Concept Map as Collaborative Workspace

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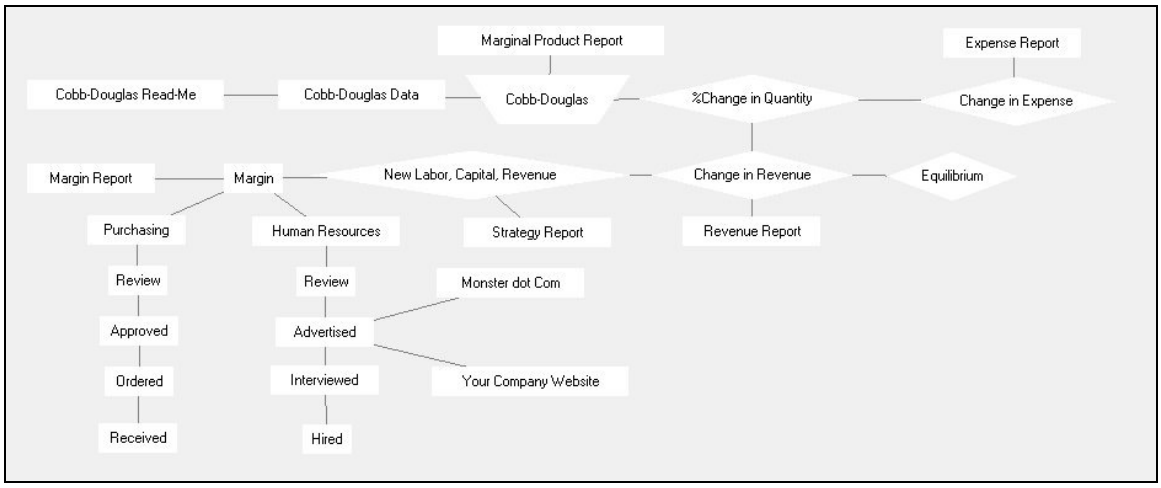
The following "Concept Map" is designed as a collaborative workspace for the hiring process of HAL Corp. We do not claim this workspace to be precise or complete. The Concept-Map is shown here as an example to demonstrate its functionality.

The collaborative team at HAL Corp. has the following task:

- Save the data for the last eleven years showing quantity produced (Q), size of labor force (L), and the amount of capital (K) on a yearly basis.
- Determine the coefficients in the Cobb-Douglas formula that connects Q-L-K.
- Determine change in Q when L or K or both is/are increased.
- Determine change in expense (E) due to change in Q.
- Determine equilibrium price (P_e) and quantity produced (Q_e).
- Determine change in revenue (R) due to change in Q.
- Compare changes in E and R to make a hiring decision.
- Save all data, underlying information, reports, applications, and reviews.

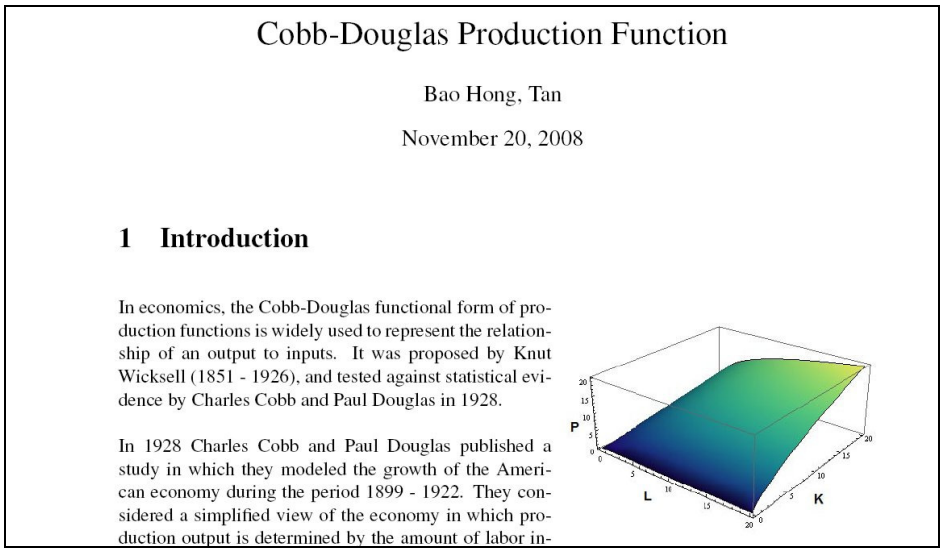


In the Concept Map:

- All the executables, e.g., spreadsheets, FORTRAN, or MATLAB, are stored in the trapezoidal nodes.
- The Concept Map software's own logic and solver engines are stored in the diamond-shaped nodes.
- All data, information, reports, etc., are stored in the rectangular nodes.

<u>Cobb-Douglas</u>

HAL Corp. has data for labor (L), capital (K), and quantity produced (Q) for the last eleven years. HAL wants to do an analysis based on the Cobb-Douglas function before making any hiring or investment decision. The theory behind Cobb-Douglas is stored as a pdf file in the "Cobb-Douglas Read-Me" node of the Concept-Map.



Cobb-Douglas Production Function

Bao Hong, Tan

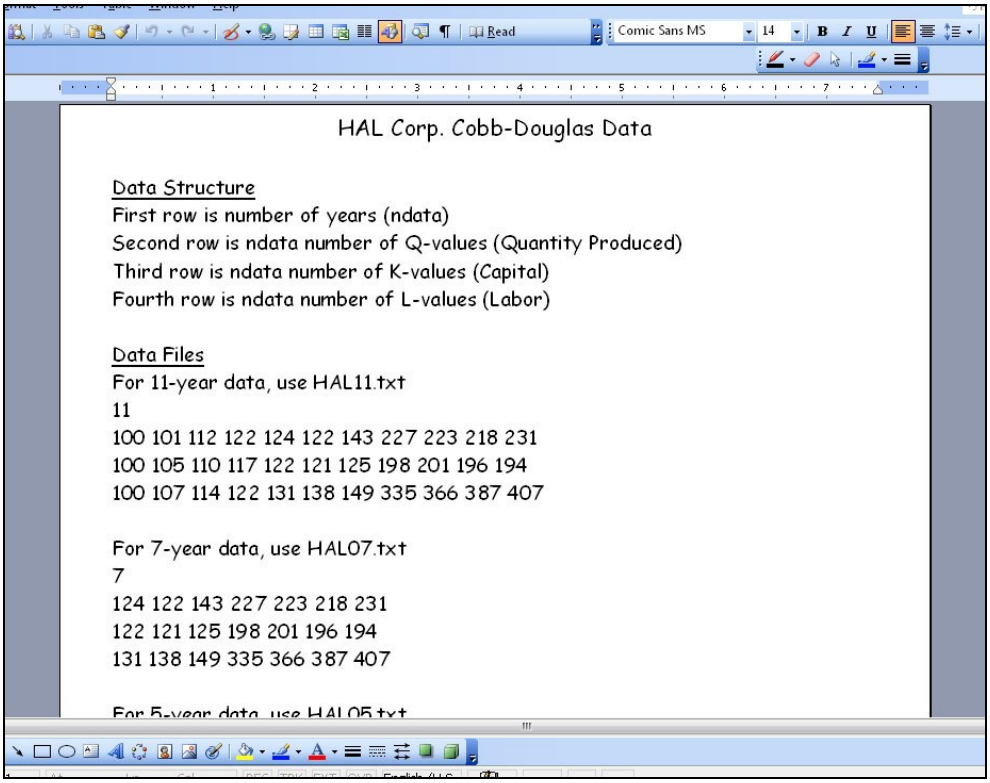
November 20, 2008

1 Introduction

In economics, the Cobb-Douglas functional form of production functions is widely used to represent the relationship of an output to inputs. It was proposed by Knut Wicksell (1851 - 1926), and tested against statistical evidence by Charles Cobb and Paul Douglas in 1928.

