DECISION MAKING IN A COMPLEX ENVIRONMENT

COURSE SYLLABUS 1.5 CREDITS

Learn how to make high-impact decisions that are reasoned, defensible, and will lead to having greater success in both making these decisions and in justifying them by individuals and organizations. Most complex decisions involve many interested parties with conflicting interests and objectives and many factors, especially intangible ones like social, environmental and political influences alongside economic ones. All these factors need to be prioritized and integrated under common goals. Such complex decisions have benefits, opportunities, costs and risks that need to be addressed.

How to put this together to make the most effective decision is the object of this class on the Analytic Hierarchy Process (AHP) and its generalization to dependence and feedback, the Analytic Network Process (ANP). The subject provides a new way of thinking about decision problems. Students will be exposed to a variety of applications and will get hands-on practice with the very usable *SuperDecisions* software that facilitates this way of decision-making. You are urged to bring your own laptop computer to class during this course. The software will be provided.

For help with software, contact Rozann Saaty. Email: rozann@creativedecisions.net

The main requirement of the course is a final project. You may work alone, or at most in teams of two, on a substantial decision problem of your choice. At the end of the course, hand in a polished executive report with an executive summary that includes a discussion of the problem and the elements of the problem, diagrams, tables and the conclusion of the decision reached and an analysis of the results. You need to submit by email your final report, the *SuperDecisions*® model file, your presentation PowerPoint slides and any other supporting files in Excel or PowerPoint.

> *If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services (DRS), 216 William Pitt Union, (412) 648-7890/(412) 383-7355 (TTY), as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.*

COURSE MATERIALS
TWO BOOKS ARE REQUIRED
These are paperback books available at a reasonable cost from the Pitt bookstore.   There will be readings assigned from them. Please read Chapters 1 and 2 of the first book before the first class and familiarize yourself briefly with the entire book.

Group Decision Making Thomas L. Saaty, and Kirti Penwati 2008, 352 pp.; paperback; ISBN 1-888603-08-9
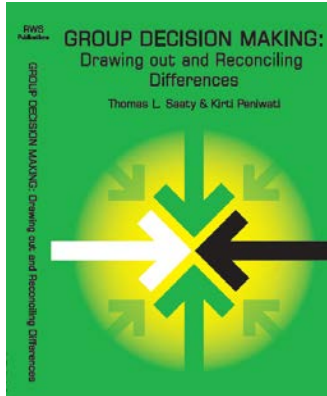
The Encyclicon, Vol.III: a Dictionary of Decisions with Dependence and Feedback Based on the Analytic Network Process; Thomas L. Saaty and Luis Vargas, 2011, 298pp. ISBN 1-888603-11-9
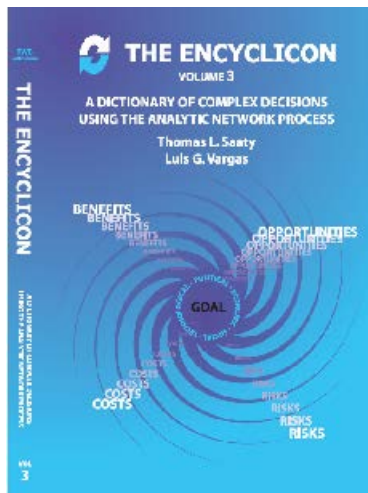
SOFTWARE

The SUPERDECISIONS software for decision making with the Analytic Hierarchy Process (AHP) and the Analytic Network Process (ANP) is available free for use in the course. You can get the software in two ways:

- To download the software go to www.superdecisions.com , register as a user, then log in and download the beta version. You can create a password for yourself on the same site. The *user name* is your email address.

- Double-click on the downloaded .exe file. If certain components that are required are not already installed on your computer you will be asked for permission to install them. The SUPERDECISIONS program icon below will be placed on your desktop. Double-click it to launch the software. You will be asked to enter a serial number the first time you run it.

If you wish to continue using the software this serial number expires, return to www.superdecisions.com and generate a new serial number that will last for 6 months each time you do it. The software is free to educators and researchers.

POWERPOINT LECTURE SLIDES
The PowerPoint slides shown by the teacher during class are available on the CourseWeb on Lecture 1, Lecture 2, Lecture 3, etc.

TUTORIALS
PowerPoint Tutorials and software user manuals in Word are available under Course Documents as well as in the weekly lectures.

