TERM PROJECT DESCRIPTION

A. General

As part of your overall evaluation in the course, you are requested to carry out a term project of your own choice dealing either with theoretical, methodological, or applied aspects of Multi-Criteria Programming. Please let me outline, then, some possible suggestions for these two approaches but you should realize that these are only suggestions and do not preclude any idea you may have.

B. Library Research Paper

For the research paper, survey the literature over the last ten years examining books, journals, and conference proceedings pertinent to your idea. For example, the International Abstracts of Operations Research available on the worldwide web or in the Graduate Physical Sciences Library may be an excellent place to begin. Use of Google, Bing, or Yahoo search will probably suffice to generate some interesting items. From this survey, choose at least ten (10) but not necessarily more than ten items to focus your research upon. Summarize the significant concepts, methodologies, trends and future directions implied by the chosen reference items. This literature review then becomes the core of your research project. Obviously, depending upon your familiarity with the topic, you may wish to probe beyond a literature survey and examine some of the underlying assumptions, principles or methodologies in more detail. You will have to be the judge of your ambitions here. Of course, I will offer you my opinion on your project idea and its progress throughout the semester. As a possible stimulus for research paper projects, the following is presented.

B.1 Applications of Multi-Attribute & Multi-objective Programming

1. Engineering Design Optimization
   - Computer Aided Design (CAD)
   - Computer Integrated Engineering (CIE)
   - Design Analysis Case Study

2. Manufacturing Engineering
   - Computer Aided Manufacturing (CAM)
   - Inventory Control
   - Project Planning and Control (PERT/CPM)

3. Location Models
   - Land Use Planning
   - Facility Layout and Location
   - Single Facility Location Models
Multi Facility Location Models

4. Transportation Planning
   o Optimal Network Design
   o Optimal Route Planning
   o Preventive Maintenance

5. Health Planning

6. Information Systems

7. Others

   B.2 Theoretical and Methodological Aspects

1. Network Optimization
   o Shortest Paths and K-Shortest Paths
   o Spanning Trees
   o Travelling Salesman
   o Chinese Postman Routings
   o Networks with Gains

2. Linear Programming
   o Assignment Models
   o Transportation Models
   o Transshipment
   o Multi-commodity Flows

3. Integer Programming
   o Optimality Conditions
   o Branch and Bound Methods
   o Cutting Plane Techniques

4. Nonlinear and Dynamic Programming
   o Meta-heuristic Programming
   o Evolutionary Programming
   o Genetic Algorithms

5. Stochastic Programming

6. Specific Techniques
   o Electre I, II
   o Saaty’s Analytical Hierarchy Technique
   o Integer Goal Programming
   o Surrogate worth Technique

7. Group Decision Making Methods
   o Group Utility Functions
   o Delphi Methods
   o Interactive Methods
8. Probabilistic and Bayesian Methods
   - Complex Decision Trees
   - Influence Diagrams
   - Bayesian Methods

C. Case Study Approach

If you have access to some real project you are currently working on or have worked upon in the past, you might wish to develop a term paper around the project. You will need to define the project background and scope as well as the underlying theory and methods which have been employed in solving the problem. What you need to also examine from our course viewpoint is the Multi-criteria nature of the problem and how any theory or methods from our course may be applicable to your project. Often the assumptions underlying a project assume a certain value structure which regulates the project development. For example, cost and quality are two often competing objectives which conflict so that tradeoffs must be made between them. How are these tradeoffs made in the project? Can they be quantified? Who makes these tradeoffs? In a larger sense, other criteria such as safety, reliability, and timeliness also enter the decision problem. How should these be addressed in your project? Which objective is most important? As a checklist of relevant items to consider here, let me suggest the following:

- What are the project alternative courses of action?
- Who are the personnel concerned, involved, and affected by the project?
- What are the criteria & how are they identified?
- How are tradeoffs made?
- Can you quantify the underlying value/utility functions of the criteria?
- Do you have an overall performance function to integrate the individual criteria weights and values?

D. Requirements

You should have a reproducible typewritten (double-spaced) paper of between 20-30 pages with an appropriate reference bibliography at the end of the semester.

E. Evaluation

The first part of the assignment is an outline or brief written summary (2-3 pages total) which should contain the essential ideas and organization of your project. It is recommended that the bibliographic sources identified for your Library Research Paper be included along with the summary/outline. This first part is due at class time beginning in October. This first part of your project will be graded.

The final term project is due in early December before the final exam. On both parts of the project, you will be graded according to the following criteria:

- Formulation
- Completeness
- Correctness
- Communication