



# Quick Start Guide

## Analytic Solver

The screenshot displays the Frontline Solvers software interface. The main window shows a simulation model with a normal distribution plot. The plot has a mean of 0 and a standard deviation of 1. The x-axis ranges from -4 to 4, and the y-axis ranges from 0 to 0.35. The plot is labeled 'PDF' and 'Reverse CDF'. The 5.00% and 90.00% percentiles are marked on the x-axis.

The histogram shows the relative probability of the simulation results. The x-axis ranges from 20 to 20.5, and the y-axis ranges from 0.00 to 0.15. The histogram is labeled 'Frequency' and 'Relative Probability'. The 5.00% and 90.00% percentiles are marked on the x-axis.

The statistics panel shows the following data:

Statistic	Value
Mean	20.3338829
Standard Deviation	0.192750563
Variance	0.0371528
Skewness	0.000761766
Kurtosis	2.95166
Mode	20.32472354
Minimum	19.70568572
Maximum	20.93979432
Range	1.234108601

The 'Advanced Statistics' panel shows the following data:

Statistic	Value
Mean Abs. Deviation	0.153824093
SemiVariance	0.0185536
SemiDeviation	0.136212

The 'Deploy Model' dialog box is open, showing options for deployment:

- Teams
- Cloud Service
- Power BI
- Tableau
- RASON Model
- Fitted Model
- Excel Model
- Probability Model

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**Patent Pending**

Systems and Methods for Automated Risk Analysis of Machine Learning Models.

# Quick Start Guide

## Version 2025 Q1

Congratulations. With your download of Frontline System's Analytic Solver, you now have access to the most powerful and fastest optimization and simulation tool for Desktop Excel *and* with our latest release of Analytic Solver Cloud, Excel for the Web (formerly Excel Online). With both products you get:

1. The confidence you want from knowing you can solve every type and size of optimization and simulation problem you may face now or in the future.
2. The efficiency you need by being able to use a tool you are already familiar with, Excel, and learning just one integrated and easy to use add-in, Analytic Solver.
3. The results you demand with the ability to run the fastest simulations and use the best solver engines available.

You can rest assured that you are in good company, since Frontline Systems not only built the basic Excel Solver but also offers powerful upgrades that are the leading optimization and simulation tools in Excel, preferred by over 7,000 businesses and universities around the world.

This Quick Start Guide covers key pieces of information to help you get started quickly and successfully with our Solver upgrade products. Everything discussed in this Quick Start Guide applies to our most powerful product, Analytic Solver Comprehensive, but can also be applied to its subset products Analytic Solver Optimization, Analytic Solver Simulation and Analytic Solver Upgrade.

For more information on any of these steps or topics, refer to the User Guide and Reference Guide, available in the Support section of Solver.com, or from within Excel by going to the **Help** menu on the **Analytic Solver** tab and selecting **User Guides**.

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## Table of Contents

What's New in Analytic Solver V2025 Q1 .....	4
What's New in Analytic Solver V2024 Q3 .....	6
What's New in Analytic Solver V2024 Q2 .....	6
What's New in Analytic Solver V2023 Q3 .....	9
What's New in Analytic Solver V2023 Q1 .....	10
What's New: Frontline Solvers V2023 .....	12
What's New: Frontline Solvers V2022 .....	13
What's New: Frontline Solvers V2021.5 .....	14
What's New: Frontline Solvers V2021 .....	15
What's New: Frontline Solvers V2020.5 .....	16
Installing the Software .....	19
Logging in the First Time .....	21
Using Your Existing Models .....	21
Using the Ribbon and Task Pane .....	21
Building Your First Optimization Model .....	28
Building Your First Simulation Model .....	29
Finding the Examples .....	29
Features for Forecasting and Data Science .....	29
Cloud Version and Solver Home Tab .....	32
Solver Engines for Optimization .....	33
Getting Help .....	34
Managing Your Licenses .....	43
Product Selection Wizard .....	45

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## What's New in Analytic Solver V2025 Q1

We've just released **Analytic Solver V2025 Q1**, with new versions of Analytic Solver Desktop and Cloud (for Excel users), Solver SDK (for developers), and our cloud platform RASON. This release features both **usability** improvements and a powerful new way to solve a **wide range of nonlinear** optimization models using the **Gurobi Solver Engine** -- traditionally known for solving linear (and quadratic) mixed-integer models. This new approach yields **globally optimal** solutions **every time** -- not possible with other nonlinear Solvers -- and often **much faster** solutions.

### Usability: New Flexible Dialogs

Analytic Solver has always offered an easy user interface with an Office-style Ribbon, Task Pane, and dialogs that you can move around and resize. But the **content** of many dialogs used fixed-size fonts and graphics. To help with both **accessibility**, and better use of **larger, high-resolution screens** when you're "consuming" this content, in Analytic Solver V2025 Q1 we've revised the Task Pane and scores of other dialogs with "**zoomable**" content. You can now press the CTRL key, then use the mouse wheel to enlarge or shrink the text and graphics in almost any dialog or pane of Analytic Solver. At the bottom of this page is an example, where we've enlarged the text in the top and bottom parts of the Task Pane, but left the middle part (Model Diagnosis) unchanged -- so you can see the difference.

### Performance: New Nonlinear Solver Power

Analytic Solver V2025 Q1 features a *very special* level of support for the just-released (November 19) **Gurobi Solver 12.0**. This popular Solver again improves performance on linear programming (about +4%) and mixed-integer programming (about 13%) models, and even better performance (about +28%) on non-convex mixed-integer quadratic models. But most interesting for our Excel users is Gurobi's improved support for (often non-convex) **mixed-integer nonlinear** optimization problems. Such problems arise in specialty chemicals, hydroelectric power, and some aeronautics and space applications.

Unlike other nonlinear Solvers (such as our LSGRG, LSSQP and KNITRO Solvers), Gurobi takes a different approach, that can yield **globally optimally** solutions **IF** you can formulate your model with (only) certain algebraic expressions -- defined via special Python API calls -- that use just over a [dozen mathematical operators](#) (plus, minus, times, divide, square, square root, exponential and logarithm, etc.). If you're really good at Python coding and really good with algebraic manipulation, you can code this yourself. But in Analytic Solver V2025 Q1, **you don't have to do any extra work** to define your nonlinear model for the Gurobi Solver.

### Standard Excel Formulas, New Solving Speed

You can write your model in Excel, using any of Excel's mathematical operators and any of Excel's 470+ built-in functions. Analytic Solver's **PSI Interpreter** will **analyze** your formulas

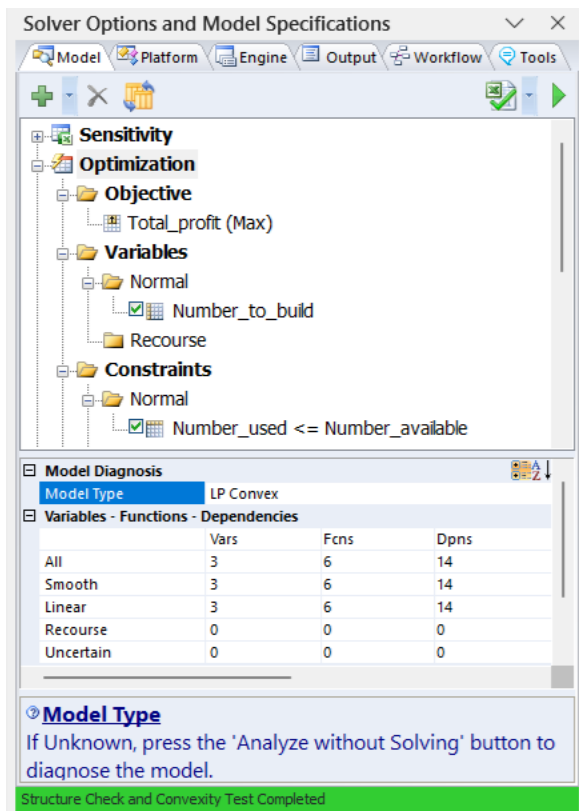
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(including formulas that depend on other formulas, to any level), **diagnose** your model as linear, quadratic, smooth nonlinear or non-smooth, and -- In V2025 Q1 -- tell you if your model is "nonlinear and **solvable via the new Gurobi Solver**". Analytic Solver can generate the internal "expression trees" that the Gurobi Solver requires.

Analytic Solver will even expand various Excel functions, based on their mathematical definitions, into chains of "Gurobi-supported primitive operators". For example, you can just go ahead and use the STDEV Excel function -- Analytic Solver will recognize this as "Gurobi-eligible" and create (internally) an expression tree using square, plus and square root operators, based on the definition of "standard deviation". The bottom line: With Analytic Solver, you can use the Gurobi 12.0 Solver to solve a much **wider range** of nonlinear models, much **more quickly and easily**, than you could any other way.

For "eligible" nonlinear optimization models, the Gurobi 12.0 Solver is often **faster** than other nonlinear Solvers, especially when **integer variables** are also used in the model, and when you require a **globally optimal** solution. This isn't always true however -- occasionally Gurobi is (much) slower -- so it's good that you have alternative nonlinear Solvers available to you, even in the basic Analytic Solver Optimization product. We do hope and expect to see even better performance in future versions of the Gurobi Solver.

Analytic Solver V2025 Q1 is a **free upgrade** for anyone with a paid Analytic Solver Optimization (or higher) license. If you've been a customer for years, you're probably accustomed to such dramatic enhancements -- but we're always working hard to bring you **more value, sooner** than anyone else in our "world" of advanced analytics.



Solver Options and Model Specifications

Model Platform Engine Output Workflow Tools

**Sensitivity**

**Optimization**

- Objective
  - Total\_profit (Max)
- Variables
  - Normal
    - Number\_to\_build
  - Recourse
- Constraints
  - Normal
    - Number\_used <= Number\_available

**Model Diagnosis**

Model Type LP Convex

Variables - Functions - Dependencies

	Vars	Fcns	Dpns
All	3	6	14
Smooth	3	6	14
Linear	3	6	14
Recourse	0	0	0
Uncertain	0	0	0

**Model Type**

If Unknown, press the 'Analyze without Solving' button to diagnose the model.

Structure Check and Convexity Test Completed

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## What's New in Analytic Solver V2024 Q3

In Analytic Solver V2024 Q3, we've gone beyond our conversational "AI Agent", introduced one year earlier in Analytic Solver V2023 Q3: Our new "AI Assistant" doesn't just consult our User Guides and publicly available info – it seeks to "understand" the *model you are working on*, so it can assist you in improving your model, or fixing problems with it!

But we don't just focus on the latest AI methods – we also improve the usability and performance of the optimization and simulation solvers you use every day.

### New AI Assistant

The most visible change in V2024 Q3 is on the Analytic Solver Ribbon, which now sports two "AI icons": On the far right next to the Help icon is AI Ask a Question, similar to the capability we introduced in Analytic Solver V2023 Q3 (but enhanced): Ask it a question, and it will answer conversationally, with links to our example models, User Guides and Reference Guides. On the far left next to the Model icon is a new AI Assist icon: When you click this icon, the AI Assistant will examine and use "as context" your currently-open model in Excel (this also works in our cloud platform RASON): You can then ask a question and engage in a dialog with the Assistant about *your model*. For example, you can ask "is my model missing an essential element?" or "my model is building products from parts in inventory, how can I add another part?"

### Optimization Improvements

In this release, we've included the latest versions of the Gurobi Solver (their 11.0.3), the XPRESS Solver (their 43.1.3.0), and the MOSEK Solver (their 10.2.0.3). For all the Solver Engines, we've expanded "Verbose" logging (enabled via the Task Pane Platform tab General – Log Level option) to include all the solution progress information that each Solver can provide. And in the case of the Gurobi Solver working on a non-integer, non-convex QCP (Quadratically Constrained Problem), Verbose logging now provides "branch level" solution progress info that just wasn't available before.

### Simulation Improvements

In Monte Carlo simulation, we've added new "alternative parameter" distribution functions named PsiFatigueLifeAlt() and PsiFrechetAlt(). The first of these, the "fatigue life" or Birnbaum–Saunders distribution, is extensively used in reliability problems to model failure times. The second, the Frechet or inverse Weibull distribution, is used to model extreme events, for example in weather forecasting and hydroelectric power application.

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## What's New in Analytic Solver V2024 Q2

In **Analytic Solver V2024 Q2**, our overall theme is "Core Performance Improvements" -- indeed we think every user with a model of nontrivial size and complexity should **upgrade** (at no extra cost), since you're likely to see performance improvements -- especially faster "**Setting Up Problem...**".

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## Solving Outside Excel

The most visible change -- though *not* the one impacting the most users -- is on the menu for the **Optimize** button on the Ribbon: the last dropdown choice, **Solve on Solver Server**, has been greatly extended. In past Analytic Solver releases, this choice allowed you to solve your model (actually perform the optimization) **outside** the running Excel program, in a separate program called Solver Server (part of our Solver SDK product), that can run on your PC or on another PC on your local area network (LAN). But the Excel-based Analytic Solver add-in continued to "monitor" the solving process, which meant that you couldn't do *something else* with Excel, while waiting for a "long solve" to complete.

In Analytic Solver V2024 Q2, this choice allows you to solve your model (again, actually perform the optimization) **outside** of Excel, on any of three alternatives: the SDK-based **Solver Server**, our public, Azure-based **RASON server**, or on a new offering: our **Containerized RASON Server** -- which brings all the capabilities of RASON to your own PC, another physical or virtual PC on your LAN, or your own cloud account (we'll say more about this in an upcoming blog post). And unlike in previous releases, V2024 Q2 is able to "monitor" the solving process **without** blocking your use of Excel for *something else*, even working on a different workbook. When the final solution for your long-running model is available, you'll be notified in Excel, and your workbook containing the original model will be automatically updated, without disturbing anything else.

## New Versions of Gurobi and OptQuest Solvers

Analytic Solver V2024 Q2 also includes new (minor) releases of the **Gurobi** Solver and **OptQuest** Solver (again at no extra cost), that improve performance on a range of models using these plug-in Solver Engines. The Gurobi Solver (their version 11.0.2) has typical speed improvements of 8% to 18% compared to pre-V11 versions. The OptQuest Solver (their version 9.1.2.9) includes an improved "diversity search" algorithm, among other enhancements.

## PSI Interpreter Improvements

In Analytic Solver V2024 Q2, we expect the biggest impact on performance for most users will come from some **deep** improvements in the **PSI Interpreter**, our "Polymorphic Spreadsheet Interpreter". This is the part of Analytic Solver (and RASON) that takes your model as expressed in Excel or RASON formulas, analyzes the model, and converts it into a form **usable** by the Solver Engines -- whether it's linear or quadratic (for the LSLP or Gurobi Solvers), nonlinear (for the LSQRG, LSSQP and KNITRO Solvers), or "non-smooth / arbitrary" (for the Evolutionary and OptQuest Solvers). The PSI Interpreter is hard at work when you see "Setting Up Problem..." in the Task Pane, but also **during the solution** of nonlinear and non-smooth models.

In Analytic Solver V2024 Q2, the PSI Interpreter has been re-engineered to use "sparse methods in [automatic differentiation](#)" (take a look at the Wikipedia article we've linked, if you're curious about the methods from algebra and calculus). The practical impact for users with large models is **faster** end-to-end solution times for linear models, less time spent in "**Setting Up Problem**", and big savings in **memory use** (which translates to faster solutions, or solutions for models that exhausted memory in the past).