SAMPLE MODELS AND SAMPLE FINAL PROJECTS
Many sample models are available in the Course Documents as well as in the software. For example, there are personal decision models, market share models and complex decision models under the Help>Sample Models command.

LECTURES AND ASSIGNMENTS

PLEASE BRING YOUR LAPTOP COMPUTER TO EVERY CLASS IF POSSIBLE

SUBMITTING HOMEWORK

Send your homework by email directly to the grader for the course. Do NOT use the Course DropBox. The name and email address of the grader for this class can be found in the Announcements on the CourseWeb home page for the course.

READING ASSIGNMENT TO BE DONE *BEFORE* THE FIRST CLASS

- In the *Group Decision Making* book read Chapter 1 *The Need for to a Structured Approach* and Chapter 2 *How to Make a Decision* (on structuring a decision hierarchy and making comparative judgments)

LECTURE 1   THE ANALYTIC HIERARCHY PROCESS FOR DECISION MAKING

1. Lecture one is an introduction to the Analytic Hierarchy Process (AHP) for Decision Making using hierarchically structured decision models.
2. Examples of models will be given. There will be an in-class group exercise to estimate the relative areas of some geometric figures and the class will work together to construct a decision model and make judgments using the SUPERDECISIONS software.

HOMEWORK

- Study the examples of Personal Decision models and reports that can be found in the Course Documents. Build an AHP hierarchical model for a decision of personal interest to you: where to take a vacation, where to live, whether to buy a house or live in an apartment, what car to buy, what job to take, etc.

- Study the examples of Personal Decision models in the Course Documents section of the CourseWeb. Build an AHP hierarchical model for a decision of personal interest to you: where to take a vacation, where to live, whether to buy a house or live in an apartment, what car to buy, what job to take, etc. You will create two models and write a report on the results:
    1) a relative decision model where the alternatives are compared pairwise against the criteria
    2) a ratings decision model where the alternatives are rated, one at a time, against the criteria.
    3) Write a report about your decision and give the results from the two ways of doing it. Are they different and why?

A decision model in the superdecisions software consists of a single file regardless of whether the file is a hierarchy, a hierarchy with ratings, or a simple network or complex: multiple levels of hierarchies or a model containing multiple levels of networks.

LECTURE 2 INTRODUCTION TO THE ANALYTIC NETWORK PROCESS FOR DECISION MAKING WITH DEPENDENCE AND FEEDBACK

- Introductory lecture on the ANP, the Analytic Network Process for decision making with dependence and feedback. You will learn how hierarchical decision models and network decision models differ and see examples of network decision models.
- You will be shown how to convert an AHP model into an ANP model.
- You will be shown examples of models for estimating market share based on "soft" factors. The class will participate in structuring a market share model. You need to choose a topic to create your own market share model - due as homework the following week.

READING ASSIGNMENT
- In the *Group Decision Making* book read Chapter 9 *Decisions with Dependence and Feedback, the Analytic Network Process*. Get an overview of the material. Don't worry about the mathematical details.
- Study the PowerPoint tutorials about changing from AHP to ANP thinking and about market share models in the Course Documents.

HOMEWORK
Exercise 1
Change the relative model from your personal decision of last week into an ANP model with feedback. Write a brief report comparing the results and also the priorities of the criteria with your first homework. If they are different, can you see why? Which do you think was better? Email the homework and your ANP decision model to the grader.

Exercise 2

Create a market share model, enter judgments and synthesize to get the relative market share. There are examples of market share models in the Course Documents on Blackboard.

> *Hint* You will get better results by choosing something you know very well. Write a brief description of your model in a Word document. Include the compatibility index if you are able to find actual market share data.

LECTURE 3 COMPLEX MODELS IN THE ANALYTIC NETWORK PROCESS (ANP)

1. Students report in class on their market share exercises and how well their results match the data for their topic.
2. The lecture is an introduction to complex ANP models. Examples of complex models with benefits, opportunities, costs and risks (BOCR) will be covered. This is the type of model that you should use in your final project.

   Corporate and Government decisions
   a. National Missile Defense case
   b. Ford Explorer tire problem case
   c. Porsche SUV decision case
   d. Predicting presidential election results

   You will be shown how to use the software to create a complex BOCR model.

GROUP WORK THAT WILL BE DONE IN CLASS

- Students will work in groups of three or four to study an example from the Course Documents to report on using the files from their example to make a presentation in the following class.

