

THE SOLVER

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Excel has the capability to solve linear (and often nonlinear) programming problems with the SOLVER tool, which:

- 1) May be used to solve linear and nonlinear optimization problems.
- 2) Allows integer or binary restrictions to be placed on decision variables.
- 3) Can be used to solve problems with up to 200 decision variables.

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- 3) Identify the decision variables that can be varied, called Changing (Variable) Cells.

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- 4) Identify the constraints and enter them into the program to tell SOLVER how to solve the problem.

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- 3) Identify the decision variables that can be varied, called Changing (Variable) Cells.
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At this point, the optimal solution to our problem will be placed on the spreadsheet, with its value in the target cell.

A factory produces:

A factory produces:

- Laptops, production cost per unit = 250\$



A factory produces:

• Laptops, production cost per unit = 250\$

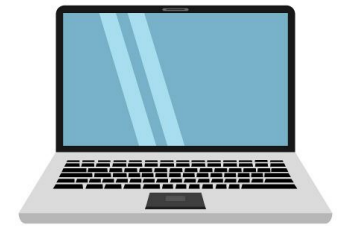


• Smart Phones, production cost per unit = 300\$



A factory produces:

• Laptops, production cost per unit = 250\$



• Smart Phones, production cost per unit = 300\$



• Plasma TV's, production cost per unit = 500\$



A factory produces:

• Laptops, production cost per unit = 250\$



• Smart Phones, production cost per unit = 300\$



• Plasma TV's, production cost per unit = 500\$



$$\text{Total Cost} = 250 \times N_{\text{Laptop}} + 300 \times N_{\text{Phones}} + 500 \times N_{\text{Plasma}}$$

Which is the minimum cost constrained to:

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- At least 100 laptops must be produced, $n_a \geq 100$

Which is the minimum cost constrained to:

• At least 100 laptops must be produced, $n_a \geq 100$

• at least 20 smart phones must be produced, $n_b \geq 20$

Which is the minimum cost constrained to:

• At least 100 laptops must be produced, $n_a \geq 100$

• at least 20 smart phones must be produced, $n_b \geq 20$

• at least 50 TV's must be produced, $n_c \geq 50$

Which is the minimum cost constrained to:

- At least 100 laptops must be produced, $n_a \geq 100$
- at least 20 smart phones must be produced, $n_b \geq 20$
- at least 50 TV's must be produced, $n_c \geq 50$
- a total of 350 widgets must be produced. $n_a + n_b + n_c = 350$

Which is the minimum cost constrained to:

• At least 100 laptops must be produced, $n_a \geq 100$

• at least 20 smart phones must be produced, $n_b \geq 20$

• at least 50 TV's must be produced, $n_c \geq 50$

• a total of 350 widgets must be produced. $n_a + n_b + n_c = 350$

$$\min_{n_a, n_b, n_c} (250 n_a + 300 n_b + 500 n_c)$$

$$n_a \geq 100$$

$$n_b \geq 20$$

$$n_c \geq 50$$

$$n_a + n_b + n_c = 350$$



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<div> <div> <div></div> <div></div> </div> <div> <div>✕</div> <div>✓</div> </div> <div> <div>fx</div> <div>=SUM(B2:B4)</div> </div> </div>			
A	B	C	D
Product	Quantity	Production Cost	Total Cost
Laptop	100	250	25000
Smart Phone	20	300	6000
Plasma TV	230	500	115000
	350		146000

Constraints:
Atleast 100 Laptops should be sold
Atleast 20 Smart Phones should be sold
Atleast 50 Plasma TV should be sold
A total of 350 widgets should be sold

*fx*`=SUM(B2:B4)`

A

B

C

D

Product**Quantity****Production Cost****Total Cost***Laptop*

100

250

25000

Smart Phone

20

300

6000

Plasma TV

230

500

115000

350**146000****Variables****Constraints:**

Atleast 100 Laptops should be sold

Atleast 20 Smart Phones should be sold

Atleast 50 Plasma TV should be sold

A total of 350 widgets should be sold

<div> <div> <div></div> <div>×</div> <div>✓</div> <div>fx</div> <div>=SUM(B2:B4)</div> </div> </div>			
A	B	C	D
Product	Quantity	Production Cost	Total Cost
Laptop	100	250	25000
Smart Phone	20	300	6000
Plasma TV	230	500	115000
	350		146000