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All you really need to know is "much better performance", but if you're curious, the rest of this post will seek to explain just some of what the PSI Interpreter does for you.

## More About the PSI Interpreter: The Jacobian

You might be surprised to learn that the Solver Engines, or optimization algorithms, don't work with your Excel formulas at all. They require as input *tables of numbers* (constant or changing) that describe your model, at a rather low level. The PSI Interpreter reads, parses, and interprets your formulas and produces those tables of numbers.

The most fundamental such table is called the **Jacobian matrix** -- see the [Wikipedia article](#) (rather technical) or "[A Gentle Introduction to the Jacobian](#)" which comes from machine learning, where the same matrix arises. In optimization models, this matrix has a row for the objective and each constraint, and a column for each decision variable -- so its size grows with variables *times* constraints. Each matrix element is the **partial derivative** (or *rate of change*) of one constraint (or the objective) with respect to one decision variable.

In linear models, the partial derivatives are all **constant** numbers and are referred to as "LP coefficients" -- but these numbers may not appear explicitly anywhere in your Excel model. They are computed by the PSI Interpreter. In nonlinear and non-smooth models, the partial derivatives are **not constant** -- their values depend on the current values of (potentially many) decision variables. So the PSI Interpreter must **re-compute** them, and re-supply them to the Solver Engine, each time the Solver Engine tests a new set of values for the decision variables -- and this can happen thousands or even millions of times while a model is being solved. So the PSI Interpreter has a lot of work to do.

Let's say your model has 32,000 variables and 32,000 constraints (the upper limits of our *Standard Large-Scale LP/QP Solver* -- the *Extended* version removes the limits). That's not very large by our customers' standards -- but it means the Jacobian matrix has 32,000 x 32,000 = 1,024,000,000 (just over **one billion**) elements. It takes a *lot* of memory, and a *lot* of computing to calculate a billion different values from your Excel model! The saving grace is that in *most* models, *most* of these matrix elements will be **zero**: A typical constraint will depend on a **small subset** of the decision variables, so its rate of change is zero with respect to all the other decision variables. The challenge for the PSI Interpreter is to **figure out which** elements will be zero (the "sparsity pattern"), **without** consuming a lot of memory and time just doing this. In V024 Q2, the PSI Interpreter is far better at this!

## Beyond the Jacobian: The Hessian

When your model goes "beyond linear", even with just a quadratic objective (as in portfolio optimization), the Solver Engines will typically require a further large table of numbers, called the **Hessian matrix** (again see the [Wikipedia article](#) if you're interested). The Hessian has as many rows and as many columns as the number of **decision variables** in your model; it is typically computed for the objective function (at least). Each matrix element is the **second partial derivative** of one function (usually the objective) with respect to **a pair** of decision variables. To compute this, the PSI Interpreter must do even more work, and it must deal with the same issues of memory and computing time, for perhaps a billion values. Again *some* of these elements will be **zero**, since the function value may not depend on *all possible pairs* of variable values -- the challenge is figuring out **which ones!** And again, in V2024 Q2 we've

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made major progress on this. We've seen some large customer models that formerly would always exhaust memory after running for hours, suddenly solve in a minute or less!

## And There's (Much) More...

There's much more to the PSI Interpreter, that we don't have time or space to fully describe here. Whenever Microsoft adds **new built-in functions** or formula features (such as "spilled arrays") to Excel, we've been hard at work supporting those new features in the PSI Interpreter. Whenever you use menu options such as "Analyze Original Model" or "Analyze Transformed Model", notice your **Model Type** (LP for linear, QP for quadratic, etc.) or the counts of model **Dependencies** in the Task Pane, or create a Linearity Report, that's the PSI Interpreter at work. And the PSI Interpreter is also the key to **super-fast Monte Carlo simulation** in Analytic Solver, usually ten times faster (or more) than other Excel add-ins for simulation. The PSI Interpreter also parses and interprets **DMN** (Decision Model and Notation) for business rules and decision tables.

You might be surprised to learn how many of our competitors offering Excel add-ins (especially firms that have been acquired by other companies) have been "resting on their laurels" for a decade or more. At Frontline Solvers, *we never rest!* We spend millions each year on real R&D, to bring you the very best in modeling and analytic software tools.

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## What's New in Analytic Solver V2023 Q3

In Analytic Solver V2023 Q3, we've made it easier than ever to create analytic models, and easier to deploy them for ongoing use, through two major new features: our new conversational "AI Agent", with a button next to "Help" on the Analytic Solver Ribbon, and a new "Identify Inputs" feature that simplifies the task of updating key input parameters when it's time to re-run your model.

### AI Agent: Ask for Help from ChatGPT "Trained on Analytic Solver"

By now, nearly everyone who's been following developments in software is aware of ChatGPT, the conversational agent using "Generative AI" methods, developed by the OpenAI nonprofit closely affiliated with Microsoft. You can ask ChatGPT questions on almost any topic – including analytic methods – and get meaningful and interesting (though not always 100% correct!) answers.

That's great – but what if you could have a ChatGPT "technical support agent" that had studied all 2,300 pages of Frontline's User Guides (including this one), Reference Guides and QuickStart Guides – everything about optimization, Monte Carlo simulation, data science and machine learning, and business rules – and was instructed to use its knowledge to answer your questions? Well, that's what you have in Analytic Solver V2023 Q3!

Actually making this work involves a fair amount of software engineering: Generative AI tools need the right "context" to respond to your question – so we've built an online resource where all those 2,300 pages of Guides are represented via "vector embeddings" that enable searches by meaning, not just "keyword matches". Our AI Agent automatically searches this online resource

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to create “context” for your queries to ChatGPT – and you can also search this online resource directly.

We’re using the “real” online ChatGPT 3.5 Turbo version for its full conversational capabilities, which costs us money for every query – so you will find some limits placed on query length and number of queries per month, depending on your software license type. But we expect you’ll be able to use our AI Agent to amplify your own efforts, ultimately building more capable and effective analytic models. We look forward to your feedback!

## Identify Inputs: Easily Set Up your Model for Data Updates and New Solves

When you’re first building and solving a model in Analytic Solver, usually your focus is on getting a solution for a specific instance of a business problem, with data you have today – gathered from one or several external sources into Excel. After some effort, you’re now getting solutions from optimization, simulation, or data science and machine learning. That’s a success by itself ... but it leads to a desire to “do it again (and again) in the future.”

But ... those data and parameter values that *should be updated* for a future run may be scattered around your Excel spreadsheet, which also includes cells with calculated formulas, cells with constant data that doesn’t need updating, and cells with data that you want to be visible, but that doesn’t actually affect or “participate in” the analytic model. How do you find *just* the parameter values that *should* be updated – and then, how do you *actually update* them?

Now you can choose **Tools – Identify Inputs** and get help doing exactly that. This tool uses our PSI Interpreter to scan your model formulas, identify and list only those cell ranges that are candidates for data updates that will affect the model when solved. You can then pick and choose from a list of cell ranges, which ones you actually need to update for a new run.

Then you can either (i) let Analytic Solver “highlight” those cells with colors and backgrounds, or even better, (ii) automatically add calls to our PsiInput() function that reference those cells. These cells will automatically appear in the Task Pane as part of your model (under the **Input Data** heading) – but when you deploy your model for use *beyond Excel*, via our RASON and Solver SDK tools, you’ll have easy ways to supply new values for exactly those input cells.

If you’ve planned in advance for data updates and re-solves, Tools – Identify Inputs can help you check and validate your work. But if – like most of us – you were focused on getting a first-time solution and ‘put off’ the task of data updates and re-solves, Tools – Identify Inputs can be a huge time-saver!

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## What’s New in Analytic Solver V2023 Q1

We released Analytic Solver V2023 in September 2022, with the innovative enhancements described above – but we surprised even ourselves by how much more we could offer our customers by December 2022! So we’ve christened this new release “Analytic Solver V2023 Q1”.

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## Faster LP/Quadratic Solver and Large-Scale LP/QP Solver Engine

Our “headline feature” for this release is a new, higher performance version of the built-in LP/Quadratic Solver, as well as its “cousin” the Large-Scale LP/QP Solver Engine which has much higher problem size limits. We expect most users will see **faster – sometimes *much* faster** solutions with this new version, both for LP and QP (linear programming and quadratic programming) models, and for LP and QP models with integer constraints.

And there’s more: Now you can solve models with (convex) **quadratic constraints**, with or without a quadratic objective, using this Solver Engine.

(There are always tradeoffs: We’ve found that for about 10% of models we’ve tested, the new version is not faster, and can even be *slower* for models with integer constraints. If you encounter this, just select the **Classic Search** option to get exactly the same performance you were getting before.)

## More Plug-in Solver Engine Improvements

V2023 Q1 also includes new versions of other large-scale Solver Engines. The **Gurobi Solver Engine** is upgraded (to their V10.0) with a range of enhancements, yielding solution times faster by 3-10% to 25% on a wide range of linear and quadratic mixed-integer models. The **Xpress Solver Engine** is upgraded (to their V9.0) with enhancements to strong branching, separation of cutting planes, and a new heuristic method, run at the branch & bound root. The **KNITRO Solver Engine** is upgraded (to their V13.2) with a range of enhancements for smooth nonlinear mixed-integer models, including new presolve, cut selection and heuristic methods.

## Greatly Improved “Deploy Your Model to Teams” Capability

We learned from surveys that a large majority of our customers work in companies using **Microsoft Teams** – so we’ve significantly enhanced a feature introduced in Analytic Solver V2022, that makes it easy to **share** your Excel model results with colleagues in your company, using Teams. The V2022 feature was designed to share your (entire) model, but we realize that many users want or need to share just the **model results** – not the full model with all its optimization and/or simulation model elements.

In V2023 Q1, when you choose **Deploy Model** from the Ribbon and click **Teams – Teams Report**, Analytic Solver will automatically create a new workbook holding only **model results**, with external links to your **model** workbook. You can choose exactly which optimization and/or simulation results you want to include in this workbook. The new workbook will be saved online, and made available to the users you want, through a “Teams channel” that you select. Your colleagues, using **just Teams**, will be able to open the workbook and view, copy or work with the results you’re providing. And perhaps the best part: When you **re-run** your optimization or simulation model with new data, the workbook in Teams will be **automatically updated** (via those external links) with the latest model results! See the chapter “Deploying Your Model” in this Guide for full details.

## Risk Analysis of Machine Learning Models Created in Other Software

Analytic Solver V2023 introduced an innovative (and patent pending) new capability for **automated risk analysis** of **machine learning** models – see “What’s New in Analytic Solver V2023” above for a complete summary, and see our Data Mining User Guide for full details.

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But we realize that many people create and test machine learning models using other software. Those folks just don't have the ability to quantify how their ML models **may perform differently** on data they will encounter in the future ... until now. But **you can help them**, using Analytic Solver V2023 Q1 (or using RASON V2023 Q1, if they prefer to use a cloud platform).

In V2023 Q1, we've made it easy to perform **automated risk analysis** of models **created in other software** and saved in **PMML** (Predictive Modeling Markup Language) format. PMML is an open standard that is widely supported by software for machine learning. Analytic Solver and RASON will also save a trained machine learning model in PMML form. But now you can bring a PMML model into Analytic Solver, plus some of the data you used to train the model (just copy the PMML text and the data onto worksheets) – then use simple menu options to quickly get insights into the future performance of this ML model, from our **automated risk analysis** methods.

There are plenty of other small enhancements and fixes in V2023 Q1 – and we have more new features “in the works”. But you can see why we felt we were ready to deliver another major version to our customers – in time for Christmas!

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## What's New: Frontline Solvers V2023

### Model Management and Run Monitoring

As you or your company make further use of RASON, you'll build up a set of RASON models for optimization, simulation, data mining and business rules, fitted machine learning models, probability models, and even Excel workbook models, that are maintained in the RASON Service and run periodically to compute new optimal solutions, new risk analyses, or make new predictions and new rule-based decisions. Managing these models as valuable intellectual property assets, and monitoring their performance, will become more important over time.

The new **Models tab** in the RASON IDE in V2023 gives you easy access to a great deal of information about each of your models, including properties such as model name, type, version and date last modified, and metrics such as total run time, number of runs, runs ending in an error, etc. The Models tab makes it easy to view your models filtered, sorted and grouped by type, data connection use, and other properties, and run outcomes and metrics such as solve time, over your choice of time intervals – and to export this data for further analysis.

### Automated Risk Analysis of Machine Learning Models

RASON V2023, our latest release, features an innovative (and patent pending) new capability for **automated risk analysis** of **machine learning** models. A further benefit of this feature is a general-purpose, easy to use new tool for **synthetic data generation**, to augment the data you already have. RASON Data Mining and Comprehensive users are able to use these new features with size limits constrained only by memory, but *all* RASON users have access to these features with “Basic size limits” for your datasets.

Until RASON V2023, data science and machine learning (DSML) tools – including ours – had no facility for **risk analysis** of machine learning (ML) models, prior to their production use. Most tools (including ours) had facilities for ‘training’ the model on one set of data, ‘validating’ its performance on another set of data, and ‘testing’ it versus other ML models on a third set of data. But this is not *risk analysis*.

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## Synthetic Dt Generation ‘For Free’

**Synthetic data generation** has come into use in recent years to augment available datasets, when the available data is limited, or is restricted by law or regulation, such as with personal health information (PHI). In RASON V2023, you have a powerful, general-purpose **transformer** named "syntheticDataGenerator". So far, we’re keeping our tools current with the “state of the art”.

But with the new **simulation** option available for every **estimator** you define in RASON V2023, we’ve gone *beyond* the “state of the art”, to bring you a new way to assess your trained ML model’s performance – not to determine how well it **has performed** on data you have, but to quantify how it **may perform differently** on data it will encounter in the future. We generate synthetic data “on the fly” and use it in a Monte Carlo simulation of your ML model’s performance – and we highlight **differences** in model performance in training versus simulated production use.

The beauty of this approach is that **you don’t have to do any work** to obtain a risk analysis of your model’s performance, beyond including the **simulation** option when defining your estimator, and including your choice of new evaluations such as **simulationPrediction** as an action to be performed – the risk analysis is entirely **automated**. You don’t even have to be familiar with the Monte Carlo simulation features of RASON to use this capability for machine learning!

(You *can* specify your own choices for distribution fitting, correlation and copulas, Monte Carlo sample generation, etc. – but the default options work very well.) Typically, the analysis adds only **seconds** to a perhaps a **minute** to the time taken to train and validate your ML model. So you can make this a routine **part of the process** of training and assessing new ML models.

As noted earlier (opposite the title page) in this User Guide, we have a patent application pending titled “Automated Risk Analysis of Machine Learning Models”. But as a RASON (or Solver SDK or Analytic Solver) user, you gain first access to this new capability at no extra cost.

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## What's New: Frontline Solvers V2022

### Faster Interaction, Faster Solves

In Analytic Solver V2022, our latest release, Excel startup is **faster**, and your ‘regular interaction’ with Excel is **faster** when Analytic Solver Desktop is loaded. Dialog rendering is improved for users with very-high-resolution monitors, as well as monitors with limited vertical depth.

Most impactful, the process of interpreting the model – when the model type is diagnosed and when “Setting Up Problem...” appears in the Task Pane status bar – is **faster** for most models, and *significantly faster* for larger models, especially on models with very deep “chains” of formulas that depend on other formulas. We’re also including new, **faster** versions of the Gurobi Solver for linear mixed-integer models, and the Knitro Solver for nonlinear models.

