Excel Optimization Overview

Excel Optimization Overview, Part I

Excel has two options for finding the best solution for a problem.

1. Goal Seek
2. Solver

Excel Optimization Overview, Part II

Goal Seek

- Limited to one input
- Limited to finding the value of the input which results in an output equal to a specific value
- Goal Seek cannot have any constraints
- Example
  - The break-even price point for sales is the price where profit equals zero.
  - The objective is to find the price that results in no profit.
  - Goal Seek varies the price until profit equals zero.

Excel Optimization Overview, Part III

Solver

- Solver can find input values that result in a minimum output value, maximum output value, or an output equal to a specified value (break-even point: profit = 0)
- Solver can change up to 200 input variables
- Solver can have up to 100 constraints
- Constraints can include inequalities (less than or equal to, greater than or equal to), binary (yes/no), and integer (whole numbers)

The End

Excel Goal Seek

Excel Goal Seek

- Goal Seek allows you to find the input value that will result in a desired output value.
- For example, given an equation for each problem:
  - It can find how much to spend on advertising to result in $1,000,000 in new sales.
  - It can find the price of a product that results in zero profit (break-even point).
  - It can find how much to spend on Google Ads to recruit 100 students.
- Goal Seek requires an equation, one input to be changed and one output that is the goal or objective.

The End

Excel Solver Unconstrained Optimization

Excel Solver Unconstrained Optimization

- Solver allows a user to minimize, maximize, or set an objective to a specific value.
- Solver allows a user to change up to 200 input variables in search of the optimal solution.
- To run solver:
  - Identify the objective function
  - Identify the objective approach (minimize, maximize, match a value)
  - Identify the inputs that can change

The End

Excel Useful Functions in Solver

Excel Useful Functions in Solver

- Solver often requires multiplying columns or rows together and summing the pieces; or multiplying tables together and summing the pieces.
- In linear algebra (matrix algebra), this is called a dot product.
- Microsoft calls this a SUMPRODUCT: multiply the columns or rows together, with corresponding pairs of cells, then sum the pieces.

The End

Excel Optimization Options Overview

Excel Optimization Options Overview, Part I

There are four types of problems where Solver can be used.

1. Linear functions
2. Nonlinear functions with one optimum
3. Nonlinear functions with multiple optima
4. Discontinuous or nondifferentiable functions

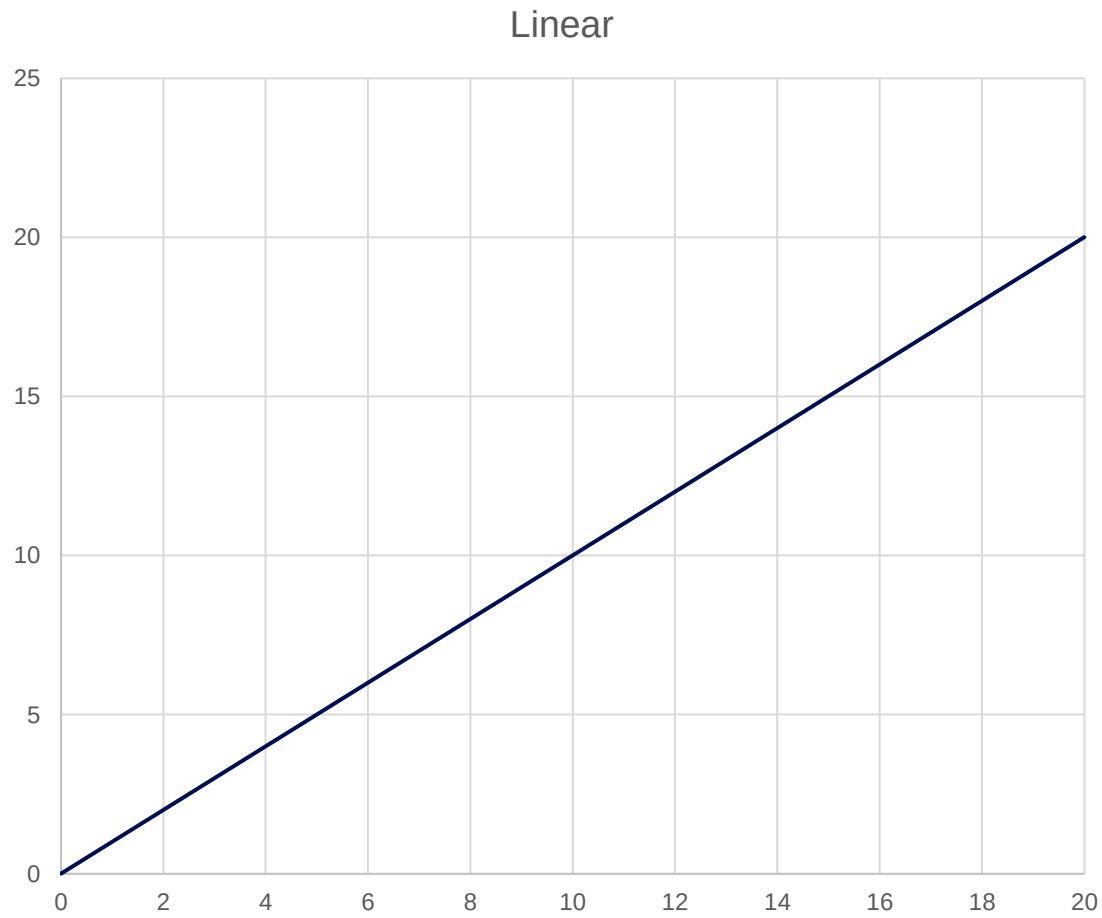
Excel Optimization Options Overview, Part II

