

One-Minute Spotlight

OPTQUEST: CONSTRAINTS AND REQUIREMENTS

OptQuest, the optimization tool available with Oracle's Crystal Ball, enhances simulation models by automatically searching for and finding optimal solutions.

Constraints and requirements are two important features that help OptQuest quickly and efficiently find optimal solutions. Constraints are restrictions on the inputs, or decision variables, and requirements are restrictions on the outputs, or forecast statistics. Not all optimization models require constraints and requirements, but when applied correctly, they can help OptQuest pick better combinations of decision variables and eliminate poor solutions.

WHAT IS A CONSTRAINT?

Constraints restrict the decision variables by defining relationships among them. For example, if the total amount of money invested in two mutual funds must be \$50,000, you can define a constraint like this:

$$\text{mutual fund \#1} + \text{mutual fund \#2} = 50000$$

OptQuest only considers combinations of values for the two mutual funds whose sum is \$50,000. If you need to invest less than the entire \$50,000, you could write a constraint like this:

$$\text{mutual fund \#1} + \text{mutual fund \#2} \leq 50000$$

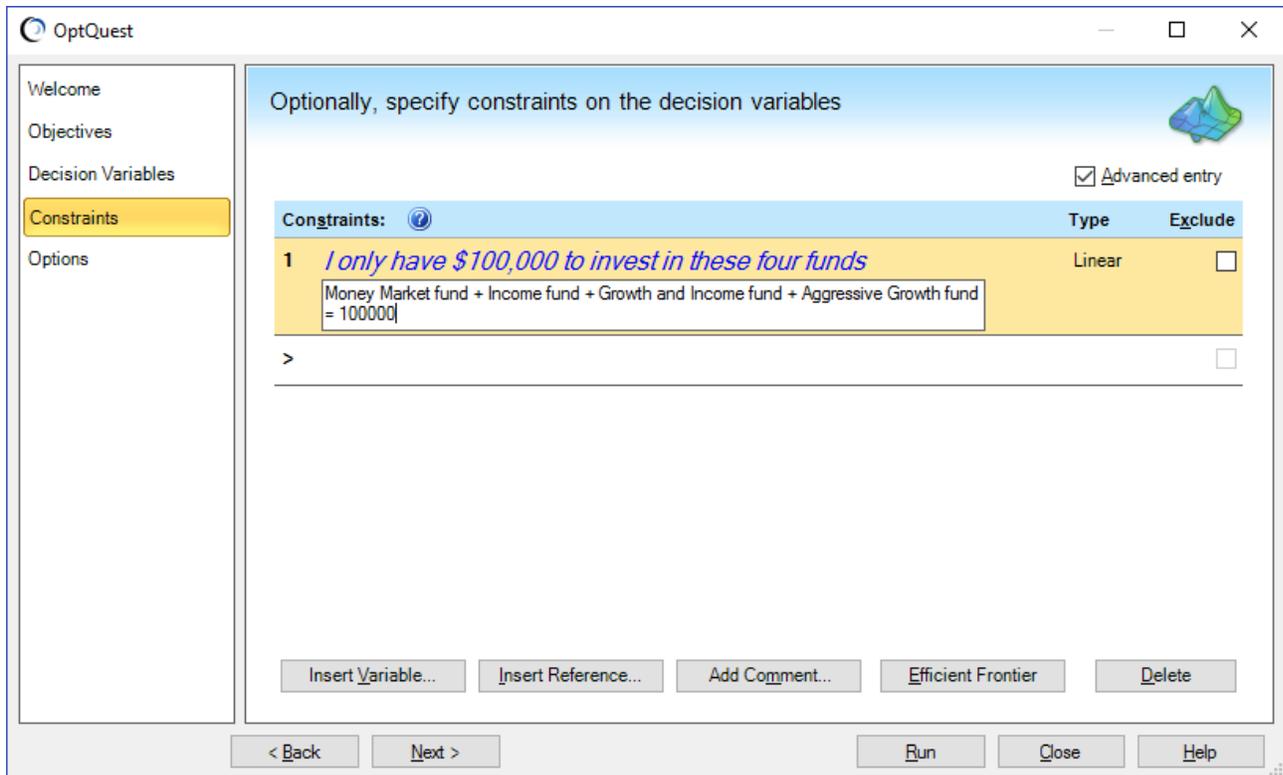
When you are running an optimization, OptQuest checks the combinations of decision variables and rejects all the combinations that do not satisfy the constraint.

DEFINING A CONSTRAINT

You define constraints in the Constraints dialog (shown below), which you can open using the left-side navigation window in OptQuest. To insert a new constraint, select the Insert Variable... Button and select the decision variable from the explorer view dialog. You can also add comments that help you to understand the purpose of each constraint.

The Oracle logo is displayed in white text on a red rectangular background.

Constraints and Requirements, continued



You can define any number of linear and non-linear constraints using mathematical combinations of constants and selected decision variables. You can also use the Insert Reference... button to select an Excel cell that contains a constraint formula. Each constraint must be placed on its own line in the editor.

WHAT IS A REQUIREMENT?