V2022 re-introduces the **Freeze** and **Thaw** options (now located on the Task Pane Tools tab), which allow you to share Analytic Solver models containing PSI function calls with users who don’t have Analytic Solver installed. (“Freeze” will save PSI function call formulas in cell comments, and “Thaw” will restore them later as formulas.)

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Deploy Model functionality in V2022 is enhanced on our RASON cloud server, and **Microsoft Teams** messaging is improved for several account types.

In case you didn't know: Recent Analytic Solver releases, including V2022, allow you to **Test Run** models that *exceed* the limits of your current license. (You don't get full results for all variables and constraints, but you do get the final objective value and solution time.) You can even use optional large-scale Solver Engines, like the Gurobi and Knitro Solvers, in a "Test Run". To make it clear what your current license does and doesn't include, in V2022 you'll see "(Test Run)" next to the names of optional Solver Engines in the Task Pane.

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## What's New: Frontline Solvers V2021.5

### Automate Data Mining with Find Best Model

Analytic Solver, our SDKs and RASON include comprehensive, powerful support for data mining and machine learning. Using these tools, you can "train" or fit your data to a wide range of statistical and machine learning models: Classification and regression trees, neural networks, linear and logistic regression, discriminant analysis, naïve Bayes, k-nearest neighbors and more. But the task of choosing and comparing these models, and selecting parameters for each one was up to you.

With the new Find Best Model options in V2021.5, you can automate this work as well! Find Best Model uses methods similar to those in (expensive high-end) tools like DataRobot and RapidMiner, to automatically choose types of ML models and their parameters, validate and compare them according to criteria that you choose, and deliver the model that best fits your data.

### Better Simulation Models with Metalog Distributions and Fitting

Analytic Solver, our SDKs and RASON support over 60 "classical" probability distributions for Monte Carlo simulation. Since mid-2017, they've also supported the increasingly popular Metalog family of distributions, created by Dr. Tom Keelin, and recently popularized by the nonprofit Probability Management group. Metalog distributions can closely approximate virtually any classical continuous distribution, and often they can better fit user data than classical distributions. In V2021.5 we've brought Metalog distributions to the fore, with a powerful new facility to automatically fit user data to the full range of possible (bounded and unbounded, multi-term) Metalog distributions. It's never been easier to get an accurate probability distribution that fits a real-world phenomenon.

### Share Data Mining and Probability Models via RASON

In recent years, our Azure-hosted RASON Decision Services platform has offered increasingly powerful facilities to deploy models to the cloud and share them with other users – culminating in Frontline Solvers V2020.5, when we enabled deployment, sharing, versioning and management of Excel models as well as native RASON models, plus support for multi-stage decision flows, encompassing and going beyond traditional data science workflows.

In V2021.5 we've gone further: You can now deploy and share data mining and machine learning models, trained in Analytic Solver or RASON, to the Azure cloud, and use them directly for classification and prediction (without needing auxiliary "code" in R or Python, RASON or Excel). You can also deploy and share probability models, following the open Probability

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Management 3.0 standard. Using these Shared Information Probability resources (SIPs, also known as “Stochastic Information Packets”), you can ensure that your group or organization uses consistent data about uncertain/risky variables across simulation or decision models, enabling model results to be meaningfully compared.

## And of Course, Optimization Enhancements

Analytic Solver, our SDKs and RASON have always offered rich support for conventional and stochastic optimization, improved in every new release. V2021.5 is no exception: We’ve made PSI Interpreter enhancements to better utilize main memory in large optimization models (with 1 million or more decision variables) in all three product lines. In our V2021.5 release, we’re also shipping the latest Gurobi Solver 9.1, Xpress Solver 37.1.3, and new KNITRO Solver V12.4 with each of our products.

## Analytic Solver Academy – Replaces Analytic Solver Basic

We’ve found that many purchasers of Analytic Solver Basic, who lacked a previous analytics background and didn’t also purchase learning aids such as our Solver.Academy courses, experience limited success and often don’t renew their licenses. In V2021.5 we are replacing Analytic Solver Basic with Analytic Solver Academy – a bundle of all four current Solver.Academy courses and a license for Analytic Solver with "basic" limits, if no other license has been purchased.

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## What's New: Frontline Solvers V2021

Analytic Solver V2021, our latest release, features faster startup and better support for 4K monitors in Analytic Solver Desktop, improved support for decision trees "on the spreadsheet" in Analytic Solver Cloud, and a new, faster version of the Xpress Solver (V37.1.3) – but the most exciting new features in this release give you new ways to define your own **custom functions**, in a way that works in both Excel Desktop and Excel for the Web, as well as our cloud platform RASON.

## Lambda, Let and Box Functions

In years past, Excel-savvy analysts used VBA (Visual Basic for Applications) to define their own custom functions. While this still works in Excel Desktop using COM (28-year-old Component Object Model), VBA functions are *not* supported in Excel for the Web – and according to Microsoft, VBA and COM will *never* move to the cloud. If you want your custom functions to work in *both* desktop and cloud, your options have been limited – until now:

- Microsoft has introduced new Excel functions LAMBDA and LET. These are very special because you can use them in Excel formulas to define your own custom functions. The Excel community has expressed much excitement over these new functions, since they effectively make Excel a “complete programming language”. (In Q1 2021, these functions are being rolled out across the different Office update channels.)
  - On another front, there’s the open standard known as DMN (Decision Model and Notation) – a business user-friendly “formula language” used to define business rules and decision tables, supported in “decision management” platforms from various vendors,
-

and in Analytic Solver and RASON since 2019. DMN – now in version 1.3 – offers a way to define your own custom functions, known as “Box functions”.

Analytic Solver V2021 includes support for *both* Excel’s LAMBDA and LET functions, and for DMN-compatible Box functions. You’ll find a new chapter in this User Guide, “Using Custom Functions”, that explains how to use both approaches. Even better, LAMBDA and LET, and DMN Box functions enjoy full support from our PSI Interpreter – which means that our full range of Solver Engines, and our high-speed Monte Carlo simulation engine “understand” and take full advantage of custom functions that you define this way. This can yield better results than you’ve ever had with VBA-based functions that are embedded in an optimization or simulation model.

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## What’s New: Frontline Solvers V2020.5

Analytic Solver V2020.5 includes significant enhancements to both Monte Carlo simulation and optimization – but the most exciting new feature ...is a greatly expanded **Create App** facility that makes it easy to **deploy** your Excel analytic model as a **cloud service** (thanks to RASON), usable from nearly any corporate, web or mobile application. What’s more, you can manage, monitor and update your own cloud services, without ever leaving Excel!

### Easily Deploy Your Model as a Cloud Service

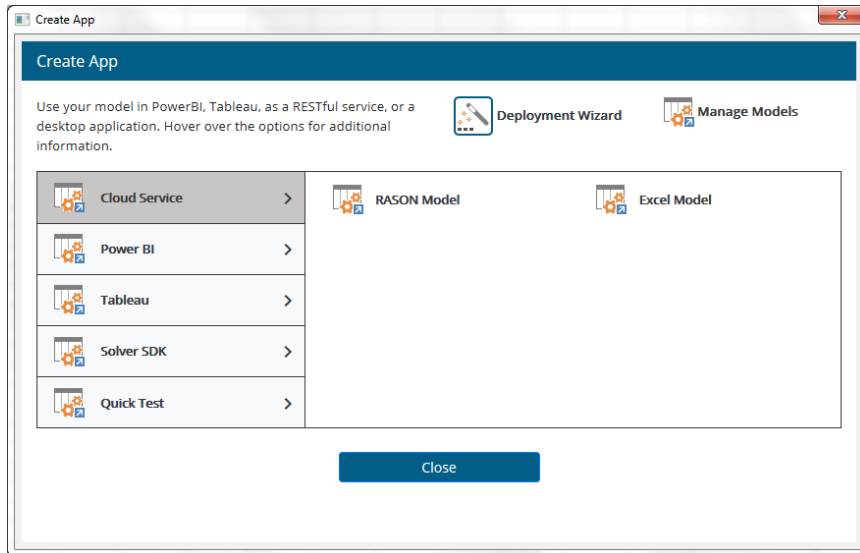
We’ve realized for many years that developing and testing your analytic model in Excel is often just the first step: To gain the **real business value** from the decisions that can be made with your model, it’s often necessary to get the model into the hands of **other people in the business** – in a form where they can easily ensure that it has **up-to-date data**, **re-run** the model’s optimization, simulation, or data mining process, and either **view** the results, or **plug them into** another software application or process.

In our 2017 and 2018 Analytic Solver releases, we took the steps that were possible at that time, enabling users to get their models into the hands of **Power BI** and **Tableau** users. And we built a facility to **translate** simpler Excel models into the RASON modeling language, enabling them to be solved in our cloud platform (RASON is an acronym for RESTful Analytic Solver Object Notation). But up to this point, a typical Excel user would still need help from a web developer, or would need learn JavaScript and other web development skills, to make truly effective use of this facility.

Now in our V2020.5 release of both Analytic Solver and RASON, we’ve gone much further to **simplify** the process of **deploying** an Excel model as a cloud service, and **connecting** it to databases and cloud data sources. The RASON cloud service will now accept and run **Excel workbook** models “on a par” with models written in the RASON modeling language. With the **Create App** menu option, you can turn your Excel model into a cloud service in seconds.

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As an Analytic Solver user, you can now create and test models, deploy them “to the cloud” – **point and click** – as full-fledged RESTful decision services, and even get reports of recent runs of your decision services, all without leaving Excel. Using our web portal at <https://rason.com>, you can go further –even embed your Excel workbook in a multi-stage “decision flow” that can combine SQL, RASON, Excel, and DMN models, passing results from stage to stage.

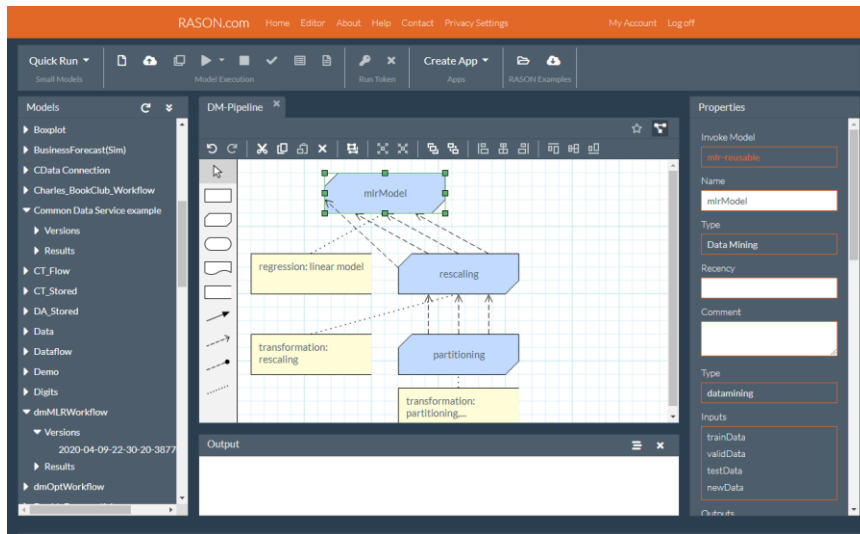
We start you out with a **RASON trial license**, so you can try out these new capabilities without purchasing anything else! (Of course, you may need an upgraded RASON license to deploy your model to many users, and re-solve it hundreds or thousands of times on our cloud servers.)

## More About RASON Decision Services

RASON is an Azure-hosted cloud service that enables your company to easily embed 'intelligent decisions' in a custom application, manual or automated business process, applying the full range of analytics methods – from simple calculations and business rules to data mining and machine learning, simulation and risk analysis, and conventional and risk-based optimization.

RASON Decision Services can be used from nearly **any application**, via a series of simple REST API requests to <https://rason.net>. To express the full range of analytic models, RASON includes a high-level, declarative modeling language, syntactically embedded in JSON (JavaScript Object Notation), the popular structured format almost universally used in web and mobile apps. RASON results appear in JSON, or as more structured OData JSON endpoints.

RASON Decision Services also includes comprehensive data access support for **Excel, SQL Server on Azure, Power BI, Power Apps, Power Automate** (aka Microsoft Flow) and **Dynamics 365**. And it includes powerful model management tools, such as tracking model versions including “champions and challengers”, monitoring model results, and automated scheduling of runs for both models and multi-stage decision flows.



## How You Can Use RASON

You can use RASON to quickly and easily create and solve optimization, simulation/risk analysis, data mining, decision table, and decision flow models – instantly deployed as cloud services. You can learn RASON, create models, supply data and solve them, and even manage model versions and cloud data connections, “point and click” using <https://rason.com>, our “web portal” to the underlying REST API service.

If you’ve used another **modeling language** to build an analytic model, you’ll find the RASON language to be simple but powerful and expressive – and integrating RASON models into a larger application, especially a web or mobile app, is **much easier** than with other modeling languages. Excel users will find that RASON includes virtually the entire **Excel formula language** as a subset. If you’ve used tools based on the DMN (Decision Model and Notation) standard, you’ll find that RASON – and Analytic Solver, as shown in the chapter “Building Decision Tables” – fully support DMN and FEEL Level 2.

Unlike existing “heavyweight” Business Rule Management Systems, with year-long implementation schedules, six-figure budgets and limited analytics power, RASON Decision Services enables you to **get results in just weeks to months**, from building and testing models, to deploying them across an organization. With RASON, you can build successful POCs (Proofs of Concept) without any IT or professional developer support – yet RASON is very “IT and developer friendly” when you’re ready to deploy your POC across your company.

## New Time Series Simulation Functions

Analytic Solver V2020.5 includes another new set of PSI Distribution functions and related PSI property functions, focused around **time series simulation**. Earlier Analytic Solver versions supported time series simulation using functions such as PsiForecast() and PsiPredict(), and models fitted via Analytic Solver Data Mining – but V2020.5 goes further, to support time series functions found in other popular Excel add-ins, such as Palisade’s @RISK. Full details are in the *Frontline Solvers Reference Guide*, but here’s a partial list of new/enhanced functions:

PsiAR1	PsiBMMR	PsiAPARCH11
PsiAR2	PsiGBMJD	PsiTSTransform
PsiMA1	PsiARCH1	PsiTSIntegrate
PsiMA2	PsiGARCH11	PsiTSSeasonality
PsiARMA11	PsiEGARCH11	PsiTSSync

With these functions, virtually any risk analysis model developed with other popular Excel add-ins, such as Palisade’s @RISK, can be easily made to work with Analytic Solver. An appendix in the *Frontline Solvers Reference Guide*, “@Risk to Analytic Solver Psi Function Conversion Table”, explains the details. And with Analytic Solver, you can easily **deploy** your risk analysis model as a **cloud service** – usable from Tableau, Power BI, Power Apps, Power Automate, or virtually any corporate, web or mobile application!

## New Optimization Result Functions

In every version of Analytic Solver (and its predecessors, such as Premium Solver and the Excel Solver), you could obtain all the properties of an optimal solution – such as initial and final values, dual values, and ranges for decision variables and constraints – via the Answer Report and Sensitivity Report, which are inserted into your Excel workbook as new worksheets. But what if you want only *select subsets* of these values – and you’d like to have them on the **same worksheet** as your model? That’s now possible in Analytic Solver V2020.5. Just type these new functions into cells, or use the Function Wizard in Excel.