In 1928 Charles Cobb and Paul Douglas published a study in which they modeled the growth of the American economy during the period 1899 - 1922. They considered a simplified view of the economy in which production output is determined by the amount of labor in-

The Q-K-L data are saved as a MS-Word file in the node “Cobb-Douglas Data” of the Concept-Map.



HAL Corp. Cobb-Douglas Data

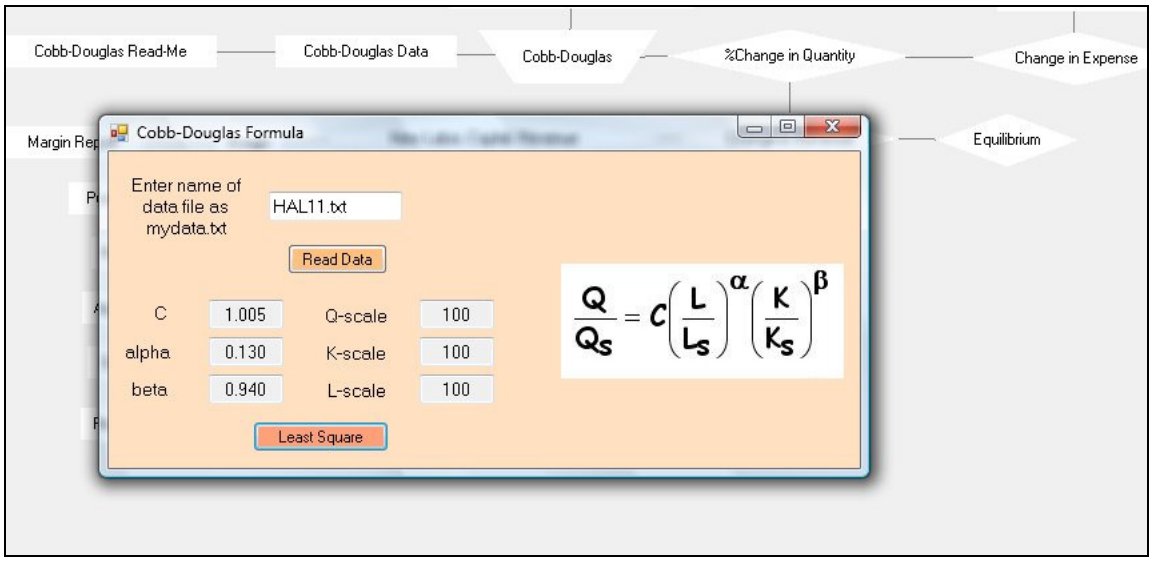
Data Structure
First row is number of years (ndata)
Second row is ndata number of Q-values (Quantity Produced)
Third row is ndata number of K-values (Capital)
Fourth row is ndata number of L-values (Labor)

Data Files
For 11-year data, use HAL11.txt
11
100 101 112 122 124 122 143 227 223 218 231
100 105 110 117 122 121 125 198 201 196 194
100 107 114 122 131 138 149 335 366 387 407

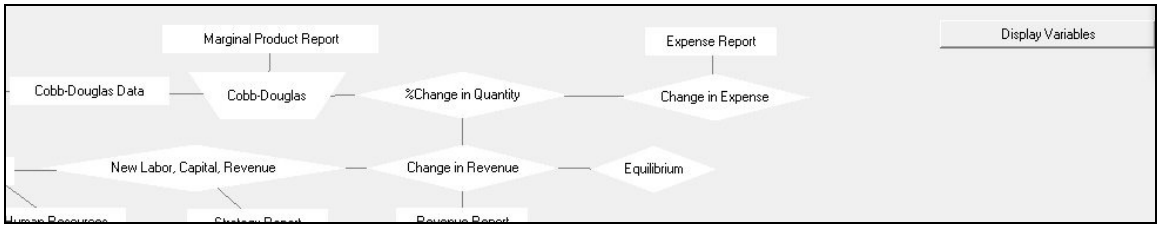
For 7-year data, use HAL07.txt
7
124 122 143 227 223 218 231
122 121 125 198 201 196 194
131 138 149 335 366 387 407

For 5-year data, use HAL05.txt

The Q-K-L data is entered into a VB.NET application to determine the Cobb-Douglas coefficients. This application is saved in the node “Cobb-Douglas” of the Concept-Map. Right-clicking the node starts the application. The application determines the coefficients by least-squared regression.



