Application Project

Suppose you work as an Operations Research Analyst or Consultant. A key decision maker or client at an organization hired you to investigate one of the *challenges* that the company has been struggling with and is affecting its bottom-line (or explore a potential *opportunity* that might boost the company's profits). The client expects you to work on this project as part of a team. Your task begins by understanding the scope and structure of the investigated challenge. First, you must expand your knowledge of current developments in operations research and management science by carefully selecting and briefly reading few articles published in top-refereed journals, such as INTERFACES, and using these articles to guide you in defining an interesting mini-case that emulates the challenge. Second, concentrating your research on an article that contains realistic application of deterministic optimization model pertinent to the challenge will help you adapt the concepts, methodologies, and approaches used in that article to the challenge (or opportunity) at the client's organization. Furthermore, literature reading and review will provide you and your team members with valuable insights about how other analysts used operations research techniques in similar situations, handled ill-defined problems, kinds of engineering judgments they made, and how they validated and tested their models. The **main objectives** of the project are:

1. Explore a real-life challenge where operations research techniques have been used to make better decisions.
2. Apply knowledge gained in the course to a practical application.
3. Experience major steps in formal model building.
4. Demonstrate the ability to tackle challenging problems with ill-defined structure.
5. Use operations research tools to solve the models, interpret results, and perform sensitivity analysis.
6. Present your model, analysis, and conclusions in a professional way.

Teams and Topics

The project will focus on an application of the modeling approaches and solution tools discussed in the course. A list of potential articles will be posted on the course website and will be assigned on a First come-First serve basis. (Be careful not to choose from to the list of Banned Articles.) Please consult the instructor if you prefer to select your own article from the INFORMS journal "INTERFACES" or any other journal.

1. The project and presentation will be done in groups; each consists of **three students**.
2. Use the course website on UW Learn to enroll in your group or ask the TA to enroll you.
3. You should submit a list of the names of the group members and the title of the chosen article to the TA by Friday January 18, 2013.
4. You have to find a group for yourself by January 15 or contact the instructor on January 17 to randomly be assigned to a group.
5. Before selecting a paper, make sure that the paper has not been chosen by any other group and it is suitable for applying a mini-case (part II). A list of selected papers will be updated as requests are received.
6. If two groups choose the same paper, the first one to request it will have the paper and the other group will have to choose another paper.

Deliverables and Deadlines

Part I: Literature Review (weights 5 marks) due on **Friday February 1, 2013**

Submit a *five-page* literature review report of the selected and approved article. A literature review is an analytical and methodological reading of a research article intended to record vital information and knowledge. You should carefully consider what kind of information worth extracting from a study. A good literature review, therefore, should give you a thorough understanding and evaluation of the theoretical concepts, applications, and modeling techniques used in the article. The submitted report should have the name and signature of each group member. It is imperative that you do not use previous term reports. Read the UW Policy 71: "Student Discipline." Here are few things, that your report might cover **but you are free to include different information based on your understanding and paper**:

1. The central purpose or focus of the study (what is the problem being addressed?)
2. What optimization technique is used in the article?
3. How the author(s) mathematically modeled the situation? Use a *graphical representation* to illustrate the model or the problem or both.
4. Discuss the strengths and/or limitations of the proposed mathematical model. Does it capture the complexity of the situation? Are the assumptions justified? Discuss any possible extensions or modifications.
5. Did the author(s) use the proper operations research procedure to perform the analyses? Can you suggest any other approach that could have possibly been used?
6. Review key results that relate to the study, their implications and savings. (This is often reported toward the end of the article.)
7. What are the main conclusions in the article?
8. Why are the conclusions important for the specific application of the study and for similar applications?
9. What evidence supports those conclusions? If any.
10. What is the quality of the evidence? If any.
11. What is the quality of the article, and how did the article help you in developing or enhancing you understanding of the concepts presented.

Do not formulate your report in the form of Questions and Answers. The report should be formal, concise, easy to read, and informative. See **Evaluation Criteria** below.