PsiInitialValue	PsiDualValue	PsiCalcValue
PsiFinalValue	PsiDualLower	PsiOptStatus
PsiSlackValue	PsiDualUpper	PsiModelDesc

These new functions have another purpose in V2020.5, when you use Analytic Solver’s enhanced **Create App** facility to deploy your model as a cloud service: You can use them to determine a select subset of values from the solution that you want to *return from your cloud service* to a calling application.

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## Installing the Software

Analytic Solver V2025 Q1 includes our next-generation offering, Analytic Solver Cloud – usable in the latest versions of Excel for Windows and Macintosh, and in Excel for the Web. Analytic Solver Cloud is divided into **two** add-ins that work closely together (since an Office add-in currently can have only one Ribbon tab): the **Analytic Solver** add-in builds optimization and simulation models, and the **Data Science** add-in (formerly known as the Data Mining add-in) builds data mining or forecasting models.

Both the Analytic Solver and Data Science add-ins support existing models created in previous versions of Analytic Solver. Your license for Analytic Solver allows you to use Analytic Solver Desktop in desktop Excel or Analytic Solver Cloud in either desktop Excel (latest version) *or* Excel for the Web.

To use Analytic Solver Desktop (Windows PCs only), you must have first installed Microsoft Excel 2013, 2016, 2019, or the latest Office 365 version on Windows 10, Windows 8, Windows

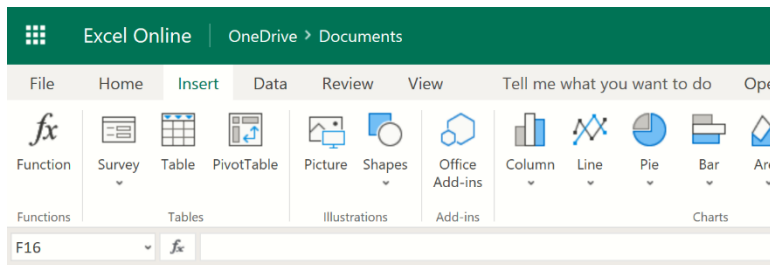
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7, or Windows Server 2019, 2016 or 2012. (Windows Vista or Windows Server 2008 may work but are no longer supported.). It's not essential to have the standard Excel Solver installed.

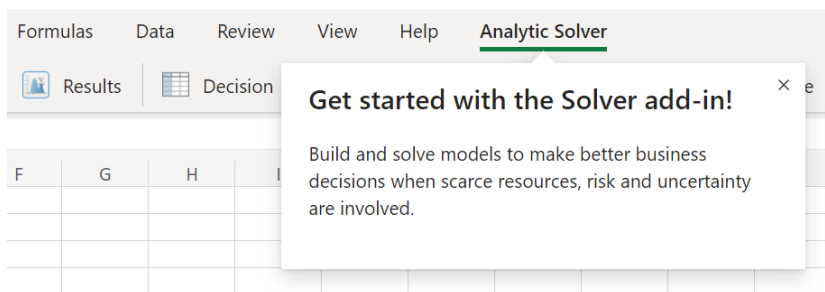
## Installing Analytic Solver Cloud

To use the Analytic Solver and Data Science add-ins, **you must first “insert” them** for use in your copy of desktop Excel or Excel for the Web, while you are logged into your Office 365 account. Once you do this, the Analytic Solver and Data Science tabs will appear on the Ribbon in each new workbook you use.

To insert the add-ins for the first time, open desktop Excel (latest version) or Excel for the Web, click the **Insert** tab on the Ribbon, then click the button **Office Add-ins** or (if you see it) the smaller button **Get Add-ins**.

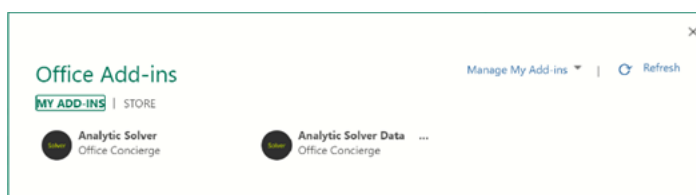


In the dialog box that appears, click the Store tab and type “Analytic Solver” into the Search box. Once you find the Analytic Solver add-in, click Add. After a moment, you should see the Analytic Solver tab appear on the Ribbon, with a note about how to “Get started with the Solver add-in”, as shown below.



*Repeat these steps* to search for, locate and Add the Analytic Solver Data Science add-in. After a moment, you should see the Data Science tab appear on the Ribbon, with a similar “Get started” note.

After you perform these steps (one time) to insert the Analytic Solver and Analytic Solver Data Science add-ins, they will appear under "My Add-ins". If you ever need to remove the add-ins, click the “...” symbol to the right of the add-in name, then click the Remove choice on the dropdown menu that appears.



To install Analytic Solver Desktop to work with any of the supported versions of Microsoft Excel (see above), simply run the program **SolverSetup.exe**, which installs all of the Solver program, Help and example files. SolverSetup.exe checks your system, detects what version of Office you are running (32-bit or 64-bit) and then downloads and runs the appropriate Setup program version.

Note that your copy of the Setup program will usually have a filename such as SolverSetup\_12345.exe; the '12345' is your user account number on Solver.com.

For more information on installing Analytic Solver Desktop, see the Analytic Solver User Guide.

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## Logging in the First Time

The first time you run Analytic Solver (Desktop or Cloud) after installing the software on a new computer, when you next start Excel and visit the Analytic Solver tab on the Ribbon, **you will be prompted to login**. Enter the **email address** and **password** that you used to register on Solver.com. Once you've done this in Analytic Solver Desktop, your identity will be "remembered," so you won't have to login every time you start Excel and go to one of the Analytic Solver tabs. In Analytic Solver Cloud, you may be asked to login more frequently. To login or logout at any time click License – Login/Logout.

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## Using Your Existing Models

All Analytic Solver versions are 100% compatible upgrades to the basic Excel Solver, from Analytic Solver Upgrade to Analytic Solver Comprehensive. This means you can solve your existing models immediately, taking advantage of Analytic Solver's faster speed, additional solving methods, and larger problem size limits, without having to make any changes to your model or existing VBA code. Simply open the workbook containing the model and use the **Solver Parameters** dialog, or just click the **Optimize** button on the Ribbon (see below).

***Online Resource:** You can see an overview video of a model built using the Excel Solver and how to solve it in Analytic Solver as-is. In addition, you can also see how to quickly and easily build the same model from scratch using the Ribbon and Task Pane interface by clicking [here](#).*

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## Using the Ribbon and Task Pane

This section contains an overview of the Ribbon and Task Pane interface, as well as the alternative Solver Parameters dialog (similar to what you've used in the basic Excel Solver).

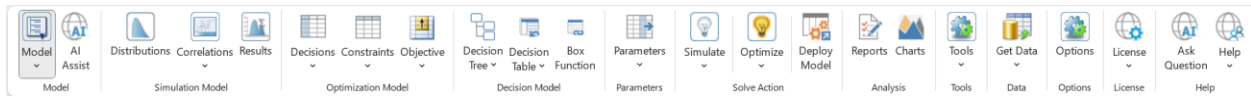
***Online Resource:** You can also see a short overview video of the Ribbon and Task Pane interface on our website by clicking [here](#).*

The Ribbon is your 'gateway' to Analytic Solver's graphical user interface. Most often, you simply click on the arrow at the bottom of a button on the Ribbon to open a dropdown gallery with more buttons, and then you click one of these choices.

The Analytic Solver Ribbon (in both the Desktop and Cloud apps) appears as a tab on the standard Ribbon at the top of the Excel application window, and it stays in this position.

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### Analytic Solver Desktop

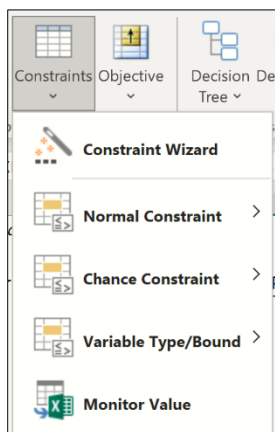


### Analytic Solver Cloud

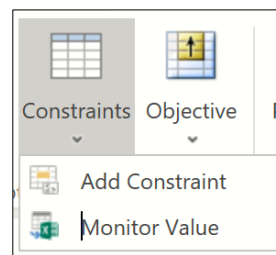


The small downward pointing arrow below each of the buttons indicates that you can open a **dropdown gallery** of options related to that button. For example, clicking the downward arrow for **Constraints** opens a gallery of further options for defining constraints:

#### Analytic Solver Desktop



#### Analytic Solver Cloud



Clicking **Normal Constraint** in Analytic Solver Desktop shows the traditional constraint relations, and clicking the remaining gallery choices will display new options that you haven't had in the basic Excel Solver.

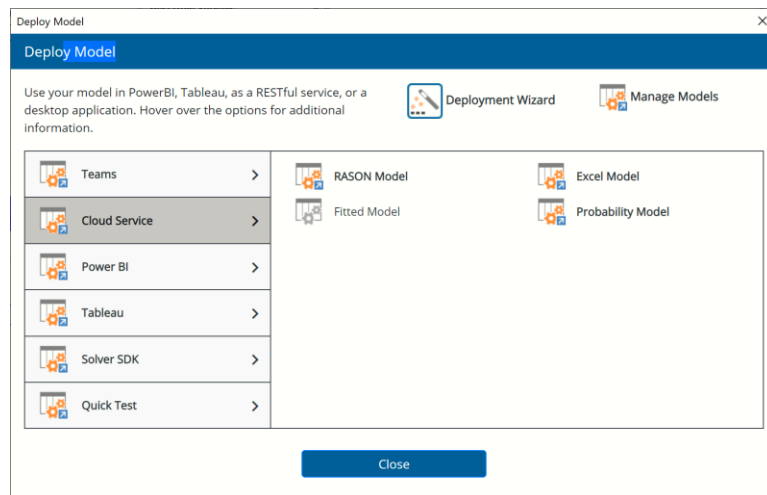
Clicking **Add Constraint** in Analytic Solver Cloud opens the Add Constraint dialog where you can enter a constraint with traditional relations or any new options not featured in the basic Excel Solver.

The buttons on the Ribbon play the following roles:

- Clicking the **Model** button displays the Task Pane (see more on this below). Click the down arrow to add Dimensional Modeling capability to your model.
- The *Simulation Model* group of buttons relate to setting up simulation models:
  - Clicking the **Distribution** button gives you a range of pre-defined probability distributions you may choose to represent uncertainty in your model and access to our new Distribution wizard.
  - Clicking the **Correlations** button brings up a dialog to allow you to easily create, edit or delete correlation matrices or fit a copula. The down-arrow allows you to turn the use of correlations on and off.

- Clicking the **Results** button opens a gallery of options that allow you to designate a cell as an output cell for an uncertain function (to obtain statistics, charts or other simulation results), or insert calls to PSI Statistics functions to compute statistics, risk measures, or range values for uncertain functions.
  - The *Optimization Model* group of buttons relate to setting up optimization models:
    - Clicking the **Decisions** button creates a new “normal” decision variable using the currently selected cell. Clicking the down arrow allows you to designate a cell as a decision variable, and in stochastic optimization, choose normal or recourse decisions.
    - Clicking the **Constraints** button opens the Add Constraint dialog which lets you easily define constraints, including bounds and integer restrictions on decision variables, and chance constraints in stochastic optimization. Clicking the down arrow allows you to do all of the above plus gives you access to our new Constraints wizard.
    - Clicking the **Objective** button opens the Add Objective dialog which allows you to designate a cell as the objective function, and choose whether it should be maximized or minimized. Clicking the down arrow allows you to do all of the above plus “summarize” an objective containing uncertainty if solving a stochastic optimization model.
  - The *Decision Model* group of buttons relate to setting up decision trees or decision table models or models that use custom box functions.
    - Click **Decision Tree** to easily create decision nodes and branches, event nodes and branches, and terminal nodes. The tree is drawn in graphic form on the spreadsheet; standard Excel worksheet formulas compute ‘rollback’ values at each node, and the best-choice value at the root node, based on either expected value or utility function (certainty equivalent) criteria. With a Ribbon choice, you can graphically highlight the optimal path through the tree.
    - Click **Decisions** to add a decision table to the worksheet. Decision tables contain a set of rules which specify actions to perform based on specific conditions. Decision tables are a good tool to use when there is a consistent number of rules, or conditions, to be evaluated followed by a specific set of actions to be performed once a rule, or condition, is met.
    - Click **Box Function** to create and utilize a user-defined function within an Excel model.
  - Clicking the **Parameters** button allows you to designate a cell as a parameter to be varied across multiple optimization or simulation runs or designate a cell range as input data for runtime use. You can even find *candidate* cells for parameters *automatically*, displaying a tornado chart that shows which cells have the greatest impact on your model results.
  - The *Solve Action* group of buttons relate to *solving* your optimization or simulation model:
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- Clicking the **Simulate** button turns on *Interactive Simulation*, and lights up the bulb; clicking it again turns off *Interactive Simulation* and the bulb. The down-arrow allows you to run a single simulation at a time.
- Clicking the **Optimize** button runs an optimization, while clicking the down-arrow gives you a list of choices for how to solve the model. You can use the Analyze Without Solving option to find out what type of model (linear, nonlinear, etc.) you've defined, and what Solver Engine can be used to solve it.
- Clicking the **Deploy Model** button opens a new dialog with a list of choices that automatically convert your existing optimization, simulation or simulation optimization model into a model written in the RASON Modeling Language. The RASON Model can be solved in Rason Cloud Services, Power BI, Tableau, with the Solver SDK, from within a customized Web application or shared via Microsoft Teams. This feature reduces months of development work to a single button click!



See the chapter, *Deploying Your Model*, within the *Analytic Solver User Guide* for more information on this exciting new feature!

- The *Analysis* group of buttons relate to analyzing your results:
  - Clicking the **Reports** button gives you access to a full range of reports for optimization, simulation, sensitivity analysis, and discriminant analysis.
  - Clicking the **Charts** button lets you create and manipulate charts related to your optimization, simulation, or sensitivity analysis results – including charts that cover multiple optimization or simulation runs, with varying parameters.
- The *Tools* button on the Ribbon or the Tools tab on the Task Pane in Analytic Solver Cloud are covered more fully in the User Guide: They allow you to create probability distributions that fit historical data, see the results of specific simulations or optimizations, manage results, and identify constant input parameters.
- Compute summary measures (sum, average, standard deviation, minimum or maximum) for variables in a dataset with up to billions of rows, stored across many hard disks in an external compute cluster running Apache Spark (<https://spark.apache.org/>), by clicking the



**Get Data** icon. This kind of summary data is often what you need as input parameters to an optimization or simulation model. See the Analytic Solver Data Science User Guide for more help on this new feature.

- Clicking the **Options** button displays a dialog of options for controlling the optimization and simulation processes, as well as for formatting charts and graphs.
- If optimization, simulation or stochastic programming are new for you, don't worry – you can learn a lot about them by consulting our **AI Agent**, Frontline's artificial intelligence technical support assistant. AI Agent is designed to provide assistance and support for users of Frontline Solvers' Analytic Solver and Analytic Solver Data Science software. The AI Agent is knowledgeable about the functionality and features of the software, as well as the concepts and processes involved in optimization, simulation and data science/forecasting. Just enter a topic or question such as “What is stochastic optimization?” and click Submit Query to get started.
- Use the **License** button to manage your account and licenses.
- Use the **Help** button to open example models, open the Help Center, where you can find pre-recorded webinars or access our Knowledge Base or explore our User Guides.

