric", c.f., page 4). I will use it to show you how your particular grade was assessed.

In Part 1 of the project you will answer a question of the exercise and write a first draft of an executive summary. In Part 2 you will correct the errors, if any, and write a second draft of the executive summary. In Part 3 (the final project), all you turn in is the third cover sheet and the final version of the executive summary.

The project must be submitted on standard 8.5”x11” page paper with fond size 12. Page numbers at bottom of page are required. It is your responsibility to get it properly formatted and printed out. When printing spreadsheets, use landscape or portrait printing, fonts, page break control, and whatever else is needed to produce something that is very easy to read. It will probably take more than one attempt.

The most important component of the project report is the “executive summary”. This should be in the form of a memo to the management of the enterprise in question presenting a recommendation for action based on all the analysis you have done, together with a clear, cogent, concise, and non-technical summary of the justification for this recommendation

Critical Thinking through Writing Rubric for MGS4120

Homework assignments and the final project in this course will emphasize the type of ***critical thinking*** that is necessary for effective decision making in business management. Specifically, you will have to identify relevant facts from a rich situation confronting a business manager; rationally analyze the identified facts by systematically applying modeling skills, and reach logical conclusions based on that analysis. These elements will then be presented clearly in prose writing. Critical thinking produces work that should show the following steps in the critical thinking process:

1. Describe the most important, over-arching problem issue in the business situation;
2. Identify the important input and the objective, and develop an efficient optimization model.
3. Solve the optimization model with the aid of Excel Spreadsheet;
4. Validate the model and perform sensitivity analysis;
5. Repeat Steps 1-4 by critical thinking;
6. Give your best solution. What action steps would you take to implement the solution and give your rationale? Be specific, precise and include a thorough explanation. Choose meaningful action.

Criteria	Ineffective (1)	Less than competent (2)	Competent (3)	Excellent (4)	Score
Effectively write a complete analysis of the business situation	Fails to distinguish relevant from trivial facts in the business situation	Fails to identify most relevant facts in the Executive Summary.	Identifies most relevant facts in the Executive Summary.	Identifies all relevant facts in all components of the Business situation.	
The ability to create a right optimization model	Does not develop the key issues.	Hints at some of the relevant issues.	Specifies most of the relevant issues, but has not developed each.	Specifies all of the relevant issues and develops each.	
The ability to apply Excel Spreadsheet to solve for the optimal solution	Ignores or inaccurately discusses all or almost all relevant components germane to the development of the business plan.	Superficially discusses most relevant components relevant to the business plan.	Discusses most relevant components germane to the business plan.	Discusses all relevant components germane to the business plan. Fully explains what is required of each component to ensure success.	
The ability to do sensitivity analysis and systematically and logically analyze and interpret the results	Conclusions based on misconceptions of major components.	Few conclusions supported by good business practices.	Most conclusions supported by viable business practices.	All or nearly all conclusions supported by sound business practices.	
The ability to reach conclusion and make recommendations	Writing incoherent and ideas illogically arranged.	Few ideas logically arranged. Writing often unclear.	Most ideas logically arranged. Writing generally clear.	Ideas logically arranged. Writing clear and precise.	

Attendance/Class Participation:
Your class participation grade will be mainly based on attendance. All homework assignments will be reviewed in class. You are expected to attend classes. Class attendance will be taken in the beginning of class. If you do miss a class, you are responsible for obtaining notes and remaining current. It is not possible to repeat lectures for students missing class. Two "free" absences are allowed. There are no "excused absences".

Late students are responsible for signing the class roll before leaving. Otherwise, you will be considered absent. Excessively late students and students leaving early will be penalized. If you arrive late, it is your responsibility to remember to sign the roll before leaving.

Course Policies:
- All projects and assignments are subject to grade penalty if not turned in at the beginning of class on the due date.
- The internet will be used extensively for communications throughout the semester. You are expected to become proficient using e-mail and web-publishing skills. It will be your responsibility to read your mail on a regular basis. The three-fold purpose is to familiarize you with online capabilities, to facilitate communication with other class members and me, and to reduce paper usage in a green manner.
- Class attendance is expected and a necessary component of class participation.
- Assignments remain due on the designated date regardless of class attendance. This is a project-oriented class using computer application programs, which require significant time commitment.