Linear functions

- Straight-line functions

Solution

- Simplex method



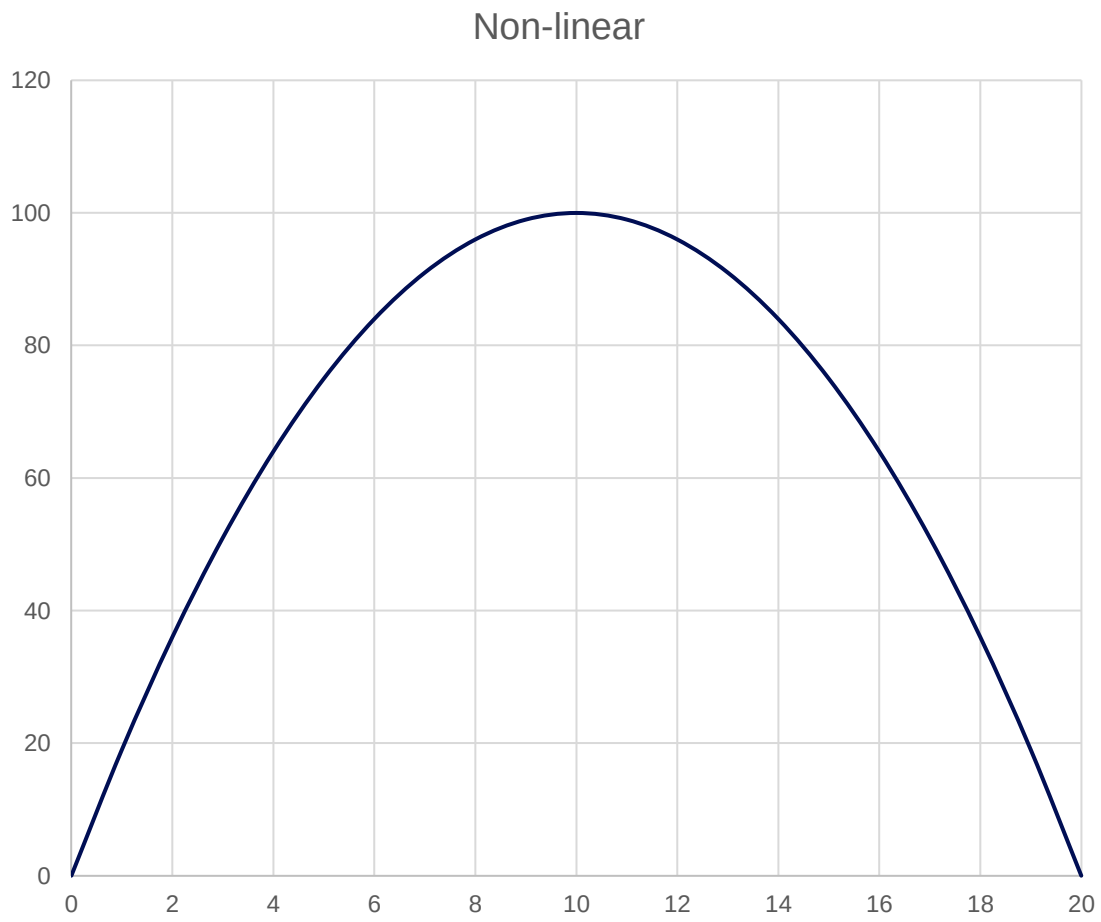
Excel Optimization Options Overview, Part III