Each of these GUI functions is described more in depth in the Reference Guide chapter “Using the Ribbon and the Task Pane.”

Alternatively, if you've used the basic Excel Solver we developed for Microsoft, you'll find the **Add-Ins** tab in Analytic Solver Desktop contains a **Premium Solver** button which displays a **Solver Parameters** dialog very similar to the one you've used before. Changes you make to a model here are reflected in the Task Pane, and vice versa.

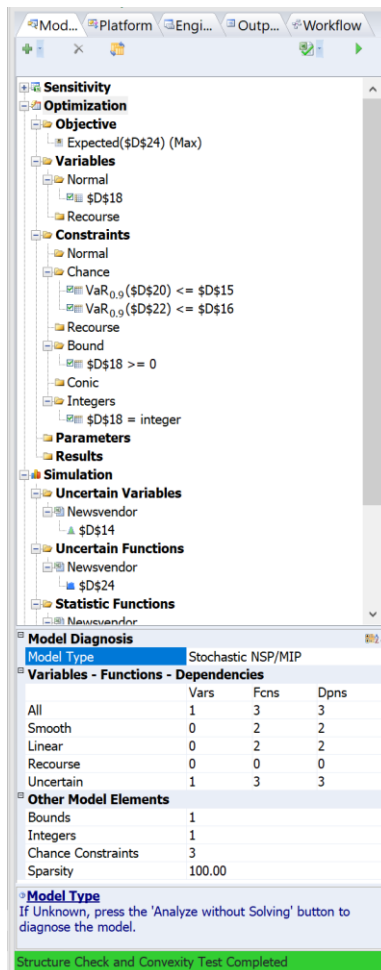
You can easily switch between the Solver Parameters dialog, and the Ribbon and Task Pane as often as you wish, without having to restart Excel or close and re-open any open workbooks.

## The Task Pane

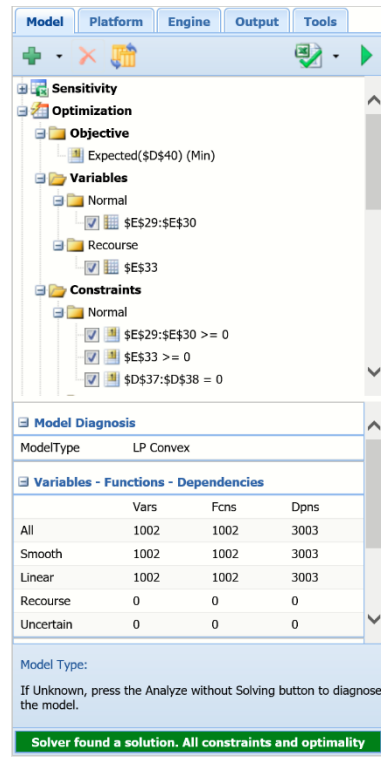
Clicking the **Model** button displays the Task Pane, normally docked at the right edge of the Excel window. On the Task Pane **Model tab**, you'll see an outlined list of all the elements of your model: (i) objective, decision variables, and constraints for optimization models, (ii) uncertain variables, uncertain functions, statistics, and correlations for simulation models, (iii) parameters for both kinds of models and (iv) datasets and results for data mining, text mining, and time series models. As explained below, other tabs on the Task Pane provide quick access to option settings, a log of events that happen during an optimization or simulation, and for long-running optimization models, a continually updated status report plus a dynamic chart of the objective.

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## Analytic Solver Desktop



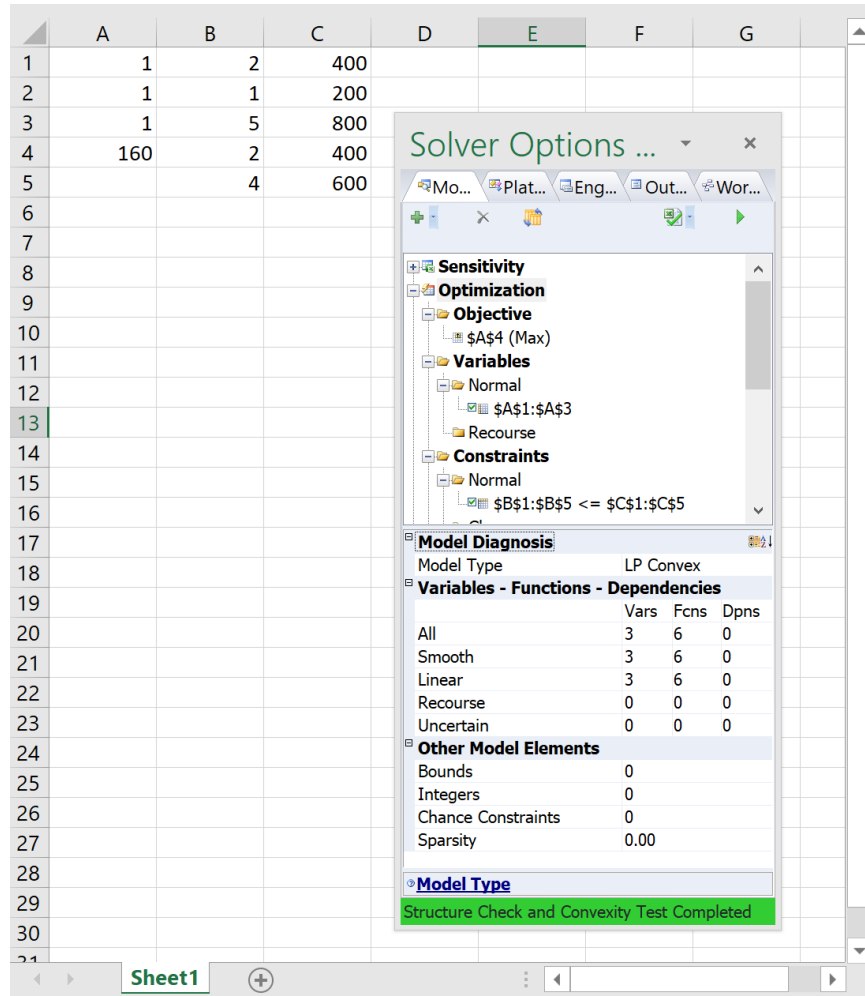
## Analytic Solver Cloud



As you can see, the Task Pane Model tab and the Solver Parameters dialog contain the same information. But where the basic Excel Solver Parameters dialog is *modal* (moving the mouse outside the dialog displays a wait cursor – you must close the dialog to do anything else), the Task Pane is *modeless*: You can move the mouse outside the pane, edit formulas on the worksheet, or use other commands.

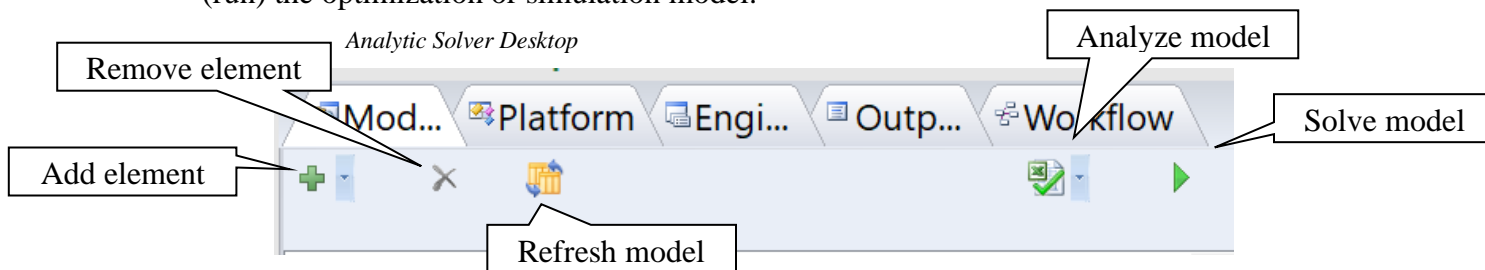
The Task Pane is initially docked to the right side of the Excel window, but you can select its title bar with your mouse, **drag** it to another position, and **resize** it, as shown on the next page. To “re-dock” the Task Pane, select its title bar with the mouse, drag to a position just beyond the right edge of the Excel window, then release the mouse.

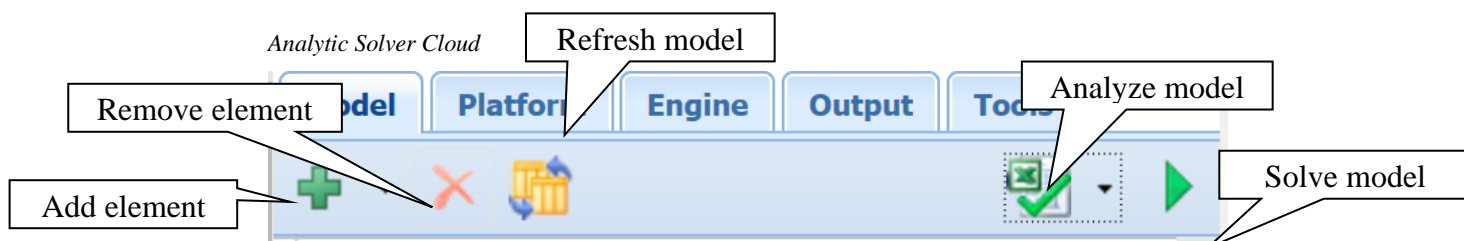
Use the **Model tab** to view your model in outline form, and optionally edit model elements in-place. Use the **Platform tab** to view or change Platform options, such as the number of optimizations or simulations to run, or default bounds on decision variables or uncertain variables. Use the **Engine tab** to select a Solver Engine and view or change its options. Use the **Output tab** to view a log of solution messages, or a chart of the objective values.



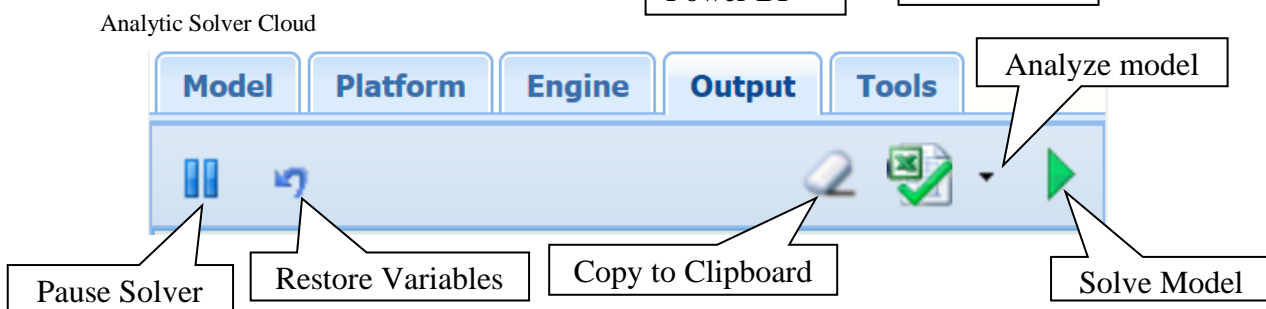
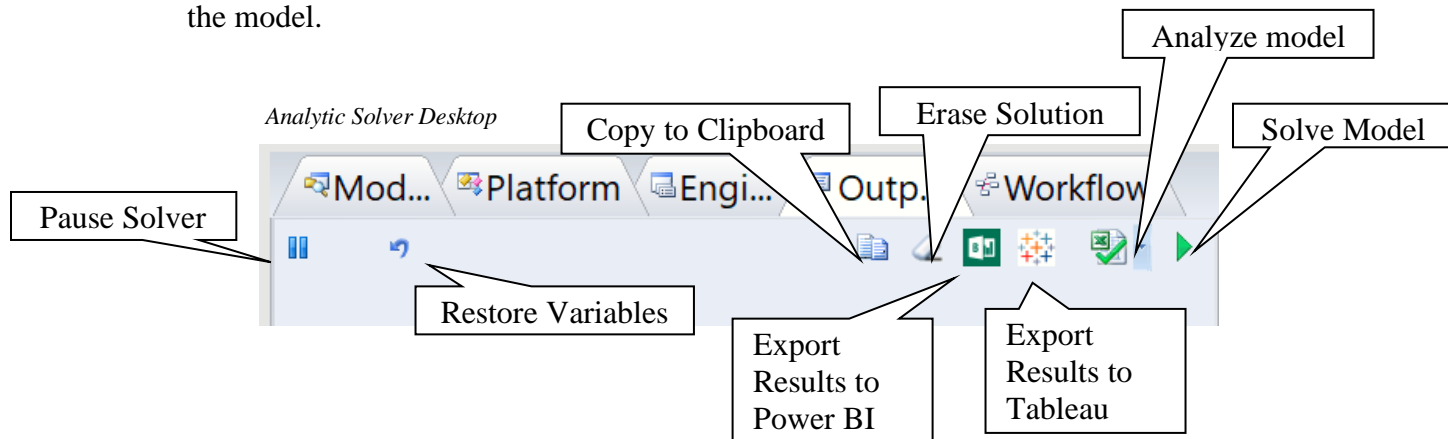
## Using Buttons on the Task Pane

Use the **buttons** at the top of the **Model tab** to add or remove model elements (you can also use the Ribbon options to do this), refresh the model outline when you've made unusual changes to the worksheet, **analyze** the structure of your model, or **solve** (run) the optimization or simulation model:





Use the **buttons** at the top of the **Output** tab to pause or stop the Solver, **restore** the original values of the decision variables, **copy** the solution message log to the Windows Clipboard (so you can paste it into another application), **erase** the solution log, **export** the Solver results to **Microsoft's Power BI** or **Tableau**, **analyze** or **solve** the model.



## Building Your First Optimization Model

While you likely already know how to build a basic optimization model, in the User Guide there is a chapter called “Examples: Conventional Optimization” which contains a section on building your first optimization model, as well as an overview of examples included with Analytic Solver. These examples will be useful for ideas as you look to build more ambitious models that better capture the business challenges you face.

**Online Resource:** You can see an overview video on our website of how to build an optimization model from scratch by clicking [here](#).

You can access the User Guide from within Excel by clicking on **Help** on the Analytic Solver Ribbon and choosing **User Guides**. In addition, see below for links to helpful introductory videos in addition to the one above.

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## Building Your First Simulation Model

Better *understanding* the range of potential outcomes in a situation, and *optimizing* your decision given that range, can be a very powerful way to make even better decisions. In the User Guide there is a chapter called “Examples: Simulation and Risk Analysis” which contains a section on building your first simulation models as well as an overview of examples included with Analytic Solver.

***Online Resource:** You can see an overview video on our website of how to build a simulation model from scratch by clicking [here](#).*

Again, you can access the User Guide from within Excel by clicking on **Help** on the Analytic Solver Ribbon and choosing **User Guides**. In addition, see below for links to helpful introductory videos in addition to the one above.

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## Finding the Examples

Use **Help – Example Models** to open workbooks with a list of optimization, simulation, forecasting/data science, stochastic optimization, simulation optimization and decision tree examples you can open by clicking hyperlinks.

### Using the Example Models and User Guide

The Analytic Solver and Data Science User Guides provide help and advice for building your optimization or simulation model, as well as step-by-step instructions for data science. Example models used in these guides can be found by clicking **Help – Example Models** and relate to:

- Conventional Optimization
- Simulation and Risk Analysis
- Forecasting/Data Science
- Stochastic Optimization
- Sensitivity Analysis
- Decision Trees

### Mastering Optimization and Simulation Concepts

Go from beginner to expert, and learn how to fully exploit the software by reading the **Mastering Concepts** chapters in the Analytic Solver User Guide.

