

Operations Research

Lab Session

TA: 陳嘉豪 Jack Chen

陳宗霆 Tim Chen

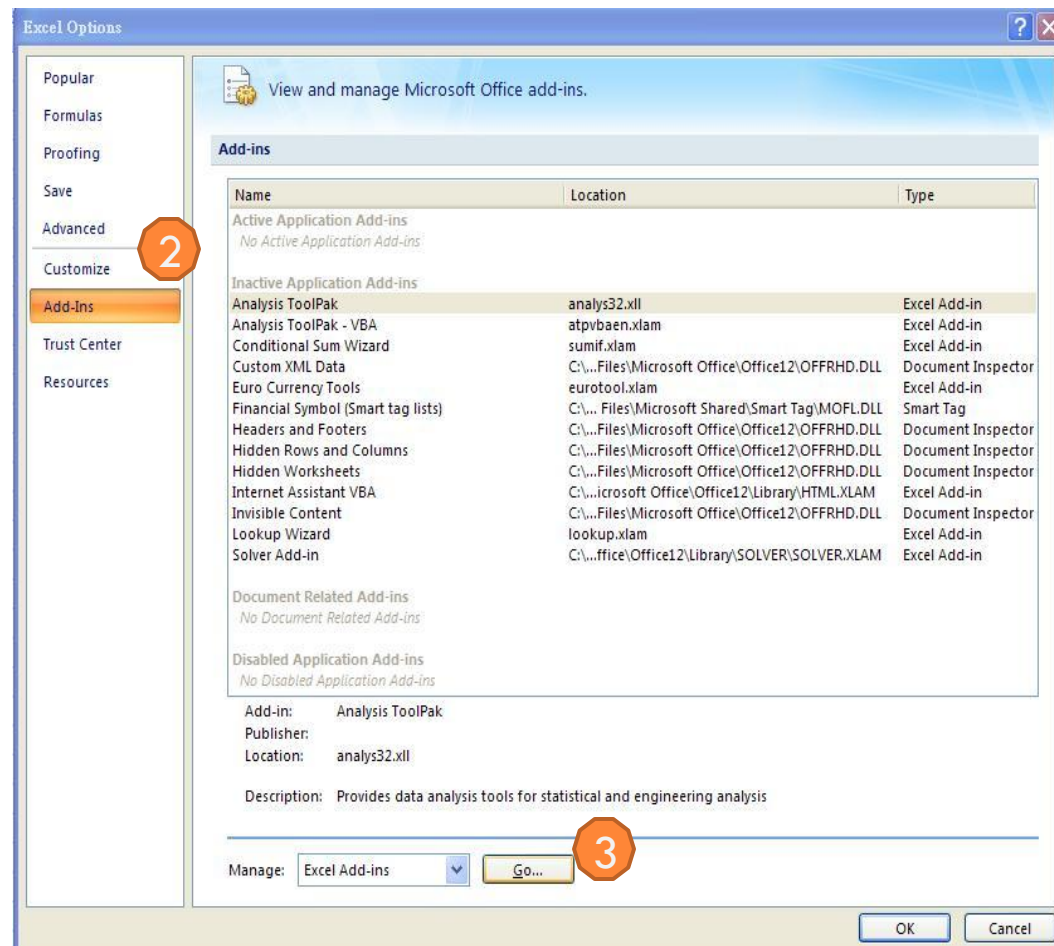
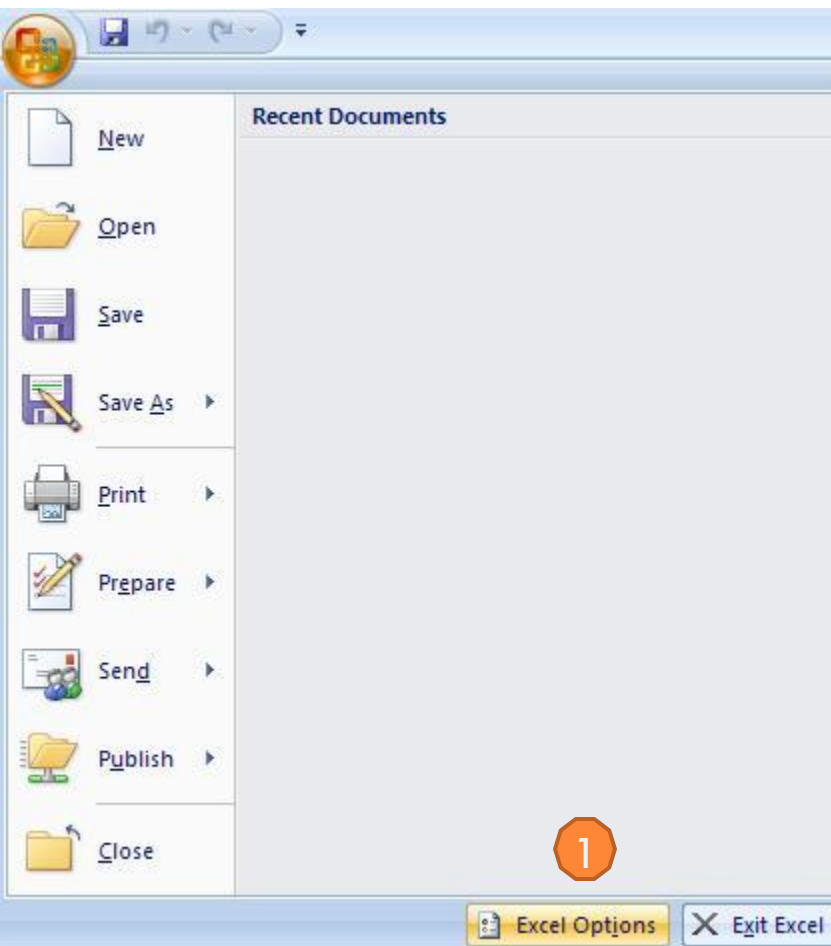
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Microsoft Excel Solver