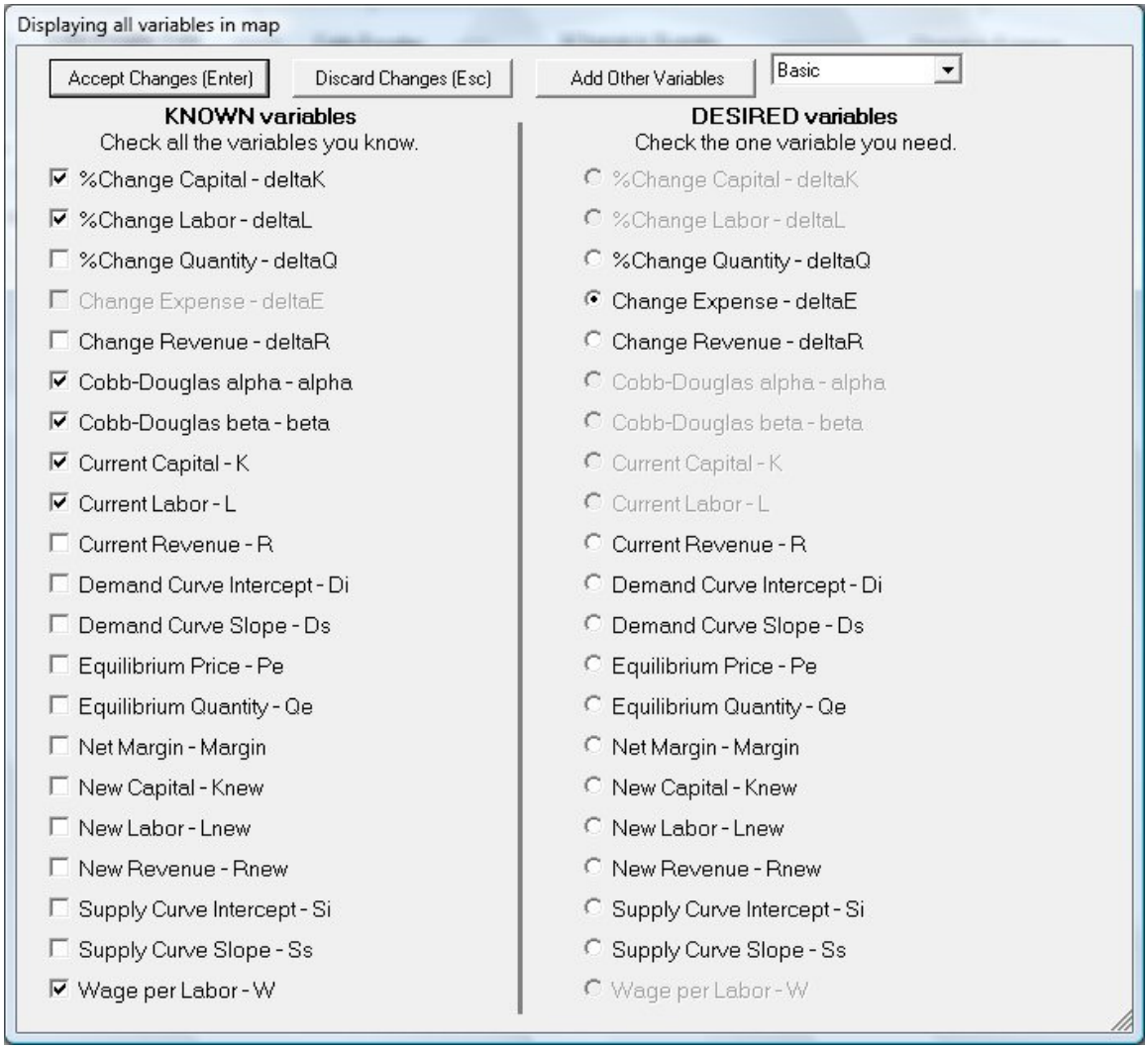
Any VB.NET GUI can be inserted in a node of the Concept-Map. FORTRAN programs are converted into a dll and MATLAB programs are converted into a standalone executable by using the MATLAB compiler. These are then executed through a VB.NET GUI embedded in a node of the Concept-Map.