Nonlinear functions with one optimum

- Quadratic functions

Solution

- GRG Non-linear



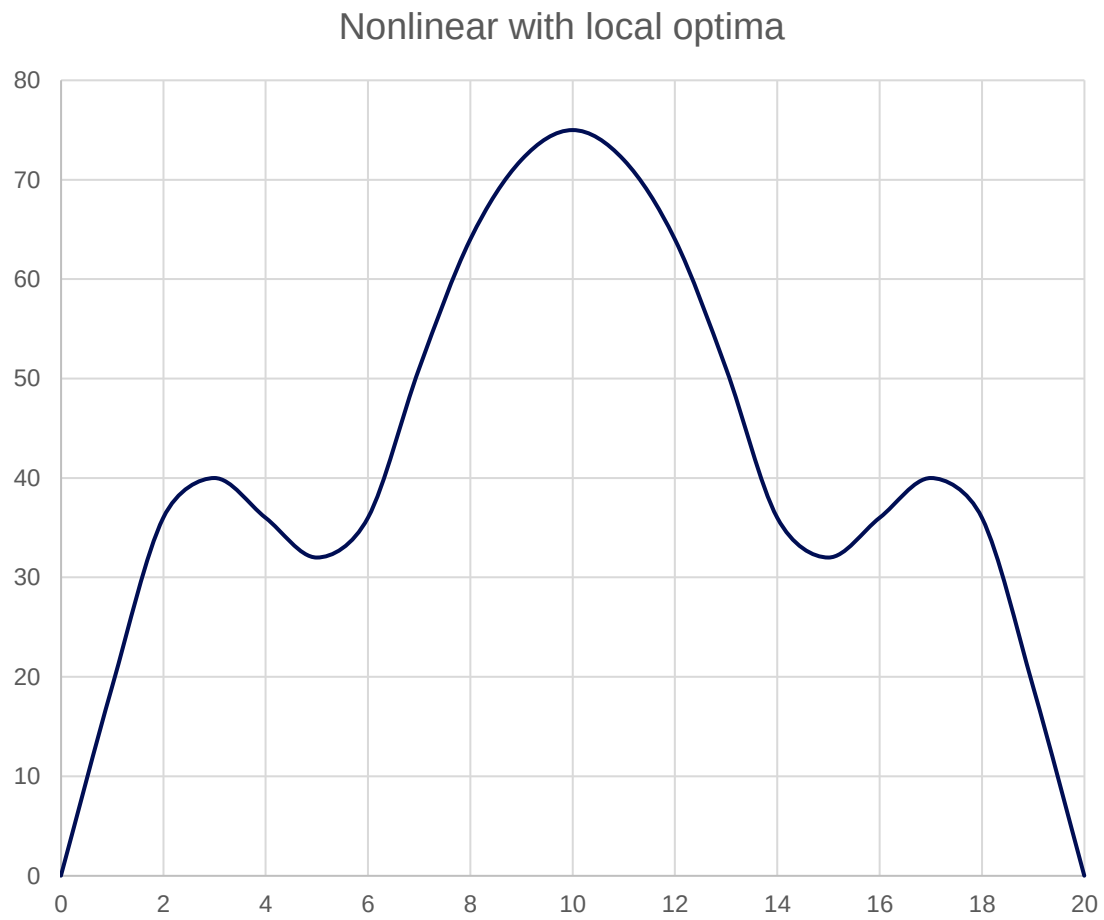
Excel Optimization Options Overview, Part IV

Nonlinear functions with multiple optima

- Multiple optima include global and local optima.
- Local optima are not the best solution.