This is the sum of the first three

Constraints:

Atleast 100 Laptops should be sold

Atleast 20 Smart Phones should be sold

Atleast 50 Plasma TV should be sold

A total of 350 widgets should be sold

<div> <div> <div></div> <div></div> </div> <div> <div>×</div> <div>✓</div> </div> <div> <div><i>fx</i></div> <div>=SUM(B2:B4)</div> </div> </div>			
A	B	C	D
Product	Quantity	Production Cost	Total Cost
<i>Laptop</i>	100	250	25000
<i>Smart Phone</i>	20	300	6000
<i>Plasma TV</i>	230	500	115000
	350		146000

These quantities are fixed

Constraints:

Atleast 100 Laptops should be sold

Atleast 20 Smart Phones should be sold

Atleast 50 Plasma TV should be sold

A total of 350 widgets should be sold

<div> <div> <div></div> <div>×</div> <div>✓</div> <div>fx</div> <div>=C2*B2</div> </div> </div>			
A	B	C	D
Product	Quantity	Production Cost	Total Cost
Laptop	100	250	25000
Smart Phone	20	300	6000
Plasma TV	230	500	115000
	350		146000

Total cost due to laptop production

Constraints:

Atleast 100 Laptops should be sold

Atleast 20 Smart Phones should be sold

Atleast 50 Plasma TV should be sold

A total of 350 widgets should be sold

<div> <div> <div></div> <div>×</div> <div>✓</div> <div><i>fx</i></div> <div>=C3*B3</div> </div> </div>			
A	B	C	D
Product	Quantity	Production Cost	Total Cost
Laptop	100	250	25000
Smart Phone	20	300	6000
Plasma TV	230	500	115000
	350		146000

Total cost due to phones production

Constraints:

Atleast 100 Laptops should be sold

Atleast 20 Smart Phones should be sold

Atleast 50 Plasma TV should be sold

A total of 350 widgets should be sold

<div> <div> <div></div> <div>×</div> <div>✓</div> <div><i>fx</i></div> <div>=C4*B4</div> </div> <div>Formula Bar</div> </div>			
A	B	C	D
Product	Quantity	Production Cost	Total Cost
Laptop	100	250	25000
Smart Phone	20	300	6000
Plasma TV	230	500	115000
	350		146000

Total cost due to TV's production

Constraints:

Atleast 100 Laptops should be sold

Atleast 20 Smart Phones should be sold

Atleast 50 Plasma TV should be sold

A total of 350 widgets should be sold

<div> <div> <div></div> <div>×</div> <div>✓</div> <div>fx</div> <div>=SUM(D2:D4)</div> </div> </div>			
A	B	C	D
Product	Quantity	Production Cost	Total Cost
Laptop	100	250	25000
Smart Phone	20	300	6000
Plasma TV	230	500	115000
	350		146000

Total cost

Constraints:

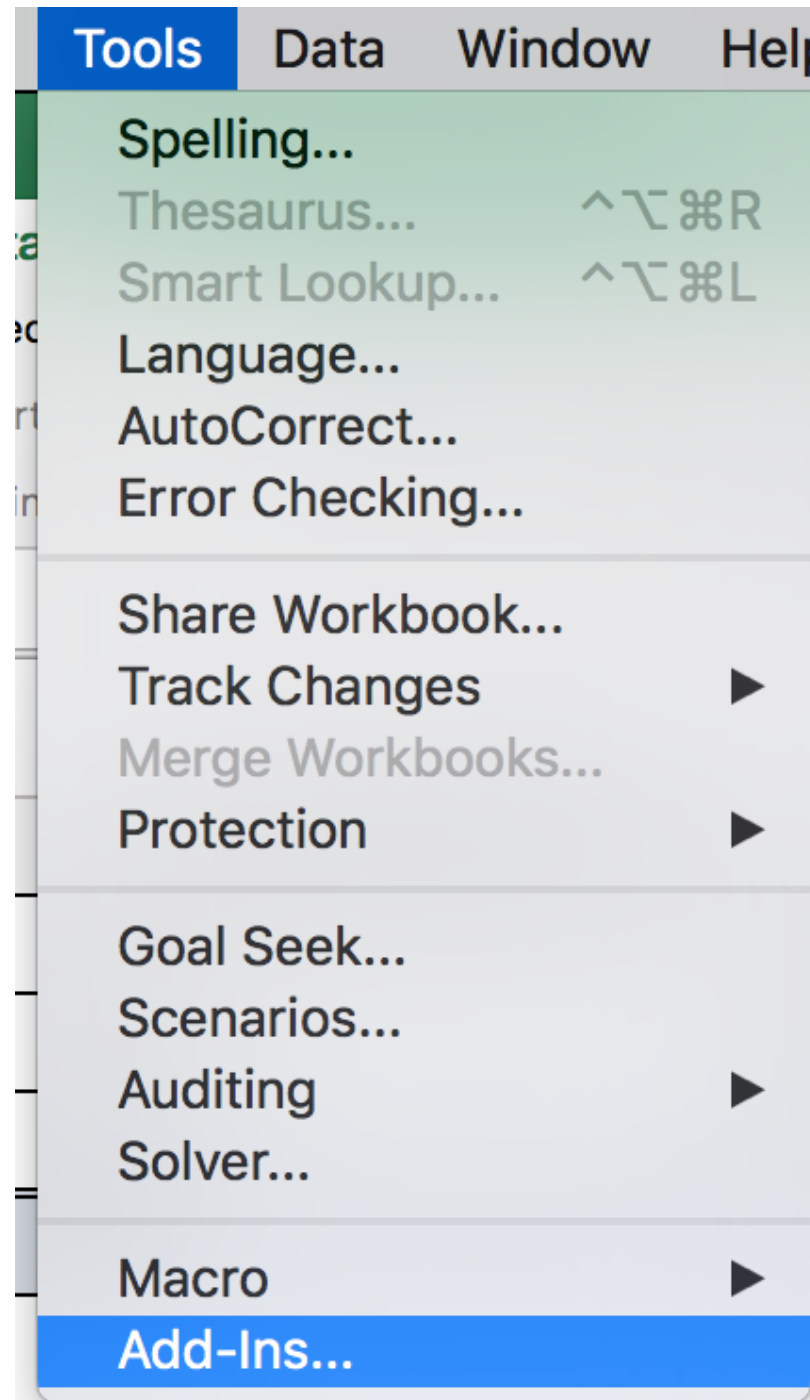
Atleast 100 Laptops should be sold

Atleast 20 Smart Phones should be sold

Atleast 50 Plasma TV should be sold

A total of 350 widgets should be sold

Activate the solver



Add-Ins

Add-Ins available:

- ☐ Analysis ToolPak
- ☒ Solver Add-In

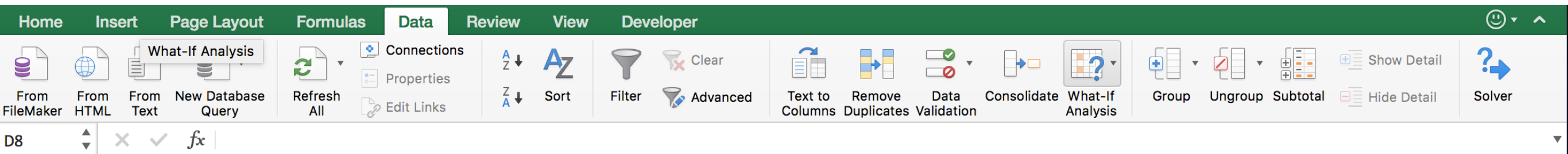
Solver Add-In

Browse...

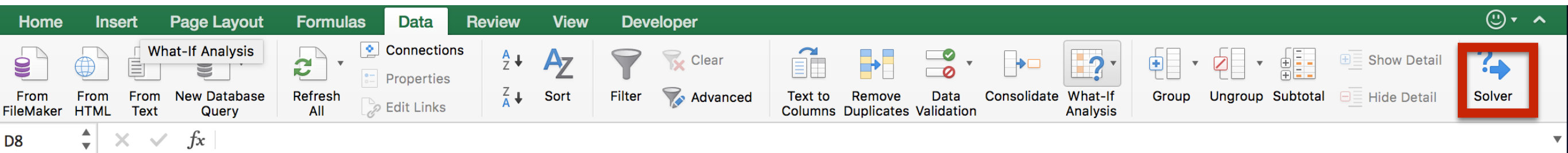
Cancel

OK

Ribbon



Ribbon



Solver Parameters

Set Objective:

\$D\$5

To:

☐ Max
 ☒ Min
 ☐ Value Of:

10000

By Changing Variable Cells:

Subject to the Constraints:

Add

Change

Delete

Reset All

Load/Save

☐ Make Unconstrained Variables Non-Negative

Select a Solving Method:

Simplex LP

▼

Options

Solving Method

Select the GRG Nonlinear engine for Solver Problems that are smooth nonlinear. Select the LP Simplex engine for linear Solver Problems, and select the Evolutionary engine for Solver problems that are non-smooth.