FINAL PROJECT

The final project is the major piece of work for the course and a good bit of the course grade will be based on it. The oral presentation, the SuperDecisions model, a PowerPoint slide presentation and a report on the project constitute the final exam. You report should include summary tables of priorities as in the National Missile Defense example in the powerpoint lecture slides of Lecture 3. Please email all files, suitably named with your last names at the beginning of the file names, to the grader. It is not necessary to print and hand in any of the material

- Students choose their final group of two (or one, if you want to do your final project alone) and think about choosing a topic for their final project, sometimes proposed by the teacher,

READING ASSIGNMENT FOR NEXT CLASS PERIOD

- In the *Group Decision Making* book read Chapter 3 *Why the AHP is Essential: The Need for a Structured Approach* (effective group decision making) and Chapter 4 *How to Structure a Decision* (prediction decisions and structures for considering the benefits, opportunities, costs and risks in a decision)

- In the *Encyclicon: Dictionary of Complex Decisions Vol. III,* read Chapter 1. The <u>first</u> example in Chapter 1 is about BOCR complex models and gives detailed steps for how to create one with the software. These steps are the ones you would follow in preparing your final project. The *Encyclicon* is full of useful examples that you can use for project ideas, and particularly criteria and concepts, though not necessarily the way they are put together, for your final project.

LECTURE 4 STRUCTURING A COMPLEX BOCR DECISION

1. Students make short presentations of model studied from sample final projects
2. Lecture on group decision making.
3. More examples of applications of AHP/ANP

    Prioritizing in Businesses and Society
    a. Student admissions
    b. University and business school rankings (also posted on the web site above)
    c. Ranking countries for investment
    d. Outsourcing
    e. Vendor selection
    f. Creativity in designing a house, a mousetrap and a trimaran sailboat

4. Students will report on the progress they are making with their final projects.

READING ASSIGNMENT
- In the *Group Decision Making* book read Chapter 5 *Turning Individual Judgments into Group Decisions* and Chapter 6 *Group Sessions: the Promise and the Problems.*
- Study the PowerPoint tutorial about BOCR models.

LECTURE 5 RESOURCE ALLOCATION, PLANNING AND CONFLICT RESOLUTION, GROUP DECISION MAKING ISSUES

Lecture on other stuff – scales of AHP, math of AHP, have class compute eigenvector, group decision making issues, resource allocation (material and human), conflict resolution.

1. Lecture on resource allocation: allocating resources to projects in a fishery; prioritizing budgets and resource allocation with intangible constraints as applied to hiring personnel
2. Groups will give a short progress report about their final project
3. The rest of the time in class will be given for you to work on your final projects. The instructors will be available to help and answer any questions you may have about your final projects.

HOMEWORK

Write a short essay about potential applications of AHP in diverse societal problems and how to prepare business people and politicians to be open minded to using the ideas in their daily work.

LECTURE 6 UNDERLYING CONCEPTS

How to promulgate and apply AHP/ANP in the business world

Students report on their essays with group discussion and recommendations for action.
Students work on their final project.

LECTURE 7

Students will report on their final projects. If the class consists of 8 sessions, students may choose to make their presentations the following week. Your final report along with your model and any other files such as powerpoint presentations will be due at the end of the last scheduled class.
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- Make sure to clearly announce your names as you start your oral presentation. Please print a one sheet summary of the project for the instructors and grader. It should include the name of your project, a one paragraph description of what it is about, and the names and email addresses of the participants.
- Put the names of group members and email addresses on the report and on the first page of your PowerPoint slideshow.
- You may use the model itself in your presentation if you wish to make a live demonstration of some part of it.

Be thorough in including background material in your project report. Give a description of the decision and its major components and elements. You do not need to go through all the factors in the model in your oral presentation, but give an overview so that your audience can understand what it is about and the conclusions that were reached. Do not assume that the reader will be able to pick up from the model all that you have in mind. In your report you CAN assume that your reader knows the ANP process so you do not have to include the mathematical background, though you certainly will need tables of final results and sensitivity screenshots.

Some final projects may be presented during this class time if they are ready.

LECTURE 8

This is the final class period during which any groups who have not presented during the 7th class period will make their presentations.

Turn in the final project by emailing the material to the grader for the course by the end of the class.

All files should be named with last names and topic. Please include the SuperDecisions model, any PowerPoint slides used in your presentation, your final report and any other relevant files such as Excel spreadsheets.

For University of Pittsburgh Courses:
If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services, 216 William Pitt Union, 412-648-7890/ (412)383-7355 (TTY), as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.