Solution

- GRG Non-linear with multi-start



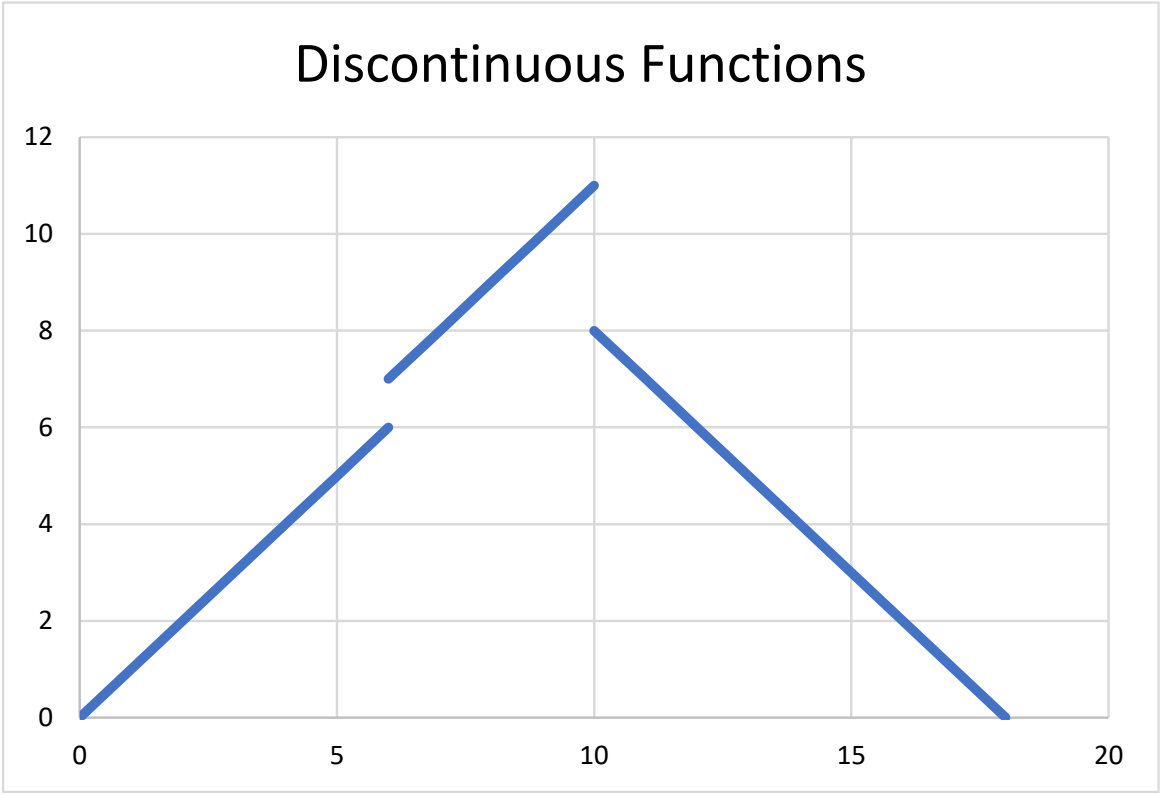
Excel Optimization Options Overview, Part V

Discontinuous functions

- A discontinuous function has a break in the line.