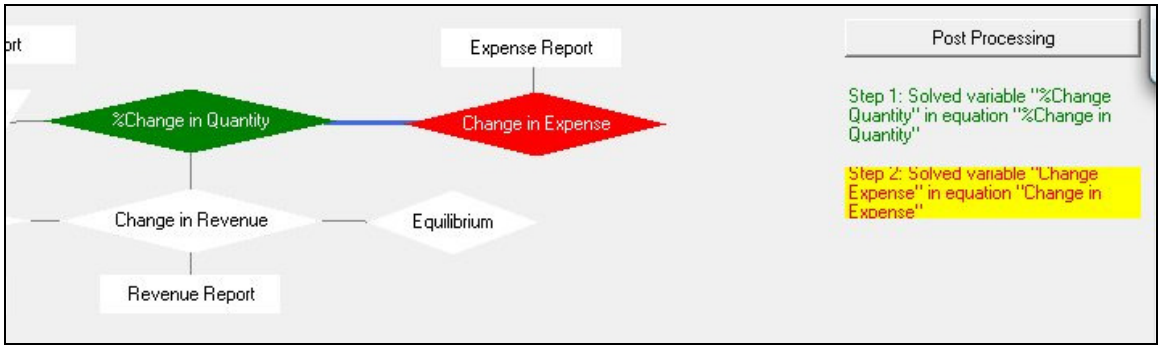
Concept-Map software's own solver-engine is started by clicking the "Display Variables" button. This solver-engine is embedded in the nodes "%Change in Quantity", "Change in Expense", "New Labor, Capital, Revenue", "Change in Revenue", and "Equilibrium."

The user interacts with the solver-engine through a list of variables. The user checks the known variables (deltaK, deltaL, alpha, beta) in the left-hand column, and checks the desired variable (deltaQ) in the right-hand column. The user then starts the Concept-Map solver by clicking the "Accept Changes" button.

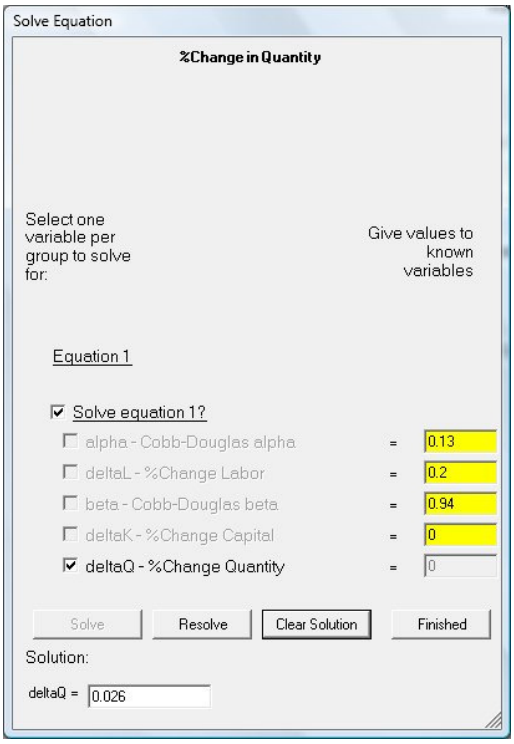
For the HAL Corp. problem, deltaK, deltaL, alpha, beta, K, L, and W are known and deltaE is unknown (desired).