While constraints ensure that OptQuest will only run optimizations using satisfactory combinations of decision variables, you are in no way assured of a desirable, or feasible, solution. For example, if you want to find an optimal investment strategy for a portfolio of assets worth \$100,000, a constraint can make sure that you invest no more than \$100,000. Your optimal solution, however, may contain excessive risk in the form of a wide range of returns (i.e., a large standard deviation).

To restrict the forecast statistics, you can use requirements. Like constraints, the requirements must be satisfied for OptQuest to consider a solution as feasible. A feasible solution is one that satisfies all requirements, whereas an infeasible solution does not.

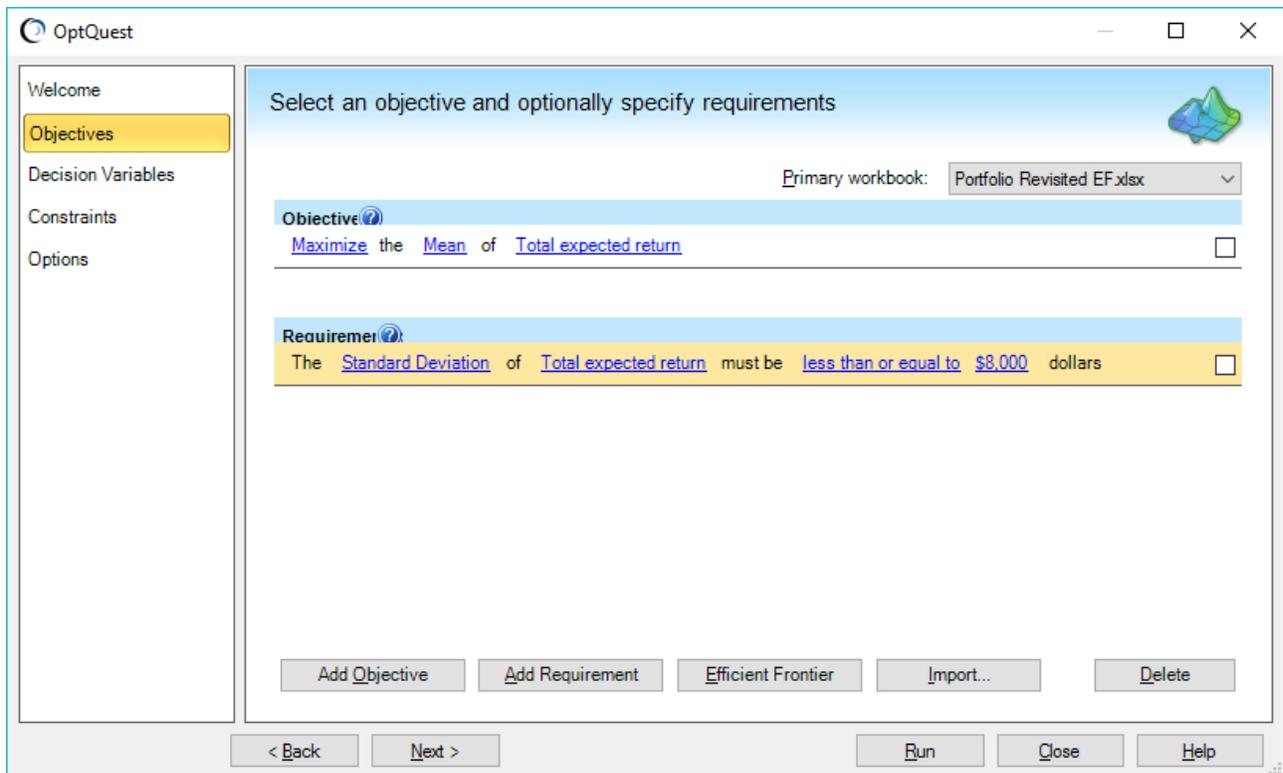
To restrict your investment risk, you could create a requirement that the standard deviation of your Total Expected Return forecast not be greater than \$8000. Now, OptQuest will reject any solution where the calculated risk exceeds your level of tolerance.

With both a constraint and a requirement defined for an optimization, OptQuest first satisfies the constraint feasibility, then focuses on finding a requirement-feasible solution, and finally works on improving this solution, driven by the objective in the model.

Constraints and Requirements, continued

DEFINING A REQUIREMENT

You define a requirement in the Objectives window (shown below), which you can open using the left-side navigation window in OptQuest.



To define a requirement, click on the Add Requirement button. If you only have one forecast, it will select that forecast. Otherwise, you will need to click on the forecast name and select the appropriate forecast for your requirement.

For every requirement, you select a forecast statistic and define the relationship you desire. For example, to ensure that the standard deviation of is \$8000 or less for your portfolio, you would set up the Requirement as shown in the above example. You can define multiple requirements in the same fashion.

CONCLUSION

Both constraints and requirements can help you improve the quality of your optimization solution as well as the efficiency with which OptQuest converges on the optimal solution. The *OptQuest User Manual* is an excellent source for examples of different types of constraints and requirements.

For more information or to contact us, browse to <http://www.oracle.com/technetwork/middleware/crystalball/overview/index.html>