Solution

- Evolutionary



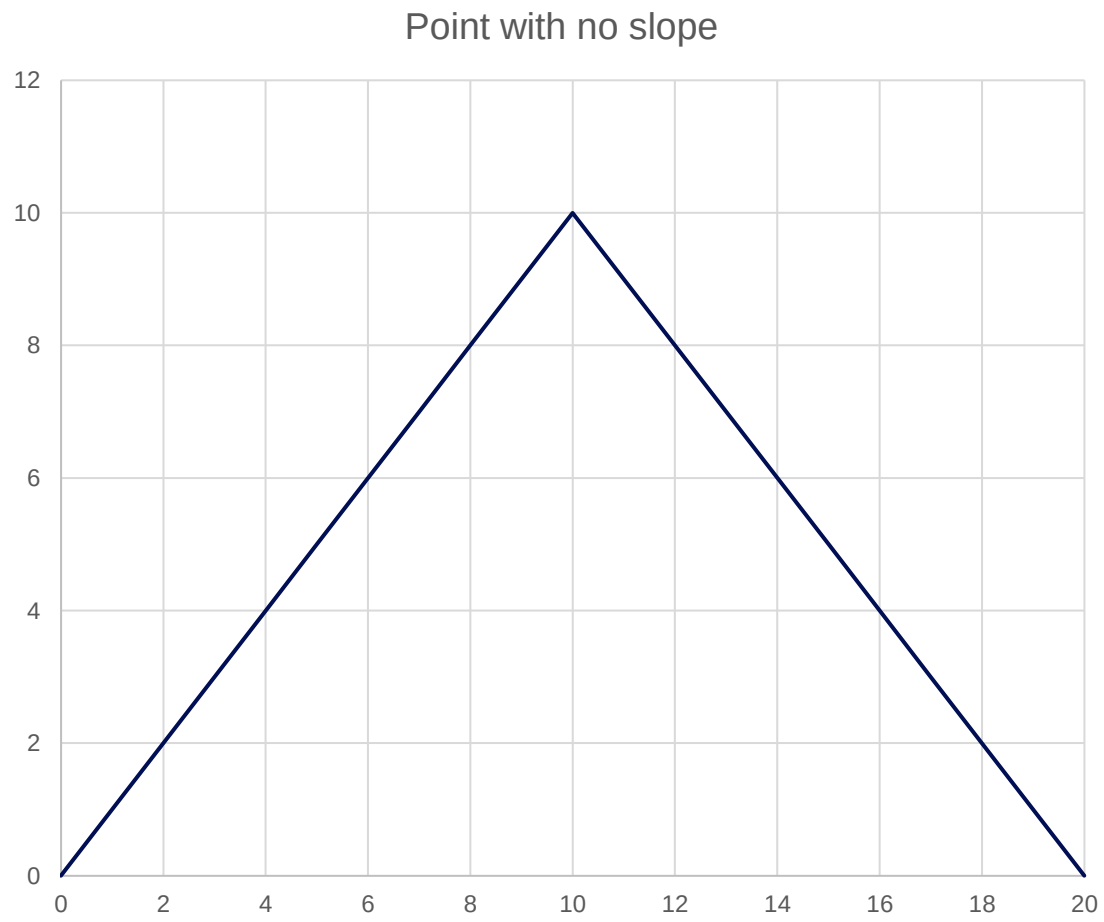
Excel Optimization Options Overview, Part VI

Nondifferentiable function

- A nondifferentiable function has a point with no definable slope.

Solution

- Evolutionary



Excel Optimization Options Overview, Part VII

	Solution technique			
Problem	Simplex	GRG nonlinear	GRG nonlinear with multistart	Evolutionary
Linear	Yes	Yes	Yes	Yes
Nonlinear, one optimum	No	Yes	Yes	Yes
Nonlinear, multiple optima	No	No	Yes	Yes
Curve has point with no slope	No	No	No	Yes
Speed	Fastest	Fast	Slow	Slowest

The End

Excel Optimal Product Mix Optimization

Excel Optimal Product Mix Optimization

- Often in industry, factory managers must decide how many items to make of a group of different products.
- Each product has different raw material and labor requirements.
- Each product will contribute different levels of profits.
- A factory will be constrained by the raw materials and labor available.
- Production will also be constrained by demand for a product—you don’t want to produce more than you can sell.

The End

Excel Workforce Scheduling Optimization

Excel Workforce Scheduling Optimization

- Banks, hospital, factories, and distribution centers are just some examples of organizations that need to optimize staffing.
- The workforce scheduling example examines how to determine how many staff to hire for a bank to ensure that all banking days have sufficient staff available to work.

The End

Excel Transportation and Distribution Optimization

Excel Transportation and Distribution Optimization

- Retailers, wholesalers, and distributors attempt to minimize transportation costs by shipping goods to customers from the warehouse locations resulting in the lowest cost.
- The organizations are constrained by inventory levels at different geographic locations and demand patterns.
- The goal in this exercise is to meet all customer demands by finding the shipping solution that minimizes costs.

The End

Excel Capital Budgeting Optimization

Excel Capital Budgeting Optimization

- Organizations often have more potential projects than they can afford to fund—they are limited by available staff and money.
- The goal of this exercise is to find the groups of projects that maximize value to the organization while being limited by staffing and budgeting constraints.

The End

Excel Warehouse Location Optimization

Excel Warehouse Location Optimization

- A common problem in the retail and distribution industry is determining the optimal location for warehouses to minimize shipping costs to customers.
- The goal of this exercise is to identify the optimal location for one warehouse, then expand the problem to include two warehouses.

The End