A tool is used to find optimal solutions for all kind of decision problems.

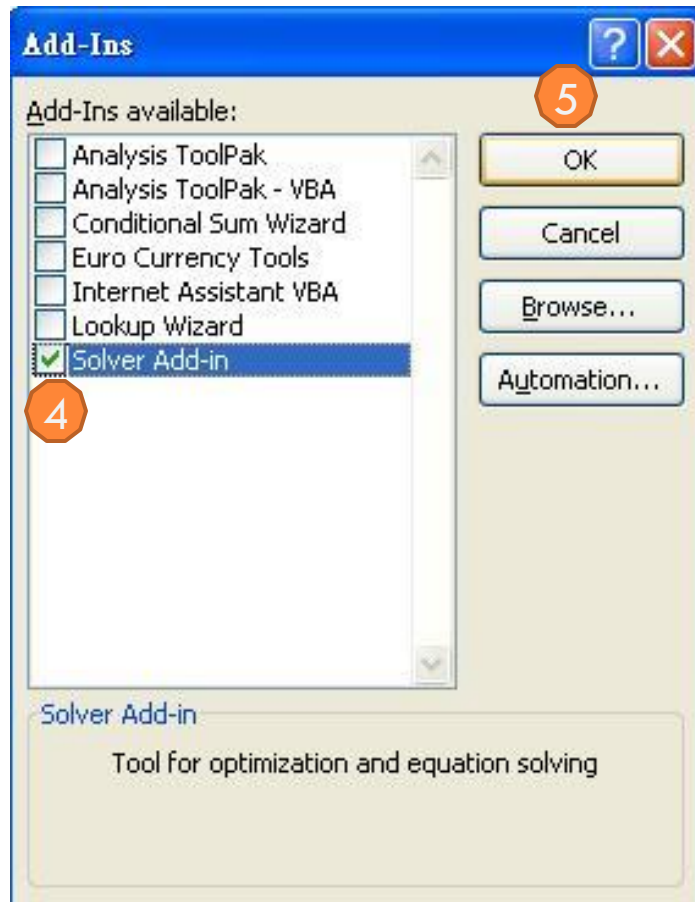
Setup

3



Setup

4



If your excel can not find the Solver Add-in, you can use the method in Readme.txt.

