Optimization Practice

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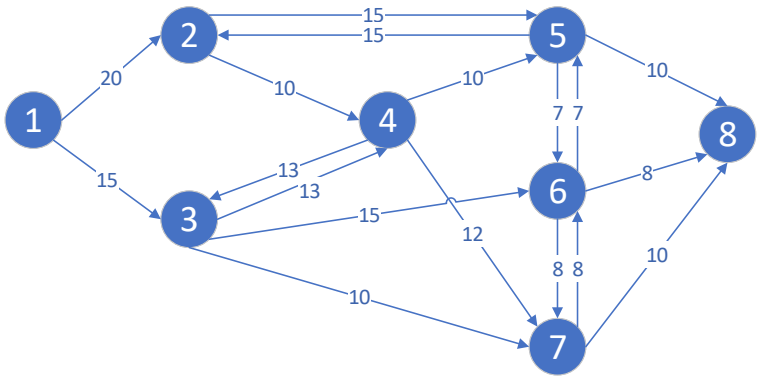
In this assignment, we will get practice with Optimization using Excel, Solver, and R. You should decide which optimizer is best—linear or nonlinear—based on your understanding of the problem. Additionally, you should decide whether integer, binary, or continuous constraints are appropriate.

Setup and Deliverables

You should complete this assignment using Excel, Solver, and R. Your deliverable will be `m6-solverR-lastname.PDF`, a short report written by you answering the questions below. You can use Word, Excel, a Jupyter Notebook, an R Notebook, LaTeX, or any other typesetting tool to write your report, but you must export it to PDF for grading. You may want to take screen shots of other applications as appropriate to incorporate into your write-up.

Problem

Willy Wonka has a chocolate pipeline distribution network as shown below. Each node corresponds to a single storage tank, and the numbers on the edges represent flow capacities (per hour) of some unit of fluid chocolate. Note that flows are allowed in both directions between some, but not all, of the tanks. Willy would like to determine the maximum amount of chocolate that can be sent from tank 1 to tank 8 per hour.



Questions

1. Formulate and solve this problem in an Excel spreadsheet using Solver. In your write-up, you should include a snapshot of your model, as well as a screen shot of your Solver window.

2. As a sensitivity analysis, the company is also considering increasing the capacity of all arcs leading out of tank 1, and all arcs leading into tank 8, and it wants to know whether this will allow it to double the chocolate flow per hour from tank 1 to tank 8. (Assume we multiply the arc capacities in question by a constant k, simultaneously.) Solve the original problem using an appropriate algorithm from the `optrees` or similar package in R, and ensure you achieve the same result as your Solver model. Then, perform the sensitivity analysis as requested. Is there a limit to increasing the expansion factor k? You must include your R code used to answer this question in your write-up.

3. Set up the simplex tableau (complete matrix in augmented form) as a simple matrix in R. Use the `rref()` function from the `pracma` package in R to solve. Include a snapshot of your R code and output, along with an interpretation of your results.

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