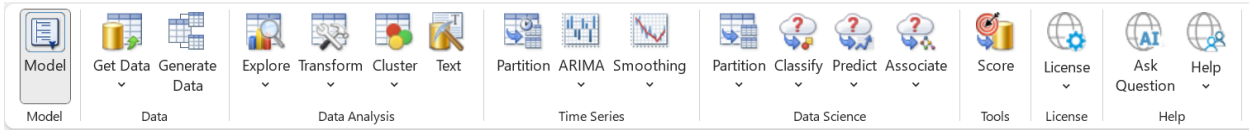
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## Features for Forecasting and Data Science

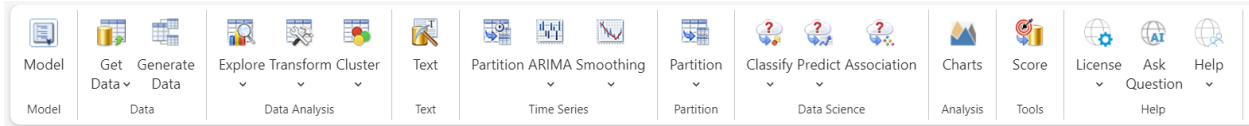
Analytic Solver Data Science software offers over 30 different methods for analyzing a dataset in order to forecast future events. The Data Science ribbon is broken up into five different segments as shown in the screenshot below.

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*Analytic Solver Data Science Desktop*

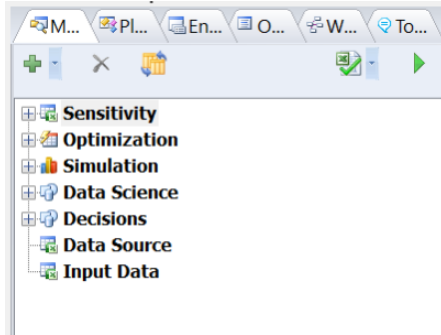


*Analytic Solver Data Science Cloud Ribbon*

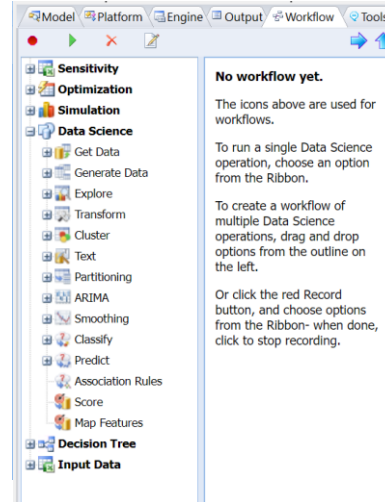


- **Model** – Click this icon to display the Analytic Solver Task Pane. Using the model tab, you can easily navigate between worksheets containing datasets and data science results.

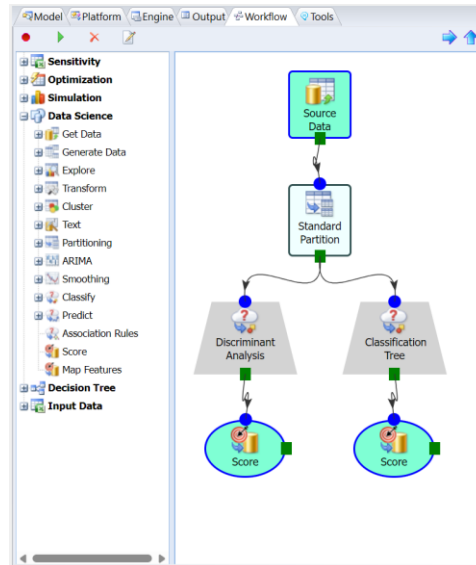
*Data Science Desktop*



*Data Science Cloud*



The Workflow tab in Analytic Solver, allows the combination of all available data science techniques into an, all-inclusive workflow, or workflows. Once the workflow, or pipeline, is created, either manually or simply by recording your actions, each data science method included in the workflow will be executed sequentially. See the *Analytic Solver Data Science Overview* chapter within the *Analytic Solver Data Science User Guide* for more information on this new feature.



- Data – This section includes the Big Data and the Generate Data icons. Click the down arrow on the Big Data icon to reveal the menu. Select *Worksheet* to draw a representative sample from an Excel worksheet. Select *Database* (Analytic Solver Desktop only) to retrieve all data or draw a representative sample from a SQL database table. Select *File Folder* (Analytic Solver Desktop only) to import all files or a representative sample from within a single file folder. Click *Big Data* to either sample or summarize from a very large dataset. Results can be obtained immediately or at a later time.

**RASON V2025**, our latest release, features an innovative (and patent pending) new capability for **automated risk analysis** of **machine learning** models. A further benefit of this feature is a general-purpose, easy to use new tool for **synthetic data generation**, to augment the data you already have. **Synthetic data generation** has come into use in recent years to augment available datasets, when the available data is limited, or is restricted by law or regulation, such as with personal health information (PHI). In RASON V2025, you have a powerful, general-purpose **transformer** named "syntheticDataGenerator". So far, we're keeping our tools current with the "state of the art".

- Data Analysis – This section includes four icons: Explore, Transform, Cluster and Text. (In the Cloud app, the Text icon is included immediately to the right of the Data Analysis.) Click Explore to create and manage charts, run Feature Selection or Analyze your data. Click Transform to transform datasets with missing data, perform binning and to transform categorical data. Click the Cluster Icon to perform cluster analysis. Click Text to perform an analysis on a collection of text documents using the new Text Miner feature.
- Time Series – This section includes three icons: Partition, ARIMA and Smoothing and are used when analyzing a time series.
- Data Science – This section includes four icons: Partition, Classify, Predict and Associate and are used to perform data science activities. (In the Cloud app, Partition is included to the immediate left of the Data Science section.) Click Partition to partition a dataset using Standard Partitioning or Partitioning with Oversampling. Click the Classification icon to use a classification method such as Discriminant Analysis, Logistic Regression, k – Nearest Neighbors, Classification Tree, Naïve Bayes, Neural Networks or Ensemble Methods to

build a classification model. Click Prediction to use Linear Regression, k-Nearest Neighbors, Regression Trees, Neural Networks or Ensemble Methods to generate a prediction model.

- Click the **Score** icon to score your test data. In the Desktop app, click the Options button to open the Web Subscription Manager, check for software updates and set your preference for Operating/Support modes. In the Cloud app, this button does not exist.
- Click the **License** icon to open the Analytic Solver Licensing Center where you can view/change/add licenses and view and pay outstanding invoices. Click the Help icon to open sample datasets, open the Help File and check for updates. See below for a complete discussion of the Help icon.
- If forecasting and data science are new for you, don't worry – you can learn a lot about them by consulting our **AI Agent**, Frontline's artificial intelligence technical support assistant. AI Agent is designed to provide assistance and support for users of Frontline Solvers' Analytic Solver and Analytic Solver Data Science software. The AI Agent is knowledgeable about the functionality and features of the software, as well as the concepts and processes involved in optimization, simulation and data science/forecasting. Just enter a topic or question such as “What classification algorithms are supported in Analytic Solver Data Science?” and click Submit Query to get started.
- Use the **Help** button to open example models, open the Help Center, where you can find pre-recorded webinars or access our Knowledge Base or explore our User Guides.

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## Cloud Version and Solver Home Tab

With your free trial or paid license, you can use Analytic Solver in desktop Excel, and its cloud-based counterpart, [Analytic Solver Cloud](#).

Analytic Solver Cloud is a “modern JavaScript add-in” that works in Excel for the Web, Excel for Windows and Excel for Mac (latest versions).

- All versions offer a Ribbon user interface featuring nearly-identical buttons and menus, and a Task Pane that summarizes models and provides access to Platform and Engine options.
- All versions use the same modeling languages (Excel formulas and our RASON® modeling language, handled by our PSI Interpreter), and both use the same algorithmic "engines" for mathematical optimization, Monte Carlo simulation and risk analysis, forecasting, data mining and text mining.
- All versions can create or open existing optimization, simulation and data science models and datasets in Excel workbooks – and you can easily move such workbooks back and forth between desktop and cloud.

## Security and Privacy Considerations

When you use Analytic Solver Desktop in Excel for Windows, your model is solved on the same computer, in the same memory and running process where Excel for Windows runs. You can save your workbook on your own computer, on Microsoft OneDrive “in the cloud”, or elsewhere.

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When you use either Analytic Solver Cloud, your workbook is stored, at least temporarily, “in the cloud”, and your model is **solved “in the cloud”**, using Frontline’s RASON servers on Microsoft Azure. While many steps are taken to ensure your security and privacy, you should understand and be comfortable with how the technology works:

When the browser running on your computer communicates with Excel for the Web, all the information transmitted is encrypted using **Transport Layer Security (TLS) 1.2**, as is true for all “https” websites.

When you run or solve a data science, optimization or simulation model, a copy of your Excel workbook is transmitted to Frontline’s RASON servers, again using **TLS 1.2**. A copy of your workbook is stored temporarily on these Azure-based servers, but is always **encrypted** “at rest” and “in motion”. After the model is run or solved, all copies of your workbook are **deleted**; only a log of filename, model size and time taken to solve remains on the RASON servers.

## Analytic Solver Cloud

Analytic Solver Cloud can be used with Excel for the Web, Excel for Windows and Excel for Mac (latest versions). Excel for the Web functions very similarly to desktop Excel so there's no learning curve; you can immediately be up to speed with Excel for the Web.

It's easy to move files between Analytic Solver Desktop and Analytic Solver Cloud products by simply saving your existing files to your Microsoft OneDrive account. Files saved on OneDrive may be opened in Microsoft Online or desktop Office. For Analytic Solver Cloud, **you will need the latest version installed via your Office 365 subscription** – older non-subscription versions, even Excel 2019, do not have all the features and APIs needed for modern JavaScript add-ins like Analytic Solver Cloud.

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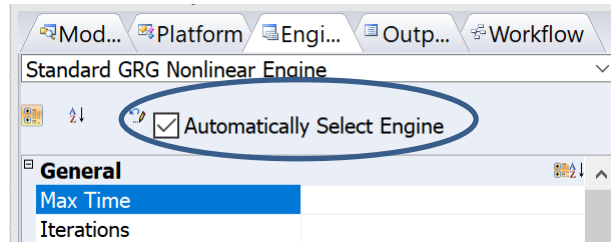
# Solver Engines for Optimization

## Using the Included Solver Engines

Your trial of Analytic Solver includes a comprehensive set of built-in Solver Engines which can be used to solve the entire range of problems you are likely to face including linear, non-linear, quadratic, non-smooth, and mixed integer problems, among others. Each Solver Engine has different strengths making it better suited to solving a particular class or range of problems. You can choose which one you want to use by going to the **Engines tab** in the Task Pane, clicking on the drop down menu at the top, and selecting a Solver Engine.

Don't worry if you aren't sure what type of problem you have or which Engine is best for it. If you wish, our “Automatic Mode” will analyze your model for you and automatically select the best choice from the available Engines to get you the best results. Simply go to the **Engines tab** in the Task Pane and make sure the “Automatically Select Engine” box is checked:

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In addition, the Solver Engine Option Reference chapter of the Reference Guide includes details for each Solver Engine bundled in Analytic Solver Comprehensive, Analytic Solver Optimization, Analytic Solver Simulation and Analytic Solver Upgrade. It also briefly describes how these options may be examined or set using VBA, or in another programming language using Frontline’s Solver SDK Platform.

## Using Large-Scale Solver Engines

In addition to the included Solver Engines, Analytic Solver Comprehensive and Analytic Solver Optimization, allow you to use additional plug-in Solver Engines.

Using the installation program SolverSetup, you can install the optional plug-in Solver Engines: Gurobi, MOSEK, OptQuest, XPRESS, and KNITRO, as well as our own Large Scale SQP, Large Scale GRG, and Large Scale LP solvers. These Solver Engines allow you to solve virtually unlimited sized models at amazing speeds. Again, our Automatic Mode can automatically choose the best one for your particular problem. You can learn more about each Engine [here](#). The Large Scale Solver Engine(s) will appear in the dropdown engine list shown at the top of the Task Pane Engine tab.

## Using VBA Code in Analytic Solver Desktop

You don’t have to know or use VBA to use Analytic Solver. But if you are familiar with the power of VBA, the User Guide includes two very useful chapters: “Automating Optimization in VBA” and “Automating Simulation in VBA.” These chapters explain how to use the Object Oriented API in Analytic Solver Desktop to create, modify, and solve optimization and simulation models under the control of a custom application you’ve written in VBA. Note: This functionality is not supported in Analytic Solver Cloud.

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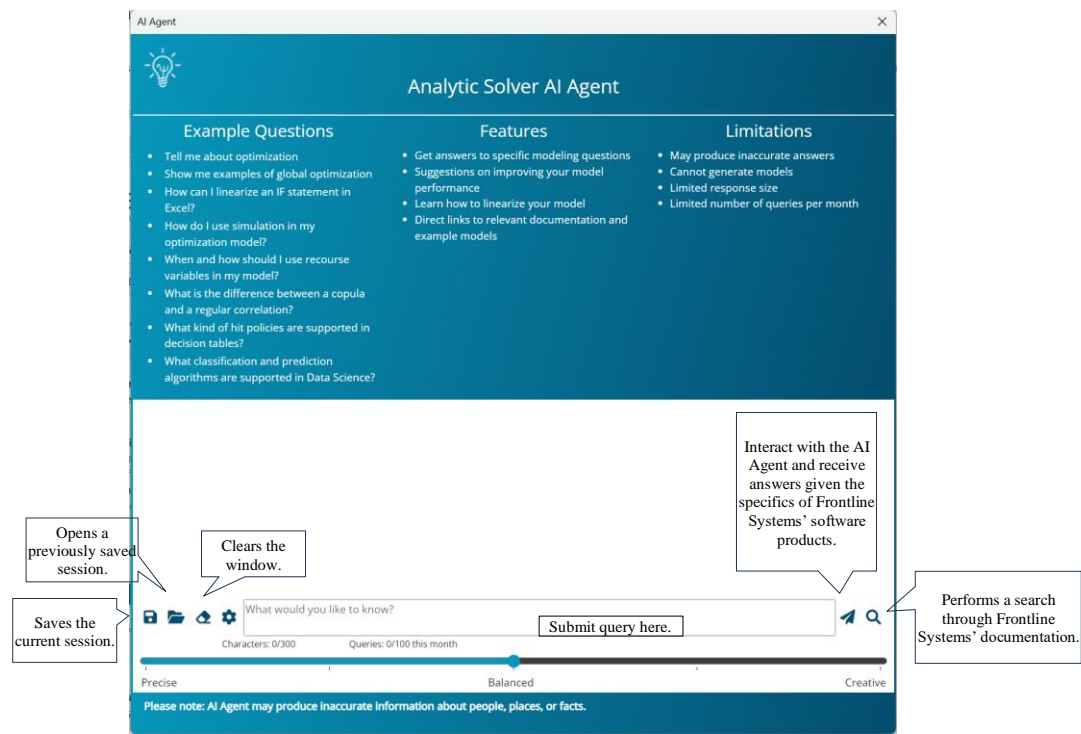
## Getting Help

The AI Help features in Analytic Solver are designed to help users of Frontline Systems' software, including Analytic Solver and Analytic Solver Data Science, by providing technical support and guidance.