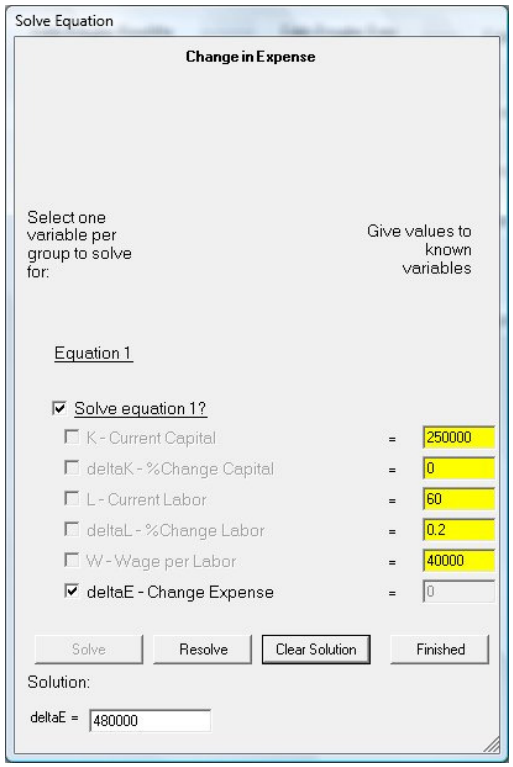


The solver determines and highlights the node relevant for the solution and displays the steps for the solution.



By double-clicking the “solution step” (on the right-hand-side of the workspace), the user starts the solver that can solve non-linear simultaneous equations.