Grading
Details will be made available in class and the course site. Grading will be based on five components, weighted as follows:

Exam 1	20%
Exam 2	20%
Drafts 1 and 2(including CTW)	20%
Final Project (including CTW)	30%
Class Participation/Attendance	10%

The grading scale for this class is as follows: A+: 97-100; A: 94-96; A-: 90-93.9; B+: 86-89.9; B: 82-85.9; B-: 78-81.9; C+: 74-77.9; C: 70-73.9; C-: 66- 69.9; D: 60.0 - 65.9; F:< 60.0

Professional and personal circumstances that preclude you from performing at satisfactory levels will not be considered in the determination of the course grade. The effect of your grade on overall GPA, eligibility for graduation, loss of scholarship, loss of a United States resident card, placement on academic probation, etc., are *not* considered in the determination of your grade. There are no extra credit assignments. Individual requests for alternative ways to improve your course grade will not be considered.

Homework and Examinations:
You must work independently on the assignment. Copying another's work, knowingly or negligently allowing another to copy yours, or collaborating on a rough draft you both copy from will all result in a grade of "**F"** for the entire course. This includes computer work.

For in-class tests and the final exam, you will need to bring a basic calculator (with a square root button!) and *one* 8.5"x11" page of notes (two-sided). Students are required to provide their own pencils and scratch paper. All material needed for tests and the final exam will be covered in class.

Tests will be administered according to the attached schedule. Tests may be a mixture of multiple choice and calculation problems. Class tests and the common final will test both your understanding of concepts and problem solving ability, and will also include questions about the use of Excel to solve Resource Allocation problems in this course.

PowerPoint Slides:
Copies of the PowerPoint slides for this course can be found on the website of this course at myRobinson.gsu.edu. To minimize note taking, you should print the slides for each class in advance and bring them to class.

Honor Code:
Plagiarism in any form is not acceptable. While discussion with classmates regarding homework and projects is encouraged, all work submitted must be your own. Evidence of plagiarism on an assignment/exam will result in a failing grade for that assignment/exam.
Importantly, all cell phones should be turned off or muted during class.

Tentative Schedule: deviations may be necessary
(Supplementary homework assignments will be added as the course progresses)

Week and Date (Monday)	Topic	Detailed Outline	Chapter #	Notes
1. Jan. 10	Introduction to Modeling	Course introduction and overview; A simple resource allocation example; The Seven-Step Modeling Process	Syllabus And Chapter 1	Prof. Bogner talks about CTW Requirement
2. Jan. 17	No class	**MLK holiday**		
3. Jan. 24	Spreadsheet Techniques Introduction to Optimization Modeling	Effective use of spreadsheets for modeling; Review of key Excel functions; Decisions Involving the Time Value of Money Introduction to Optimization; A Two-Variable Model Sensitivity Analysis A Product Mix Model	Chapter 3	**Draft 1 Assigned**
4. Jan. 31	An Introduction to Linear Programming	A simple Maximization Problem Graphical Solution Extrem Points and the Optimal Solution A simple Minimization Problem Special Cases	Chapter 2	Set up Appointment with Prof. Bogner for Draft 1
5. Feb. 7	Linear Programming:	Sensitivity Analysis Interpretation of Solution	Chapter 3	**Draft 1 Due**
5. Feb. 14	**Exam 1**			
6. Feb. 21	Go over Exam 1 Linear Programming Applications	Marketing Applications, Financial Applications Operations Management Applications	Chapter 4	Feb. 25 is the last day to withdraw
7. Feb. 28	No class,	**Spring break**		Spring Break, Feb. 28- Mar. 6
8. Mar. 7	Advanced Linear Programming Applications	Data Envelopment Analysis Revenue Management Protfolio Models and Asset Allocation	Chapter 5	**Draft 2 Assigned**
9. Mar. 14	Distribution and Network Models	Transportation Models Assignment Models Minimum Cost Network Flow Models Shortest Path Models	Chapter 6	Set up Appointment with Prof. Bogner for Draft 2
10. Mar. 21	Integer Linear Programming	Types of Integer Linear Programming Models Graphical and Computer Solutions for an All ILP Applications Involving 0-1 Variables	Chapter 7	**Draft 2 Due**
11. Mar. 28	**Exam 2**			
12. Apr. 4	Go over Exam 2 Nonlinear Optimization Models	Basic Ideas of Nonlinear Optimization Pricing Models Advertising Response and Selection Models A Production Application Facility Location Models Markowitz Portfolio Optimization Models	Chapter 8	
13. Apr. 11	Project Scheduling: PERT/CPM	Project Scheduling with Known Activity Times Project Scheduling with Unknown Activity Times Time-Cost Trade-Offs	Chapter 9	
14. Apr. 18	Inventory Models	Economic Order Quantity Model Economic Production Lot Size Model Single-Period Inventory Model with Probabilistic Demand Order-Quantity, Reorder Point Model with Probabilitic Demand	Chapter 10	
15. Apr. 25	**Final Project (including CTW)**	Project		**Final Project Due**