Tutorial #6: Decision Aid Methodology
22nd May, 2012

Aeromexico is the flag carrier airline of Mexico based in Mexico City, and it operates flights to several local and international destinations. The set of flights to be flown by one particular type of aircraft in the fleet of Aeromexico, has been obtained after solving the fleet assignment problem. The number of flights in the sub-network flown by this aircraft type is 26. Unfortunately, the airline has been incurring huge losses in revenue owing to large delays in its operations on the sub-network of flights for this particular aircraft. To alleviate the losses, the airline wants to design more robust schedules which are less sensitive to disruptions and can absorb flight delays to a much larger extent. There are 23 potential routes for the sub-network of flights for this aircraft type, and maintenance operations can be performed at the MEX, CUL and GDL airports. Presently, the particular aircraft type flies on routes 1, 5, 11, 12 and 22. For robust scheduling, the expected values of the independent arrival delays and propagated arrival delays for each flight leg have been computed from past historical data of the airline and are provided in the Excel worksheet given to you. The minimum turn time at each of the airports is 30 minutes.

Problem A: The airline wants to minimize the sum of expected propagated delays for the sub-network. Write the mathematical formulation for the problem and solve it using GLPK solver. Is the new routing different from the routing currently in use? If yes, what is the improvement in the sum of expected propagated delays over the present situation?

Problem B: To ensure a more equitable distribution of delays, where certain flights are not heavily penalized with large values of arrival delays, the airline decides to revise its plan and instead minimize the maximum total expected arrival delay over all the flight legs. Make changes in the earlier formulation to achieve this new objective, and solve the new formulation using GPLK solver. Compare the distribution of delays over the operating sub-network in the new solution with that obtained in Problem A, and comment on the results.

Note: Assume that Aeromexico currently has 5 aircrafts of the aircraft type used on the sub-network, and exactly one aircraft is required to operate a single route.

Implementation:

To download the software, visit: http://gnuwin32.sourceforge.net/packages/glpk.htm

Run the mathprog model with the following command

glpsol --model <*model_file_name*> --data <*data_file_name*> --output <*output_file_name*>

For a detailed list of options, refer http://www.maximal-usa.com/solvopt/optglpk.html