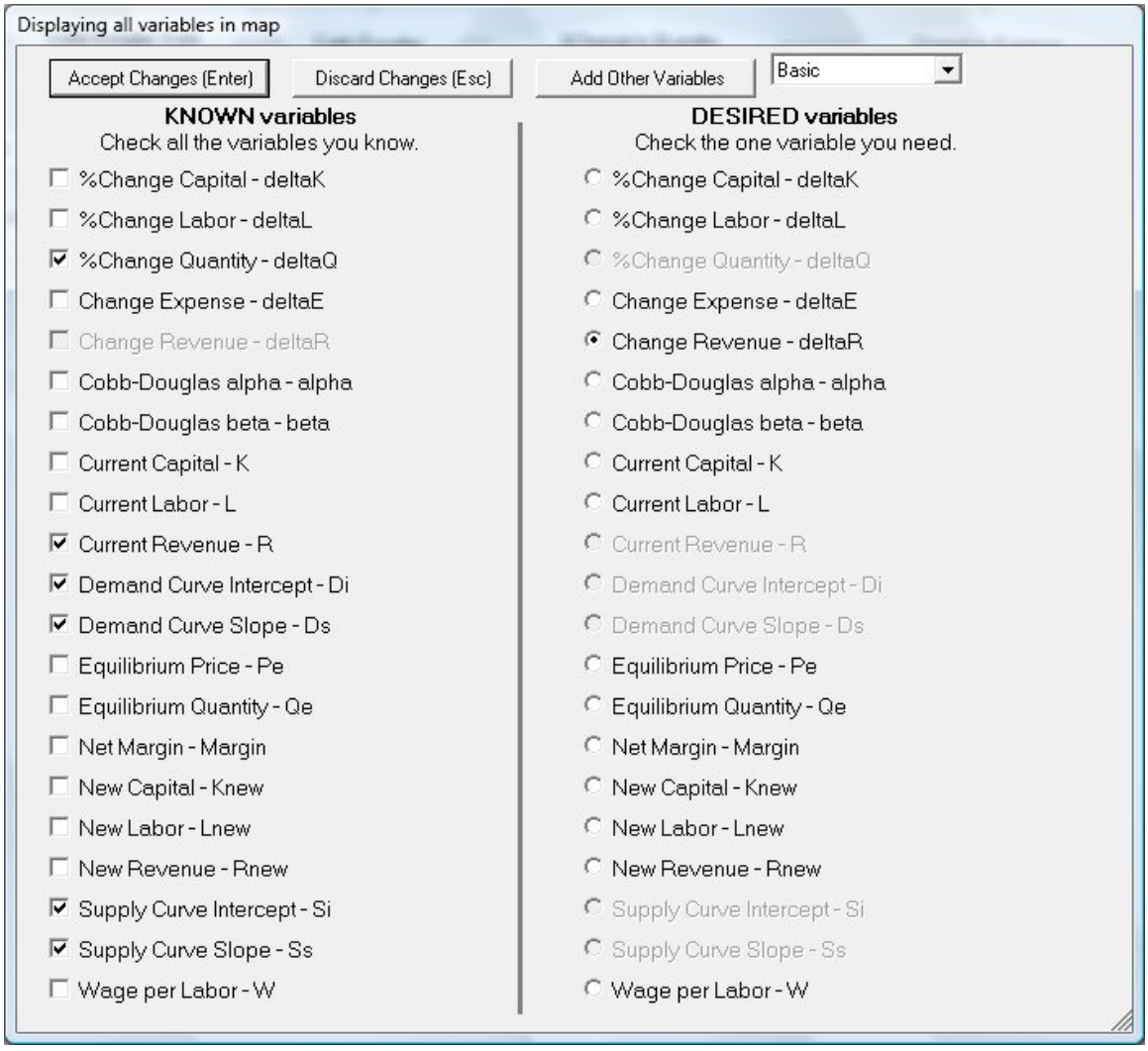




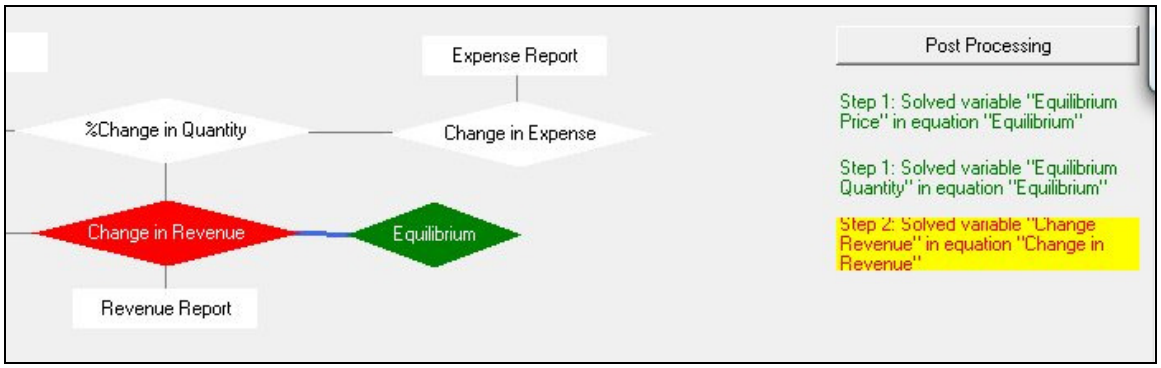
For alpha = 0.13, beta = 0.94, deltaL = 20%, deltaK = 0%, L = 60 persons, and wage per person = $40,000, the solver finds deltaQ = 2.6% and deltaE = change in expense = $480,000.

Supply-Demand and Change in Revenue

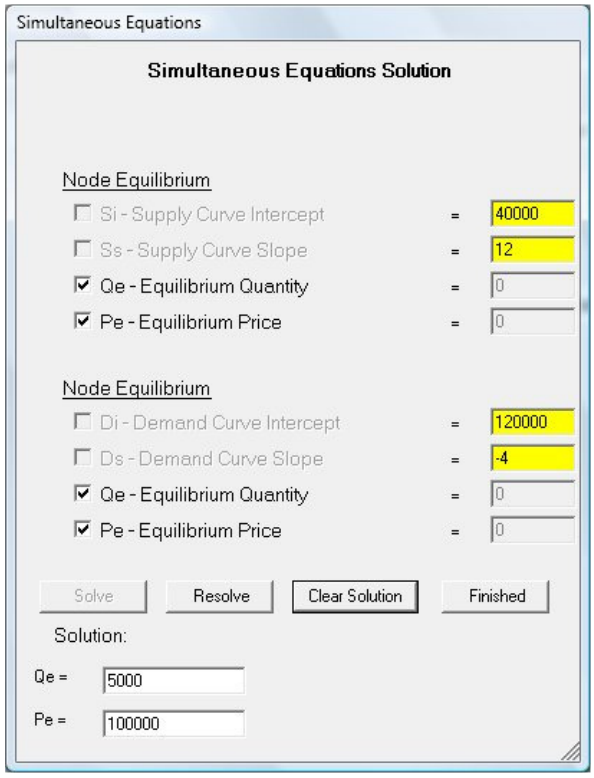
The Concept-Map software's internal logic and solver engine is started by clicking the "Display Variables" button.



