

Math 3401 (Ng/Spring 2009)
Course Project
 February 13, 2009
Final Report Due Friday May 1, 2009.

The main objective of this project assignment is to provide MATH 3401 students an opportunity to be familiar with real applications of the modeling and analysis approaches that we studied in the course. In particular, how (*LP*) and (*ILP*) models are used and what issues operations research practitioners encounter in the process.

One way to do this is for you to, first, find a journal article about a real application of **deterministic** optimization, or of any one of the specific topics covered in class this semester. Then, you are to report on that article, in addition to finding what other applications known to you that can use this particular model or technique. You are required to write a report **and** give a presentation.

Your article **MUST** be approved by you and the instructor by **February 28** in order to **avoid duplications**. The rules and regulations for choice of articles are given below.

Your Project's Grade: Your project consists of two parts, namely, a written report and an oral presentation in class, each of which is graded on a basis of *50 points* for a total of 100 points.

General theme for project: Your project should include the formulation and analysis of one of the models in the paper (sometimes there are several), or of the problem you are working on. Questions that you address may include, but not limited to the following:

- What was the problem being modeled? Briefly tell the story.
- What type of models or techniques were considered? (*LP*, Network models, etc; Simplex, Network-simplex, etc.)
 - input and output variables, decision variables
 - objective functions or cost matrices, constraints
- What optimization methods were used to analyze the model? If a special analytic procedure was created for the study, briefly explain it.
- What results came (could come) from application of the model and optimization method? For example, was a million dollars saved by implementing the results? If it was not implemented in a real organization, are results provided for a case example, etc?

A few guidelines for Your Written Report: Of the total of *50 points*, 10 points will be for neatness and organization of your written report, with the rest for substance of content especially on the quality of the mathematical level of the project.

Your report **MUST** have the following outline structure with **sections and subsections numbered and appropriately titled**. (Otherwise, you will lose credits for organization.)

- Description of the problem, including some motivation as to why the problem is worth looking at (according to you or others).
- Connections between the project and the contents of the course.
- The approach to solving the problem.
- Results and analysis (of a problem or an example).
- Conclusions.
- Bibliography or references.

Attach a xerox copy of the journal paper reviewed to your report when you submit it, (ff you are doing choice 1). If you wish to retain a copy of your report, make one before you turn it in. All reports will be archived as part of the assessment of student learning at UMM's Math Discipline, and only a "Scoring and Comments" sheet will be returned.

Oral Presentation: You will be responsible for preparing a 20 minutes talk in class about the article in your report or your project. This talk is intended to give you a chance to present some complicated ideas in such a way that your audience (who may or may not be knowledgeable in this area) will at least be able to grasp the big picture of the work you are doing.

Your oral presentation should be prepared with the following attributes and outline in mind:

- Introduction
- Description of Problem/Project
- Substance & quality of mathematical level used, and connections between the project and the contents of the course.
- Organization & Clarity
- Enthusiasm
- Communication

Any presentation tools is acceptable; you will be judged on how effectively you used the tools and not on the type of tools you use.

Finding a Paper: The first task of the assignment is to locate and make a xerox copy of the paper you wish to report on. The instructor highly recommends a journal called *Interfaces* which has more practitioners' articles, and which is a little more readable. *Interfaces'* focus is on applications, and others cover some applications in sections called "O.R. Practice", "Cases", or "Applied Papers", etc. There are other OR related journals such as *Operations Research* and *Mathematics of OR* which also contain many applications.

Acceptable Papers: To be acceptable, the article you choose must meet certain ground rules:

- The article need not have appeared in one of the journals listed above, but it must have appeared in a peer-reviewed journal available in libraries within the University System of Minnesota or elsewhere.
- The article must describe a realistic application setting. It need *not* name a specific organization where the work was applied, but it should be clear the authors are thinking about solving a real problem rather than demonstrating their analysis ideas on a bogus one.
- The article must describe formulation and analysis of a *concise, deterministic optimization model*, i.e. and (*LP*) or an (*ILP*) model or a mixture. The entire model need not be present in the paper, but enough information should be provided for you to see its structure and be able to write it down on a page or two. Stochastic models are **not** acceptable.
- A formal optimization algorithm must have been used to find an optimal (or at least good feasible) solution. Heuristic (not necessarily globally optimal) algorithms are fine, but you should be able to formulate everything considered in the heuristic in a concise mathematical programming model. Heuristics that drop one part of the problem for a while, then return to it and drop another are not good choices.
- **Nonduplication.** *Each student must find and report on a different article.* To control duplication, the article that each student chooses **must be approved** by the instructor. Thus, you should start this assignment **early!**

Stages of Project: In order for me to help you to succeed, to give you periodic feedback, and to help you avoid procrastination, you are advised to make progress in your project by way of several stages in time. (See below.)

The several stages of this project throughout the rest of the semester are listed below; these deadlines are to be followed if you want feedback.

Stage 1 Regardless of what option you choose, go to the library and browse through the journals called *Operations research* and *Interfaces*. The purpose of this is for you to familiarize with what and how the concepts in this course are used in the world beyond academia. (Note that there is more to OR than (*LP*)'s and (*ILP*)'s, but we will concentrate on these two areas which do have a large number of applications.)

Complete Stage 1 by Feb 26th.

Stage 2 Now that you have seen several real-world applications of OR, you should decide on the article you would like to work on.

Inform me of your choice of article by **Feb 28**.

Stage 3 Go through the article with a fine tooth comb; research other related articles if you have to.

Think about the problem that they are trying to solve, their approach, their solutions and analysis, their savings due to their OR model, etc..

Stage 4 If you have a rough draft and you would like me to take a look at it then you should give it to me **BEFORE April 10**; I shall then give you my feedback by the following Monday.

Stage 5 You will have till May 1 to complete your final report, etc..

Your completed report of your course project is **due on Friday May 1, 2009**, no exceptions.

A postscript note: The project must be done in an independent manner, i.e., the instructor will **not** be directly involved in your write-up of your report. (She will only render suggestions, comments and feedback to your multi-stage progress before your final report and also suggestions concerning the oral presentation.)

Cooperation: Please be responsible in your use of the library