

Assignment. Problem analysis (maximum 10 pages, Font Arial, Size 10)

Describe and analyse a (business) problem of reasonable size (minimum 20 decision variables) using the methodologies discussed in the course module. Any problem is good. It can be a simplified version of a problem you encountered in your business, or it can be a problem you invented or have seen somewhere (in a company, your free time, internet, ...) It doesn't have to be a real one, but it should be realistic, make sense, and interesting. Just be creative! You can use your own experience of the business, or you can just make up a problem yourself using your own imagination and experience. As long as the problem is clear and challenging, and amendable for modelling, it's good!

The individual coursework consists of an assignment with 4 analyses. For each analysis, you should do the following:

- Be concise and to-the-point, and include details about the assumptions and calculations, but also include summary graphs with results.
- Don't forget to draw conclusion for each analysis (calculations and graphs without conclusions are not very useful).
- Indicate the advantages and disadvantages of each analysis from a management perspective.
- Highlight possible improvements.

The use of the Solver tool (in MS Excel) is allowed, but you can use any other software tool if you want.

The written reports will be assessed on the following aspects:

- Quality of the argument (clarity of problem description, clarity of assumptions, motivation of methodology used).
- Demonstrating how calculations have been done (clear presentation of data, easiness to follow calculations, clarity of the model).
- Supporting arguments with data (interpretation of result, showing shortcomings, and drawing clear conclusions).
- Presentation (presenting results in a clear manner to management).

In the next paragraph, you find a summary of what each analysis should contain, but you should use this **only** as a guideline. That means that you can skip some parts, and/or extend others. Beware that the written report must be targeted to a company stakeholder, so it should be (i) crystal clear, (ii) easy and attractive to read, (iii) 100% correct, and (iv) results oriented. As a decision maker, you should come up with not only a sound and correct analysis but also with an ingenious and innovative solution. Focus on the problem and the solution, not only on the model. Try to be original! Remember: you are a data scientist, so originality is in your nature!

Analysis 1. Project description (maximum 1 page)

Give a short problem description (descriptive) and highlight the most important aspects (the nature of the problem, the sector (healthcare, IT, construction, tourism, ...), the client, the company, the challenge, ...). Make this description as attractive as possible, and include graphics whenever desirable.

Analysis 2. Mathematical Programming (maximum 4 pages)

Analyse the problem and build (a) mathematical model(s) (either linear programming (LP), or integer programming (IP))., which must include the following items:

- Define the problem with data, and use assumptions to clearly define the scope of the problem.
- Construct a LP/IP model and clearly show how you have defined the decision variables.
- Solve the LP/IP model (under different assumptions, if necessary).
- Analyse the solution(s) using sensitivity analysis (LP only) and draw conclusions for the management team.

Hint: Make sure that you clearly show that the problem could only be solved using the model, which means that - without this model - people quickly come up with solutions that might be good (or not) but are certainly not optimal. Convince people that the model leads to significant improvements for the company. Improvement the company would otherwise not have found. You are a data scientist, don't forget! Modelling is the art of doing better!

Analysis 3. Meta-heuristic Analysis (maximum 4 pages)

Present a meta-heuristic that can solve the problem and model(s), and explain how you would translate your problem to this meta-heuristic, including the following items:

- Analyse the overall flow off the meta-heuristic and link them to your problem.
- Discuss how diversification and intensification can be achieved.
- Describe how a local search can be implemented on a specific part of this problem.
- Draw conclusions and clarify why you have chosen this meta-heuristic over other approaches.

Hint: You don't have to code a new heuristic (of course not!) but you better explain your building blocks as specific as possible!

Analysis 4. Executive summary (maximum 1 page)

Write a single page executive summary indicating the highlights of the previous analyses, and make sure it contains the details that you want to communicate to your stakeholders.