Close

Solve

The objective is the total cost, and we want to minimise it.

A	B	C	D
Product	Quantity	Production Cost	Total Cost
Laptop	100	250	25000
Smart Phone	20	300	6000
Plasma TV	230	500	115000
	350		146000

Constraints:
Atleast 100 Laptops should be sold
Atleast 20 Smart Phones should be sold
Atleast 50 Plasma TV should be sold
A total of 350 widgets should be sold

Solver Parameters

Set Objective: \$D\$5

To: ☐ Max ☒ Min Value Of: 10000

By Changing Variable Cells:

Subject to the Constraints:

\$B\$5 = 350

Add
Change
Delete
Reset All
Load/Save

☐ Make Unconstrained Variables Non-Negative

Select a Solving Method: Simplex LP Options

Solving Method

Select the GRG Nonlinear engine for Solver Problems that are smooth nonlinear. Select the LP Simplex engine for linear Solver Problems, and select the Evolutionary engine for Solver problems that are non-smooth.

Close

Solve

A	B	C	D
Product	Quantity	Production Cost	Total Cost
Laptop	100	250	25000
Smart Phone	20		000
Plasma TV	230	500	115000
	350		146000

By Changing Variable Cells:

\$B\$2:\$B\$5

Minimisation must be done by varying the
choice variables = number of units produced.

Atleast 20 Smart Phones should be sold

Atleast 50 Plasma TV should be sold

A total of 350 widgets should be sold

Solver Parameters

Set Objective:

To: ☐ Max ☒ Min ☐ Value Of:

By Changing Variable Cells:

Subject to the Constraints:

☐ Make Unconstrained Variables Non-Negative

Select a Solving Method:

Solving Method
Select the GRG Nonlinear engine for Solver Problems that are smooth nonlinear. Select the LP Simplex engine for linear Solver Problems, and select the Evolutionary engine for Solver problems that are non-smooth.

Solver Parameters

Set Objective:

\$D\$5

To:

☐ Max

☒ Min

☐ Value Of:

10000

By Changing Variable Cells:

\$B\$2:\$B\$4

Subject to the Constraints:

\$B\$2 >= 100

\$B\$3 >= 20

\$B\$4 >= 50

\$B\$5 = 350

Add

Change

Delete

Reset All

Load/Save

☒ Make Unconstrained Variables Non-Negative

Select a Solving Method:

Simplex LP

Options

Solving Method

Select the GRG Nonlinear engine for Solver Problems that are smooth nonlinear. Select the LP Simplex engine for linear Solver Problems, and select the Evolutionary engine for Solver problems that are non-smooth.

Close

Solve

Solver Results

Solver found a solution. All constraints and optimality conditions are satisfied.

- ☒ Keep Solver Solution
- ☐ Restore Original Values

Reports

Answer
Sensitivity
Limits

☐ Return to Solver Parameters Dialog

☐ Outline Reports

Save Scenario...

Cancel

OK

A	B	C	D
Product	Quantity	Production Cost	Total Cost
<i>Laptop</i>	280	250	70000
<i>Smart Phone</i>	20	300	6000
<i>Plasma TV</i>	50	500	25000
	350		101000

Solver Data

Objective Cell (Min)

Cell	Name	Original Value	Final Value
\$D\$5	Total Cost	146000	101000

Variable Cells

Cell	Name	Original Value	Final Value	Integer
\$B\$2	Laptop Quantity	100	280	Contin
\$B\$3	Smart Phone Quantity	20	20	Contin
\$B\$4	Plasma TV Quantity	230	50	Contin

Constraints

Cell	Name	Cell Value	Formula	Status	Slack
\$B\$5	Quantity	350	\$B\$5=350	Binding	0
\$B\$2	Laptop Quantity	280	\$B\$2>=100	Not Binding	180
\$B\$3	Smart Phone Quantity	20	\$B\$3>=20	Binding	0
\$B\$4	Plasma TV Quantity	50	\$B\$4>=50	Binding	0

Answer Report 1