- Click AI Assist (on the far left of the Analytic Solver ribbon) while your model is open to allow AI Assist to analyze your model and check the formulation for correctness.
  - Click Ask Question (on the far right of the Analytic Solver and Data Science ribbons) to open the AI Agent. AI Agent is knowledgeable about the functionalities and features of the software, as well as the underlying concepts and processes involved in optimization, simulation, forecasting, and data science.
-

## Ask Question

If you are new to Analytic Solver and/or optimization, simulation, forecasting and data science, don't worry – Frontline's AI technical support assistant, AI Agent, is here to help. AI Agent is designed to provide assistance and support for users of Frontline Solvers' Analytic Solver and Analytic Solver Data Science software. The AI Agent is knowledgeable about the functionality and features of the software, as well as the concepts and processes involved in optimization, simulation and data science/forecasting. Just enter a topic or question such as “What classification algorithms are supported in Analytic Solver Data Science?” and click Submit Query to get started.



Toggle between Precise, Balanced, and Creative to determine the type of answers returned. If Precise is selected, AI Agent will attempt to be as exact and deterministic as possible while Creative will usually result in more original, uncertain and non-repetitive answers. Use Balanced (the default) for the best of both worlds.

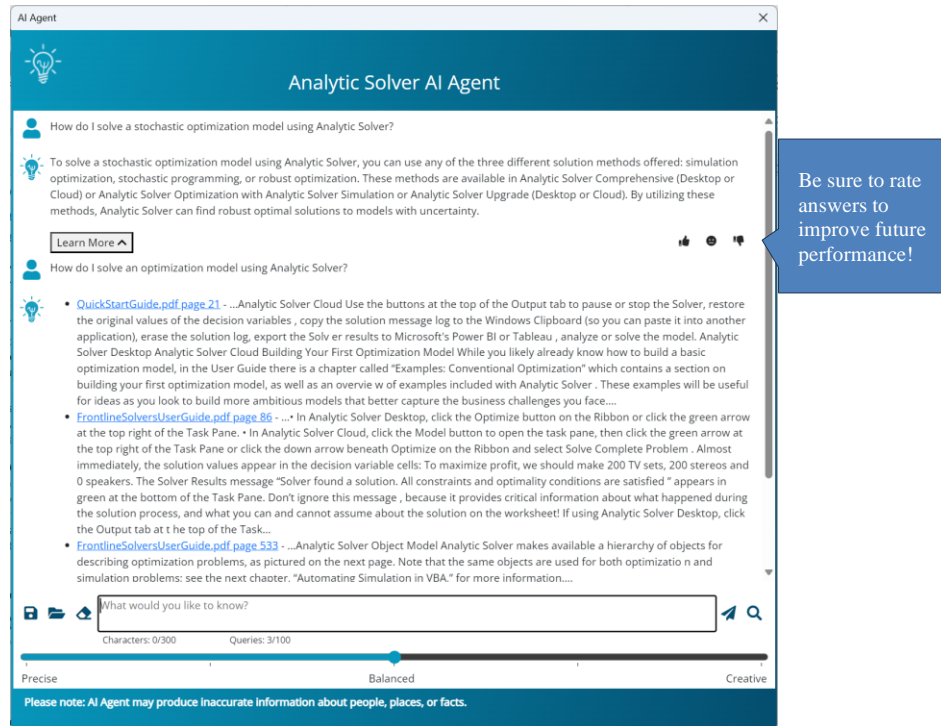
Click the **Save** file icon to save the current session. The file, transcript.json, will be downloaded. Click the **Open** file icon to open and restore a previously saved session. Click the **Erase** icon, to clear the current search window and start a new topic.

After typing a query,

- Click **Submit Query** to interact with the AI Agent and receive answers given the specifics of Frontline Systems' software products. On each new question, the AI Agent will take into account the chat history that is present in the current session. Click *Learn More* to view all extracts of source documents that are most relevant to the query. Each extract contains a link to the appropriate page in one of the official documents.

- Click **Search Documentation** (for faster search results) to perform a semantic/relevance search through all Analytic Solver and RASON documentation. The resulting response will be similar to the “Learn More” section as described above.

The screenshot below illustrates the difference between the two different types of queries. The first query used AI technology by using Submit Query. The 2<sup>nd</sup> query was performed using Search Documentation.



## AI Assist

Frontline Systems' new AI assist is a feature designed to enhance model formulation for optimization, simulation, and stochastic models. AI Assist helps users by:

1. **Analyzing Model Formulation:** AI Assist incorporates artificial intelligence to analyze your existing model and giving you tips on how to expand and improve your current model formulation.
2. **Providing Recommendations:** The AI can offer suggestions for improving model performance or adjusting parameters to achieve better results.
3. **Enhancing User Experience:** It aims to simplify the process for users by offering intuitive guidance and insights, making advanced analytics more accessible.

This feature is part of Frontline Systems' broader effort to integrate AI into their suite of decision support tools, making it easier for users to leverage powerful optimization and analytics capabilities.

## AI Assist Example

To demonstrate this exciting new feature, open the Product Mix example model by clicking Help – Examples – Optimization Models. While the model worksheet is open, click AI Assist. AI Assist opens and automatically enters the prompt, "Please describe the model and check for correctness."

AI Assist first translates your model to a RASON model, Frontline's modeling language, then diagnoses the model type and examines the model for correct formulation.

```
Please describe the model and check for correctness
### Description of the Model
```

Model diagnosis

The provided model is an optimization type, specifically focused on determining the optimal mix of products a company should manufacture in order to maximize gross profit. Here's a detailed breakdown:

Model name & description

```
#### General Information
- **Model Name**: ProductMix(Opt)
- **Model Description**: Not provided, likely a version of a Product Mix optimization problem.
- **Worksheets**: The model uses two worksheets named "Example 1" and "Example 2", but it is set to use "Example 1" as the active sheet.
```

Engine settings

```
#### Engine Settings
- **Engine**: LP/Quadratic (Linear Programming/Quadratic)
- **Scaling**: -1 (Automatic scaling is disabled)
```

Variables

```
#### Variables
- **Alias Name**: Number_to_build
- **Initial Value**: 0
- **Lower Bound**: 0
- **Final Value**: []
```

These variables represent the number of different products to be manufactured.

Description of data used in model.

```
#### Data
- **Production Coefficients**: `c18:e22` represents the production coefficients matrix, which is a 2D array of the resources consumed by each product. The values are:
- `[ [1, 1, 0], [1, 0, 0], [2, 2, 1], [1, 1, 0], [2, 1, 1] ]`
```

- **Inventory/Resources Available**: `h18:h22` represents the available quantity of each part/resource. The values are:
  - `[450, 250, 800, 450, 600]`, referred to as "Number\_available".
- **Profit per Unit**: `c24:e24` indicates the profit per unit of each product. The values are:
  - `[[75, 50, 35]]`

Description of constraints

- #### Constraints
- **Alias Name**: Number\_used
  - **Formula**: For each part/resource, the total used is computed via the SUMPRODUCT of production coefficients and the variables (Number\_to\_build).
  - **Upper Bound**: "Number\_available"

The constraints ensure that the total number of each part/resource used to produce the products does not exceed the available quantities.

Description of objective

- #### Objective
- **Alias Name**: Total\_profit
  - **Formula**: The objective function is to maximize the total profit calculated as the SUMPRODUCT of the profit per unit and the number of units to be built.
  - **Type**: Max (Maximize the total profit)
  - **Final Value**: []

Conclusions of model analysis.

### Checking for Correctness

The model appears to follow the structure of a standard linear programming problem for product mix optimization. However, to ensure correctness, here are some specific checks:

1. **Data Integrity**: The data values provided for parts, inventory, and profit are realistic and consistent with typical optimization models.
2. **Variable Definitions**: Variables for the number of products to build have correct initial values and bounds.
3. **Constraints**:
  - Formula for SUMPRODUCT (C18:E22[i,], \$C\$14:\$E\$14) is correctly defined for each part/resource.
  - Upper bounds are correctly specified using "Number\_available".

#### 4. **Objective Function**:

- Formula for SUMPRODUCT (C24:E24,\$C\$14:\$E\$14) correctly aggregates the profit over all products.
- The type of objective function is set to maximize, which aligns with the goal of maximizing total profit.

Given the provided structure and the components, no obvious mistakes are present, and the model appears to be correctly formulated for an optimization problem aiming to maximize total profit while respecting resource constraints.

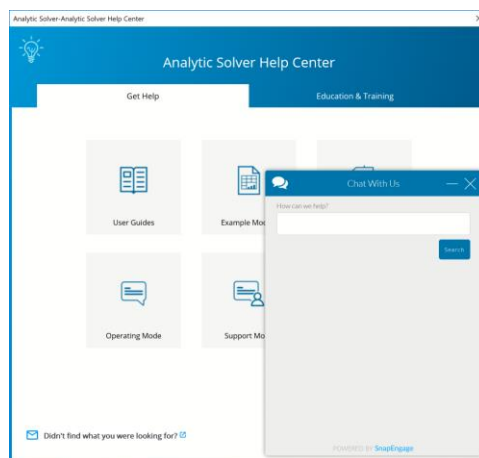
As with the AI Agent, toggle between Precise, Balanced, and Creative to determine the type of answers returned. If Precise is selected, AI Agent will attempt to be as exact and deterministic as possible while Creative will usually result in more original, uncertain and non-repetitive answers. Use Balanced (the default) for the best of both worlds.

For more information on AI assistance in Analytic Solver, see the Analytic Solver User Guide.

Note: Frontline's AI Agent uses artificial intelligence which could produce erroneous information about people, places or facts, including misinformation concerning Frontline Systems software products. Frontline Systems bears no responsibility for these inaccuracies.

## Help Center

Click Help – Help Center to open the Help Center. Click *Support Live Chat*, in the bottom right hand corner, to open a Live Chat window. If you run into any issues when using the software, the best way to get help is to start a Live Chat with our support specialists. This will start a Live Chat during our business hours (or send us a message at other hours), just as if you were to start a Live Chat on [www.solver.com](http://www.solver.com) – but it saves you *and* our tech support rep a lot of time – because the software reports your latest error message, model diagnosis, license issue or other problem, without you having to type anything or explain verbally what's happened. You'll see a dialog like this:



Since the software automatically sends diagnostic information to Tech Support, we can usually identify and resolve the problem faster. (Note: No contents from your actual spreadsheet model

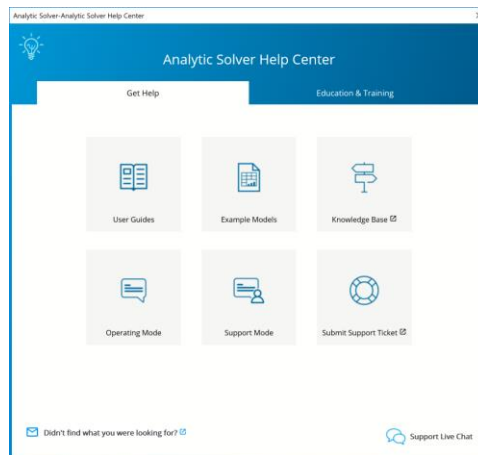
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is sent, only information such as the number of variables and constraints, last error message, and Excel and Windows version.)

Note: If Support Live Chat is disabled, click the down arrow beneath Help and select *Support Mode – Active Support*.

## Accessing Resources

The Help Center gives you easy access to video demos, User Guides, online Help, example models, and Website support pages to learn how to use our software tools, and build an effective model.



## User Guides

Click the User Guides menu choice to open PDF files of the Analytic Solver Optimization and Simulation User and Reference Guides, Analytic Solver Data Science User or Reference Guides, or our Quick Start Guides.

## Example Models

Clicking this menu item will open the Frontline Solvers Example Models Overview dialog with nearly 120 self-guided example models covering a range of model types and business situations.

## Knowledge Base

Click Knowledge Base to peruse a multitude of online articles related to support and installation issues or to locate articles that will help you to quickly build accurate, efficient optimization, simulation, and data science models.

## Operating Mode

Click Operating Mode to switch between three different levels of help. The Excel formulas and functions you use in your model have a huge impact on how fast it runs and how well it solves. If you learn more about this, you can get better results, but if you don't, your results will be limited. Guided Mode can help you learn.

- Guided Mode prompts you step-by-step when solving, with dialogs.
  - Auto-Help Mode shows dialogs or Help only when there's a problem or error condition.
  - Expert Mode provides only messages in the Task Pane Output tab. (This mode not supported when using a trial license.)
-



## Support Mode

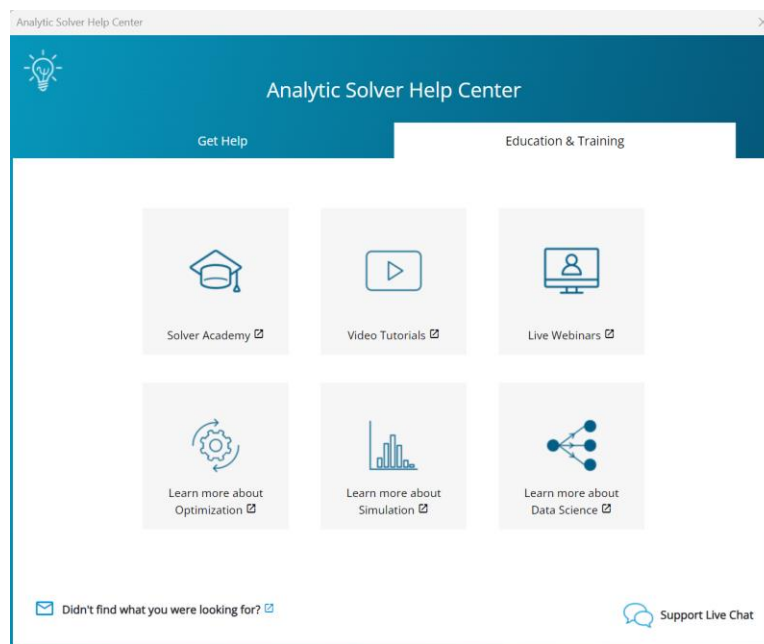
Click Support Mode to switch between three different levels of support. No information (cell contents etc.) from your Excel model is ever reported automatically to Frontline Systems, in any of these Support Modes. Only events in Frontline's software, such as menu selections, Solver Result messages, or error messages are reported.

- **Active Support** automatically reports events, errors and problems to Frontline Support, receives and displays messages to you from Support, and allows you to start a Live Chat with Support while working in Excel (**Recommended**). Auto-Help Mode shows dialogs or Help only when there's a problem or error condition.
- **Standard Support** automatically reports events, errors and problems anonymously (not associated with you) to Frontline Support, but does not provide a means to receive messages or start a Live Chat with Support.
- **Basic Support** provides no automatic connection to Frontline Support. You will have to contact Frontline Support manually via email, website or phone if you need help.

## Submit a Support Ticket

If you're having installation, technical, or modeling issues, submit a Support Ticket to open an online support request form. Submit your email address and a short, concise description of the issue that you are experiencing. You'll receive a reply from one of Frontline's highly trained Support Specialists within 24 hours, and generally much sooner.

Our technical support service is designed to supplement your own efforts: Getting you over stumbling blocks, pointing out relevant sections of our User Guides or example models, helping you fix a modeling error, or -- in rare cases -- working around an issue with our software (always at our expense).



## Solver Academy

[Solver Academy](#) is Frontline Systems' own learning platform. It's the place where business analysts can gain expertise in advanced analytics: forecasting, data science, text mining, mathematical optimization, simulation and risk analysis, and stochastic optimization.

