

OPTWORKS LOGISTICS DATABASE EXAMPLE

This example demonstrates using OptWorks to optimize a logistics scheduling problem which pulls its data from an Access database. A version of OptWorks must be installed to run the example problem. A demonstration version of OptWorks can be downloaded from www.piblue.com/products/optworks_demo.html. The example is contained in the Excel worksheet OptWorks_Logistics_Database_Example.xls downloaded from the online examples section of the Pi Blue website www.piblue.com/support/examples.html.

NOTE: When opening the example workbook, Excel will attempt to update its imported data from the database OptWorks_Logistics_Database.mdb (included in the download file), if the database is not in the default location (c:\Program Files\OptWorks\Examples) Excel will attempt to find the database automatically, which usually works: click “Ok” on the first dialogue, then “Yes” to connect to the database in its new location.

The workbook file contains data imported from the database on the “Imported Data” worksheet, the example problem on the “Database Example” worksheet, a complete OptWorks setup for this problem using a genetic algorithm on the “OptWorks Example Setup” worksheet, and finally an OptWorks setup using an automated genetic algorithm on the “OptWorks Example Setup – AutoGA” worksheet. Running OptWorks from either of the setup worksheets will automatically load the example into OptWorks. The example involves an OptWorks optimizer connected to a set of functions describing the scheduling of a company’s loading dock deliveries. The inputs to the functions are which trucks should arrive at each dock each hour. The resulting output is the number of required deliveries per day, with several constraints on truck types and delivery times. The example worksheet contains a more detailed description of the problem.

The database connection used in this example was set up to import an entire Access table into Excel, updating the data each time the workbook is opened. In general, to create a new set of linked data in a spreadsheet, use the external data import wizard from Excel’s menu bar: Data->Import External Data->Import Data... Then link to an Access database and a table in that database. Excel will import the entire table, and then its contents can be used in an optimization problem with OptWorks.

The single objective function for this problem is maximizing the number of unique required deliveries each day, with a maximum of 8 deliveries, one for each truck type. The design variables are truck types, set to discrete values of either 0 for no truck or 1 through 8

for different truck types, to arrive at each delivery time slot. The data from the database table is used to determine if there is a conflict with the contents of the two trucks at a loading dock at any one time: there should never be either two “heavy” trucks or two “labor intensive” trucks. The number of conflicts plus some additional time restrictions constitute the constraints on the problem. While this example problem could be solved by hand, the same setup could easily be expanded to draw from a database of hundreds of trucks, span several weeks worth of deliveries, and have thousands of potential conflicts. Such a complex problem would require the use of an optimizer such as a genetic algorithm to sort out the discrete choices at discrete times and locations. For more help setting up a genetic algorithm’s options, see the genetic algorithm examples section of the OptWorks manual or help file. An automated genetic algorithm setup sheet is also provided to highlight the differences between the two algorithms: the automated genetic algorithm is much easier to set up, but takes longer to run as its choices for genetic operators are more conservative. The genetic algorithm’s random seed is specified as 0 to provide consistent results for the purposes of this example, but note that the random seed option should not be used for most problems.

The results of this problem give one of many solutions which provide the maximum of 8 different deliveries each day while avoiding any conflicts with the types of trucks at the dock at one time. Try modifying the data in the database (such as which truck loads are heavy), then reopening the example workbook (to refresh the imported data) and re-running the optimizer to see how the data in the database affects the results.