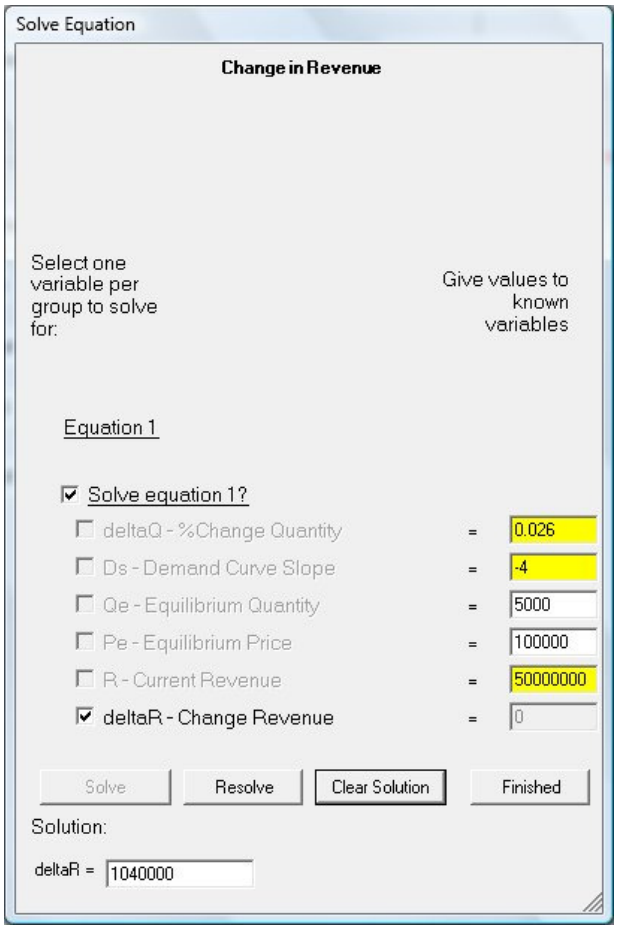
Known variables are deltaQ, R, Di, Ds, Si, Ss. The desired variable is change in revenue deltaR. The logic-engine in the Concept Map software determines the solution path and the solution steps.



In Step-1 of the calculations, the equilibrium price of HAL Corp's product is determined.



In Step-2 of the calculations, the change in revenue (deltaR) is calculated.



At the end of this calculation HAL Corp. team determines that a 20% change in personnel results in $480,000 increase in expenses and $1,040,000 change in revenue.

Analysis

HAL Corp. team can examine various scenarios by calculating the change in expense and revenue for various magnitude and combination of change in labor and capital. This analysis is stored in documents embedded in the rectangular nodes labeled as Expense Report, Revenue Report, Strategy Report, and Margin Report. These reports remain visible to the entire team and any changes in these reports become accessible to the entire team as soon as those changes are made.

Human Resources and Purchasing

Human Resources and Purchasing departments have immediate access to these reports in real time.

The Human Resources department keeps the entire team informed by posting its reports in the rectangular nodes labeled as Review, Advertised, Interview, and Hired. The Purchasing department keeps the entire team informed by posting its reports in the rectangular nodes labeled as Review, Approved, Ordered, and Received.