Part II: Mini-Case (weights 7.0 marks) due on **Friday March 22, 2013**

Design a mini-case or example as a replica of the problem in your literature review report, and apply the optimization technique discussed to the problem (or opportunity) at the organization. Your detailed technical investigation of the mini-case must:

- define scope and boundaries for the problem/opportunity,
- generate the necessary information and hypothetical data,
- identify different alternatives, if any, for addressing the problem/opportunity,
- write the mathematical model and solve it using a suitable software,
- perform an appropriate quantitative sensitivity analysis, and
- provide viable and feasible recommendations with all the necessary costs/benefits associated with implementing these recommendations.

This challenging part of the assignment should neither be trivial nor complicated. Use your judgment to come up with a mini-case that is representative enough of the article or parts of it and be easy to understand, solve, and discuss. **Proper choice of the mini-case has a big impact on your grade**. The final report should include a clear statement of the problem and the mathematical model. The problem statement should give complete details and it should indicate the objectives, variables and constraints, and the operations research technique you have adopted to address the problem. As a suggestion, your report may have some or all of the following:

- Formulation as a decision model or a deterministic optimization problem, clearly identifying and justifying the choices of decision variables, objective function and functional constraints. Your model should be of a moderate-size. Use an index system to reduce the number of notations in describing the variables. Do not try to come up with a new solution method, nor try to solve the full original model in original article. The focus is on the modeling side as well as analysis of the solution.
- Verification of LP requirements, including details and justifications of any assumptions or approximations made.
- Solution of the abstracted LP problem, indicating what software and methodology you used.
- Interpretation, clearly indicating what this solution means in the original language of the problem.
- Include sensitivity analyses and examine how changes in any of your assumptions might affect the final outcome.
- Cost/benefit analysis of implementing your recommendations.
- The length of the final report including all supporting material should not exceed *10 pages* (not including the cover and reference pages).

- Give references to the sources you use and all formulas should be typed using an **Equation Editor**.

<u>Presentation</u> (weights 3 marks) TBD

In addition to the final report, you must give a presentation to the class that describes your final report. Make sure that the presentation is logical, clear and educational, and not more than 20 slides.

- The length of presentation is 15-20 minutes.
- All group members must be in class during their own group presentation. Any student misses his or her own group presentation will be given a zero mark on that component.
- It is expected that each member to be totally familiar with your own group's project. Every member is expected to participate in the presentation, but there is a possibility that a particular member may be asked to give the whole presentation. So be prepared!
- Students will have the opportunity to grade other groups. Hence at least 2 members of each non-presenting group must attend other groups' presentations. Assessment forms will be provided to each group.

Evaluation Criteria

Your reports will be assessed based on the following criteria:
- Insightfulness (significance, value of information presented).
- Maturity of analysis.
- Logic and structure of argument.
- Conciseness and clarity (your ability to explain technical material well).
- Quality of writing and presentation (use of graphical representations).
- Equal contribution by all team members (**Very important**).

See the evaluation rubrics for more information on how reports will be evaluated.

General instructions about the quality of reports

- Keep the length of your reports reasonable and as indicated (5 pages for Part I and 10 pages for Part II).
- Use at least 10-point Times-Roman font and margins of 2.5 centimeters (1 inch) on all sides.
- Use at least 1 ½ line spacing in your reports.
- In all reports include one title page with the names, ID numbers, and signatures of all group members.
- Write *'impersonally'* and therefore never use *'I'*, *'we'*, or *'my group'*.
- Be clear and concise in the way you write. Short sentences and paragraphs are better than long rambling ones. However, do not make the sentences too short or your piece will look like a series of notes. It is a question of balance.
- Good grammar and punctuation; correct sentence and paragraph construction are all "a must".
- Use appropriate and clearly labeled tables, charts, graphs, etc. (These often convey information more vividly than lengthy text.) However, you must ensure that you make a reference to them; that you explain what they show; and that they are fully integrated into the report.
- Ensure that all sources such as quotes and statistics are properly referenced. Use the Harvard or Chicago Manual of styles for referencing, or a one of your choice. You can use footnotes or endnotes for the references.
- Take care over things such as margins, spacing, page numbering, underlining, highlighting, etc.
- Proofread the final version carefully to eliminate any typographical mistakes. Spell check alone may not be sufficient to clean up the report.