## Video Tutorials/Live Webinars

Click Video Tutorials to be directed to Frontline's You Tube Channel. Browse videos on how to create an optimization or simulation model or construct a data science or prediction model using Analytic Solver.

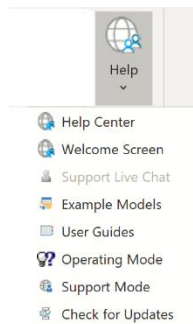
Click Live Webinars to be redirected to [www.solver.com](http://www.solver.com) to join a live or pre-recorded webinar. Topics include *Using Analytic Solver Data Science to Gain Insights from your Excel Data*, *Overview of Monte Carlo Simulation Applications*, *Applications of Optimization in Excel*, etc.

## Learn more!

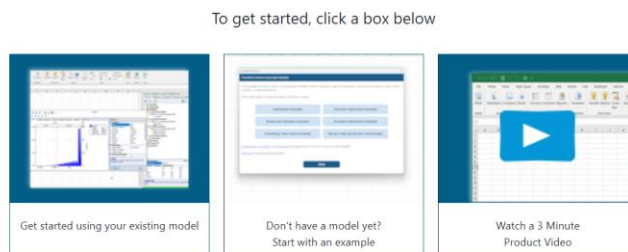
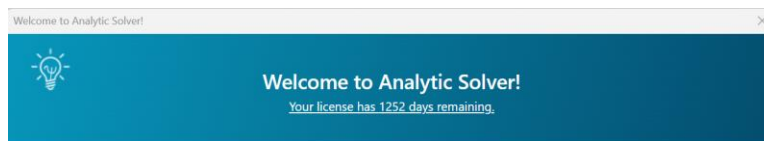
Click any of the three Learn More buttons to learn more about how you can solve large-scale optimization, simulation, and data science models, reduce costs, quantify and mitigate risk, and create forecasting, data science and text mining models using Analytic Solver.

## Help Menu

Use the Help Menu to gain short cuts to live chat, example models, documentation, set your operating and support mode preferences, and also to open the Welcome Screen and check for software updates.

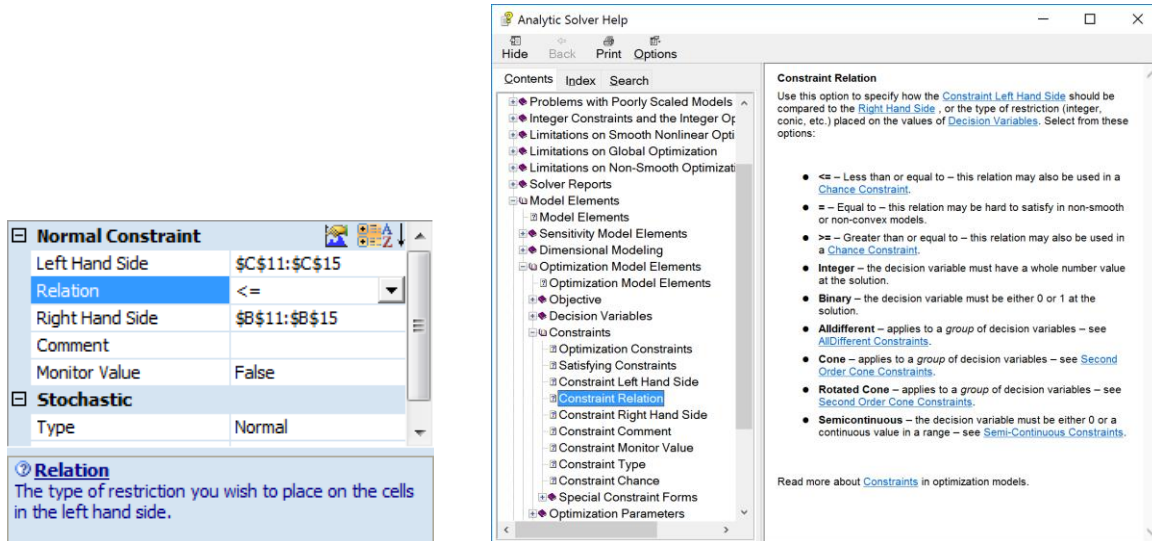


Use the Welcome Screen to get help with an existing model, open our example models or watch a quick video on how to get running quickly with Analytic Solver.



## Using Online Help Available in Analytic Solver Desktop

Analytic Solver's online Help appears when you click the Help button in the Analytic Solver Desktop Ribbon. More Help options appear on the dropdown menu below the Help button. You can also get help on Solver Result messages, Platform options, or any element of your model, by clicking the hyperlink that appears at the bottom of the Task Pane. For example, clicking the **Relation** hyperlink displays the Help window shown below.

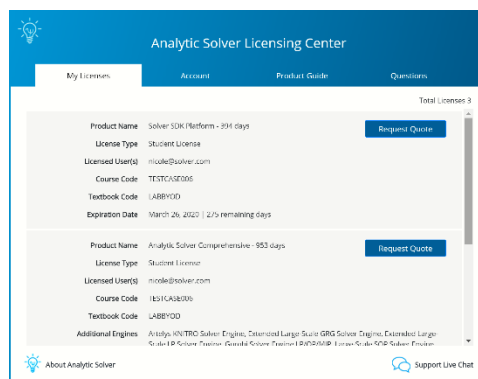


As with other buttons on the Ribbon, clicking the first menu choice has the same effect as clicking the main button: It opens the online Help viewer.

## Managing Your Licenses

Click the License button to open the License Manager where you can manage your current licenses and accounts, open our Product Selection Wizard, connect to Live Chat or peruse through a list of FAQs.

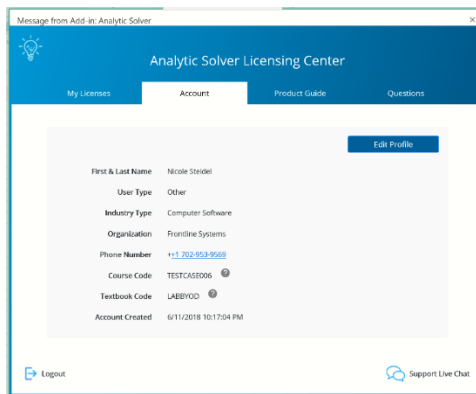
The "MyLicenses" tab displays your current license and license type, along with the expiration date. You can request a quote to renew your current license or, if your license has expired or is within 30 days of expiring, you can purchase a new license through our online store.



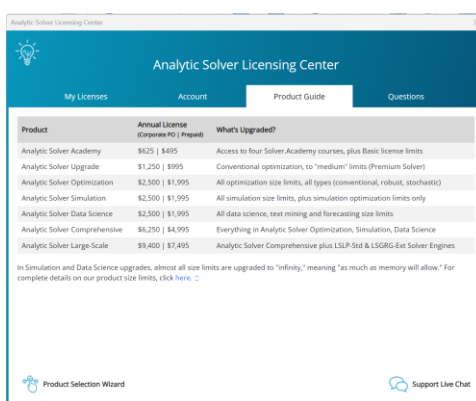
Click *About Analytic Solver* to open the following dialog containing information on this release.



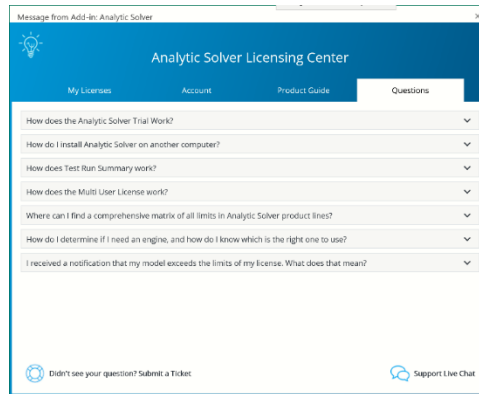
Click the Account tab to view your account on [www.solver.com](http://www.solver.com). Click Edit Profile to edit the information. Click Live Chat to open a Live Chat window or Log Out to log out of the product.



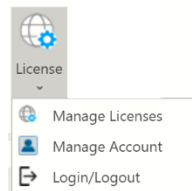
Click the Product Guide tab to view a list of products and pricing information. Click Product Selection Wizard to open the Product Selection Wizard. See the next section for information on this feature.



Click the Questions tab to review a list of FAQs, submit a support ticket or start a live chat.



Use the License menu to gain shortcuts to your account and to login or logout of Analytic Solver.



## Product Selection Wizard

Select **Product Selection Wizard** from the Product Guide tab in the Licensing Center to open a series of dialogs that will help you determine which product will best meet your needs based on your recent pattern of use.

Welcome to the **Product Selection Wizard!** Since you can use – and pay for – only what you need, this Wizard will help you choose from the available license options.

Analytic Solver's features cover three main problem solving areas – what do you want to do in each area?

Analytic Area	I want to gain modeling skills, or build a proposal/prototype	I have a current project to build a significant model of this type
Optimization	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Simulation/Risk Analysis	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Data Science	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

With any paid Analytic Solver license, you can always use **all** optimization, simulation, and data science features to build small models! But licenses have different **size limits** on models and data.

The Optimization upgrade you need depends on your model **type** (linear, nonlinear, integer), **size** and **complexity**. There are three basic levels of Optimization upgrades:

Optimization License Upgrade	Annual License + Support (Corporate PO   Prepaid)
<input type="checkbox"/> Analytic Solver Upgrade (formerly Premium Solver Pro)	\$1,250   \$995
<input type="checkbox"/> Analytic Solver Optimization (formerly Premium Solver Platform)	\$2,500   \$1,995
<input type="checkbox"/> Analytic Solver Optimization + plug-in Solver Engine (Analytic Solver Large-Scale offers special discount)	Contact us for details

For more details on specific size limits enabled by these upgrades, click [Optimization Choices](#).

Select the Product that you'd like to purchase and then click **Next**. Click the *Optimization Choices* link to learn more about Analytic Solver products that can solve optimization models and to find more information on speed, memory, and the use of plug-in Solver Engines.

**Analytic Solver Optimization Choices**

All Analytic Solver versions can solve at least small-size models of all problem types (linear, nonlinear, etc). But the **size** of model you can solve, and the best Solver Engine (optimization algorithm) to use, depends on the problem type. **Why?** – Click [Optimization Advanced](#).

**Linear Optimization Problems**

Analytic Solver Version	Decision Variables	Integer Variables	General Constraints
Analytic Solver Academy	200	200	100
Analytic Solver Upgrade	2000	1000	8000
Analytic Solver Optimization	8000	2000	8000
LSP-Std Solver Engine	32000	32000	32000
Adv. Plug-In Solver Engine	Unlimited	Unlimited	Unlimited

**Nonlinear and Non-Smooth Optimization Problems**

Analytic Solver Version	Decision Variables	Integer Variables	General Constraints
Analytic Solver Academy	200	200	100
Analytic Solver Upgrade	500	500	250
Analytic Solver Optimization	1000	1000	1000
LSGRG-Ext Solver Engine	12000	12000	12000
Adv. Plug-In Solver Engine	Unlimited	Unlimited	Unlimited

Your recent models had 161040 decision variables, 25404 general constraints, and the most complex model type was a Nonlinear Programming problem (NLP).

OK

On this screen, the Product Selection Wizard will recommend a product or products based on your answers on the previous screens. Click Upgrade to purchase the recommended product. Click the *Optimization Choices* link to learn more about Analytic Solver products that can solve optimization models. If at any time you'd like to chat with a member of our Technical Support staff, click **Live Chat**. Or if you'd like to amend your answers on a previous dialog, click **Back**.

When you run a simulation or optimization model that contains too many decision variables/uncertain variables or constraints/uncertain functions for the selected engine, the Product Wizard will automatically appear and recommend a product that *can* solve your model.

**Recommended Product**

Your optimization model has 13873 variables, 552 integers and 3202 constraints. This exceeds the size limits of the Standard LP/Quadratic Engine in Analytic Solver Comprehensive, which handles 8000 variables, 2000 integers and 8000 constraints. But your model **will** fit within the size limits of an upgraded Analytic Solver version, as shown below.

**Gurobi Engine LP/MIP**

The Gurobi Optimizer is a state-of-the-art linear and mixed integer solver, built from the ground up to exploit modern multi-core processors. [Click here for more information.](#)

To review this later, click the **Get Quote** button to email yourself a quote in PDF form. If you have an existing paid license, click the **Upgrade Order Form** button to see your reduced price after a credit for time left on your existing license.

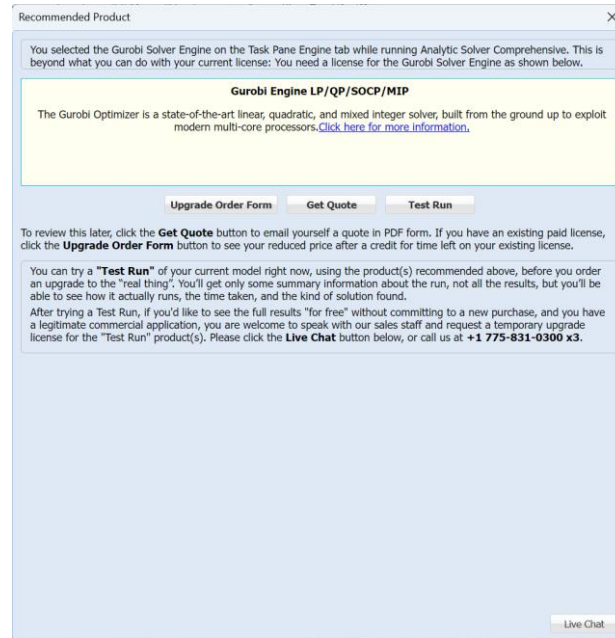
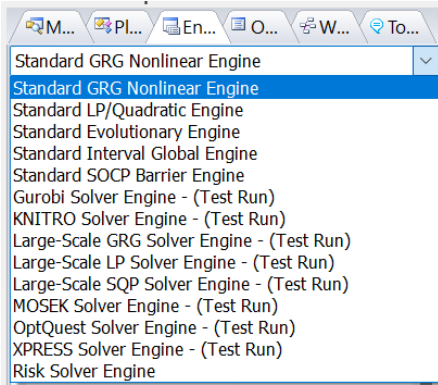
You can try a **"Test Run"** of your current model right now, using the product(s) recommended above, before you order an upgrade to the "real thing". You'll get only some summary information about the run, not all the results, but you'll be able to see how it actually runs, the time taken, and the kind of solution found.

After trying a Test Run, if you'd like to see the full results "for free" without committing to a new purchase, and you have a legitimate commercial application, you are welcome to speak with our sales staff and request a temporary upgrade license for the "Test Run" product(s). Please click the **Live Chat** button below, or call us at **+1 775-831-0300 x3**.

Live Chat

When you click "Test Run", the Product Wizard will immediately run the optimization or simulation model using the recommended product. (Only summary information will be available.) At this point, you can purchase the recommended product(s), or close the dialog.

This same behavior will also occur when solving smaller models, if you select a specific external engine, from the Engine drop down menu on the Engine tab of the Solver Task Pane, for which you do not have a license. The Product Wizard will recommend the selected engine, and allow you to solve your model using this engine. Once Solver has finished solving, you will have the option to purchase the product.



## Help Building Models

We also offer consulting assistance, from helping you define the problem, to building and solving the model, to interpreting and communicating results. You can learn more online on our [Consulting Assistance Page](#). You can also call us at 775-831-0300, or email us at [support@solver.com](mailto:support@solver.com).