6

Book1 - Microsoft Excel

7

Home Insert Page Layout Formulas Data Review View


Get External Data Refresh All Edit Links Connections Sort & Filter Filter Clear Reapply Advanced Text to Columns Remove Duplicates Data Validation Consolidate What-If Analysis Group Ungroup Subtotal Outline Analysis

A1


A B C D E F G H I J K L M N

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

Solver Parameters

Set Target Cell: 

Equal To: ☒ Max ☐ Min ☐ Value of:

By Changing Cells: 

Subject to the Constraints:

Example

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Book	Title	Price	Weight
1	Calculus	500	4
2	Computer Programming	400	2
3	Operating Research	200	3

$$\begin{aligned} \square \max \quad & 500x_1 + 400x_2 + 200x_3 \\ \text{s.t.} \quad & 4x_1 + 2x_2 + 3x_3 \leq 5 \\ & x_i \in \{0, 1\} \quad \forall i = 1, \dots, 3. \end{aligned}$$

	A	B	C	D	E	F	G	H	I	J	K
1											
2		Book	Title	Price	Weight						
3		1	Calculus	500	4		x1				
4		2	Computer Programming	400	2		x2				
5		3	Operating Research	200	3		x3				
6							total weight	0			
7											
8											
9		Goal									
10											
11											

Data

Decision variable

Objected value

$$=SUMPRODUCT(D3:D5,H3:H5)$$

$$500x_1 + 400x_2 + 200x_3$$

$$=SUMPRODUCT(E3:E5,H3:H5)$$

$$4x_1 + 2x_2 + 3x_3$$

Add some redundant
symbols to notice yourself!

	A	B	C	D	E	F	G	H	I	J	K
1											
2		Book	Title	Price	Weight						
3		1	Calculus	500	4		x1				
4		2	Computer Programming	400	2		x2				
5		3	Operating Research	200	3		x3				
6							total weight	0	<=	5	
7											
8											
9		Goal									
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											

Decision variable

Objected value

Constraints

Solver Parameters

Set Target Cell: **C9**

Equal To: ☒ Max ☐ Min ☐ Value of: 0


By Changing Cells: **H\$3:H\$5**

Subject to the Constraints:


H\$3:H\$5 = binary
H\$6 <= J\$6

Solve
Close
Options
Add
Change
Delete
Reset All
Help

Solver Parameters

Set Target Cell: 

Equal To: ☒ Max ☐ Min ☐ Value of:

By Changing Cells: 

Subject to the Constraints:

Solver Options

Max Time: seconds

Iterations:

Precision:

Tolerance: %

Convergence:


☒ Assume Linear Model ☐ Use Automatic Scaling
☒ Assume Non-Negative ☐ Show Iteration Results

Estimates: ☒ Tangent ☐ Quadratic


Derivatives: ☒ Forward ☐ Central

Search: ☒ Newton ☐ Conjugate

Solver Parameters

Set Target Cell: 

Equal To: ☒ Max ☐ Min ☐ Value of:

By Changing Cells: 

Subject to the Constraints:

Solver Results

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

Reports

☒ Keep Solver Solution
☐ Restore Original Values

Answer
Sensitivity
Limits

11

[illegible]

Practice

12

$$\max \quad 5x + 8y$$

$$\text{s.t.} \quad x + y \leq 6$$

$$5x + 9y \leq 45$$

$$y \leq 3x$$

$$x \geq 0$$

$$y = \{0, 1\}.$$

Solution-method1

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	A	B	C	D	E	F	G	H	I
1									
2									
3			x	y					
4			5	1	total				
5			1	1	6	<=	6		
6			5	9	34	<=	45		
7			5	8	33	Goal			
8									
9			3x	y					
10			15	1					
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									

Solver Parameters

Set Target Cell:

\$E\$7

Solve

Close

Options

Reset All

Help

Equal To:

☒ Max
 ☐ Min
 ☐ Value of:

0

By Changing Cells:

\$C\$4:\$D\$4

Guess

Subject to the Constraints:

\$C\$10 >= \$D\$10

\$C\$4 >= 0

\$D\$4 = binary

\$E\$5 <= \$G\$5

\$E\$6 <= \$G\$6

Add

Change

Delete

Solution-method2

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	A	B	C	D	E	F	G	H	I
1									
2									
3									
4			x	y					
5			5	1	total				
6			1	1	6	<=		6	
7			5	9	34	<=		45	
8			-3	1	-14	<=		0	
9			5	8	33	Goal			
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									

Solver Parameters

Set Target Cell:

Equal To: ☒ Max ☐ Min ☐ Value of:

By Changing Cells:

Subject to the Constraints:

-
-
-

Buttons: Solve, Close, Options, Add, Change, Delete, Reset All, Help

Include 3 constraints