



Modeling with Linear Programming

Based on: www.INFORMS.org & Taha, H. A. 2017. Operations Research: An Introduction. 10th Edition. Boston, MA: Pearson

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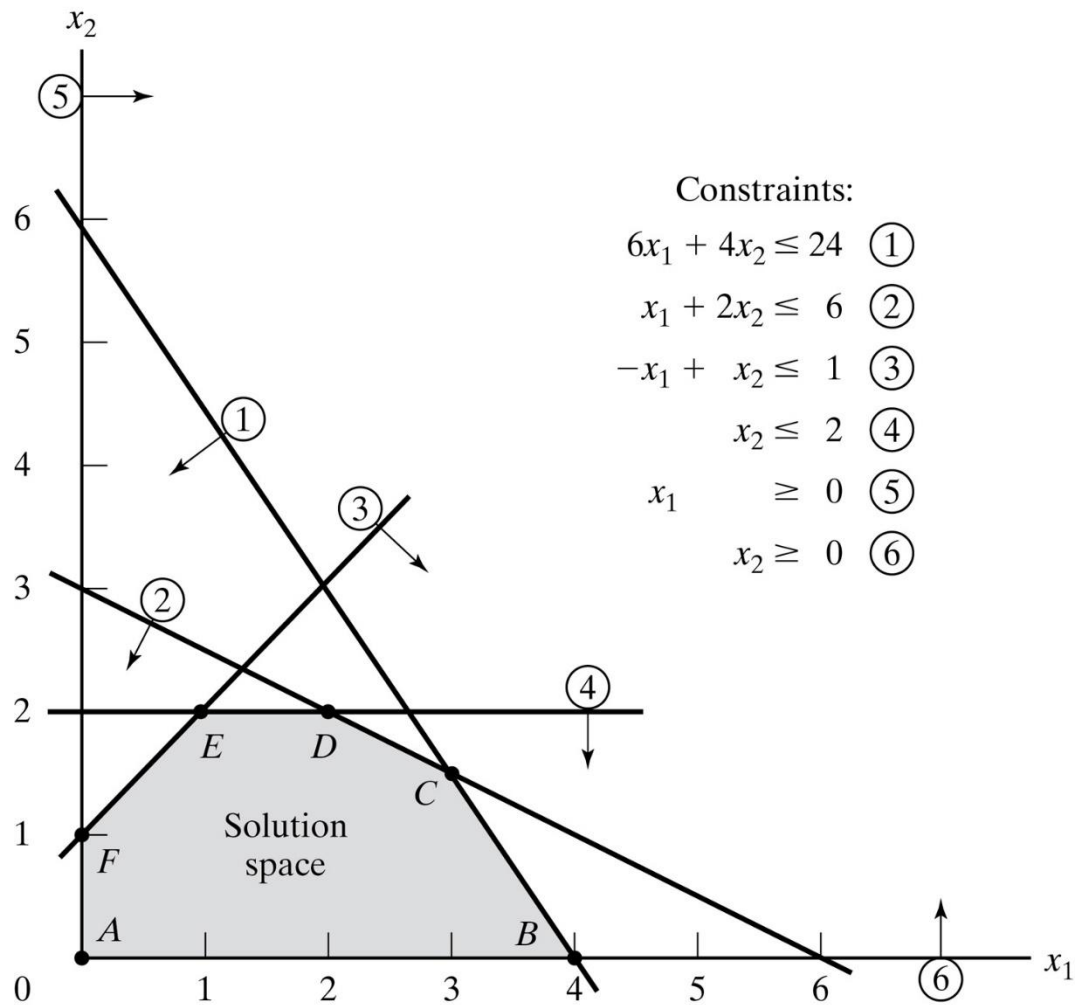
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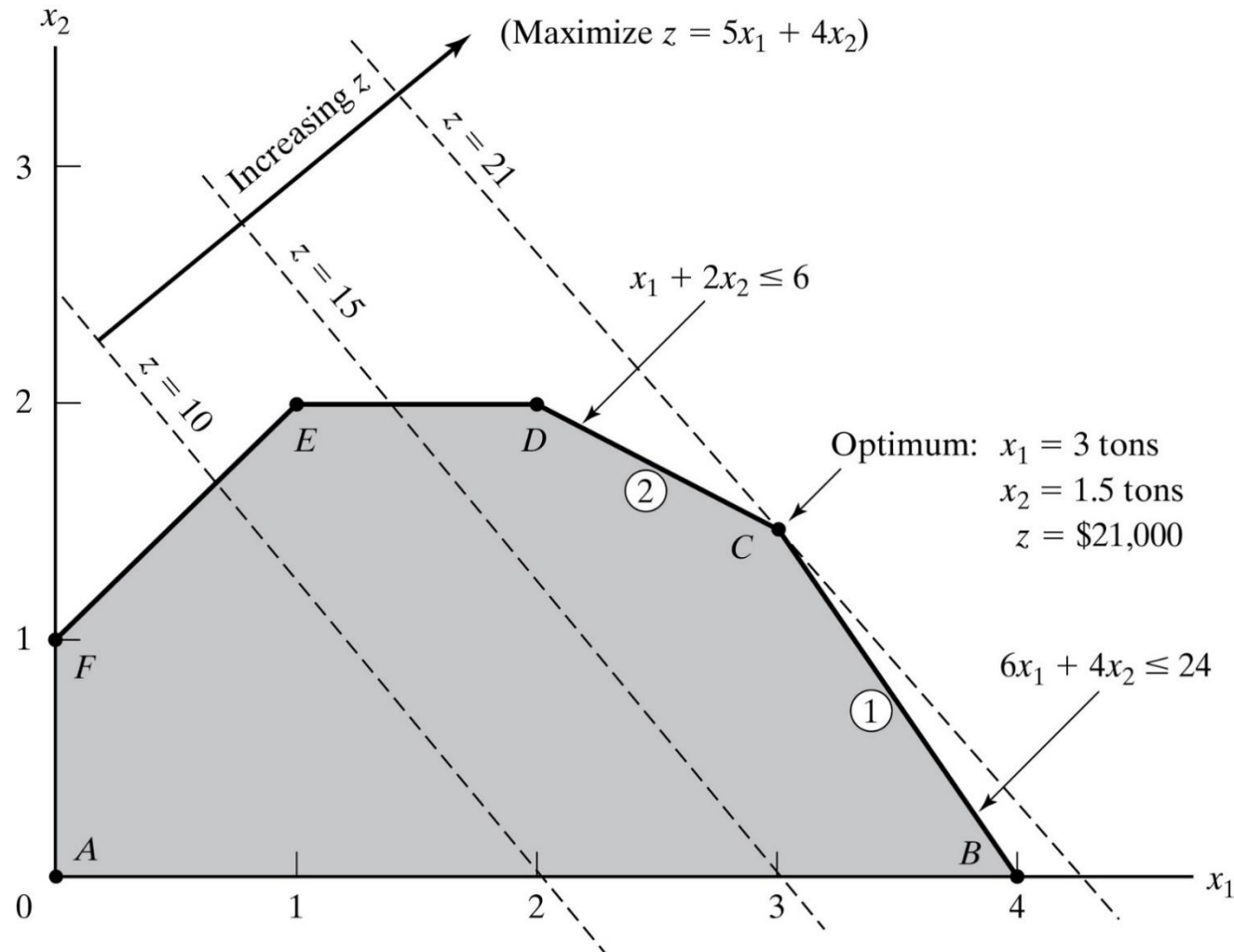
ISE 4623/5023: Deterministic Systems Models / Systems Optimization

The University of Oklahoma, Norman, OK, USA

Feasible Space of the Reddy Mikks Model



Optimum Solution of the Reddy Mikks Model





Solving of the Reddy Mikks Model in Excel (Solver)

	A	B	C	D	E	F	G	H	I	J
1	Reddy Mikks Model									
2	Input data:						Cell	Formula	Copy to	
3		x1	x2	Totals			D5	=B5*B\$13+C5*C\$13	D6:D9	
4		Exterior	Interior		Limits		D13	=D5		
5	Objective	5	4	21						
6	Raw material 1	6	4	24	<=	24				
7	Raw material 2	1	2	6	<=	6				
8	Market limit	-1	1	-1.5	<=	1				
9	Demand limit	0	1	1.5	<=	2				
10		>=0	>=0							
11	Output results:									
12		x1	x2	z						
13	Solution	3	1.5	21						

Solver Parameters

Set Target Cell:

Equal To: ☒ Max ☐ Min ☐ Value of:

By Changing Cells:

Subject to the Constraints:

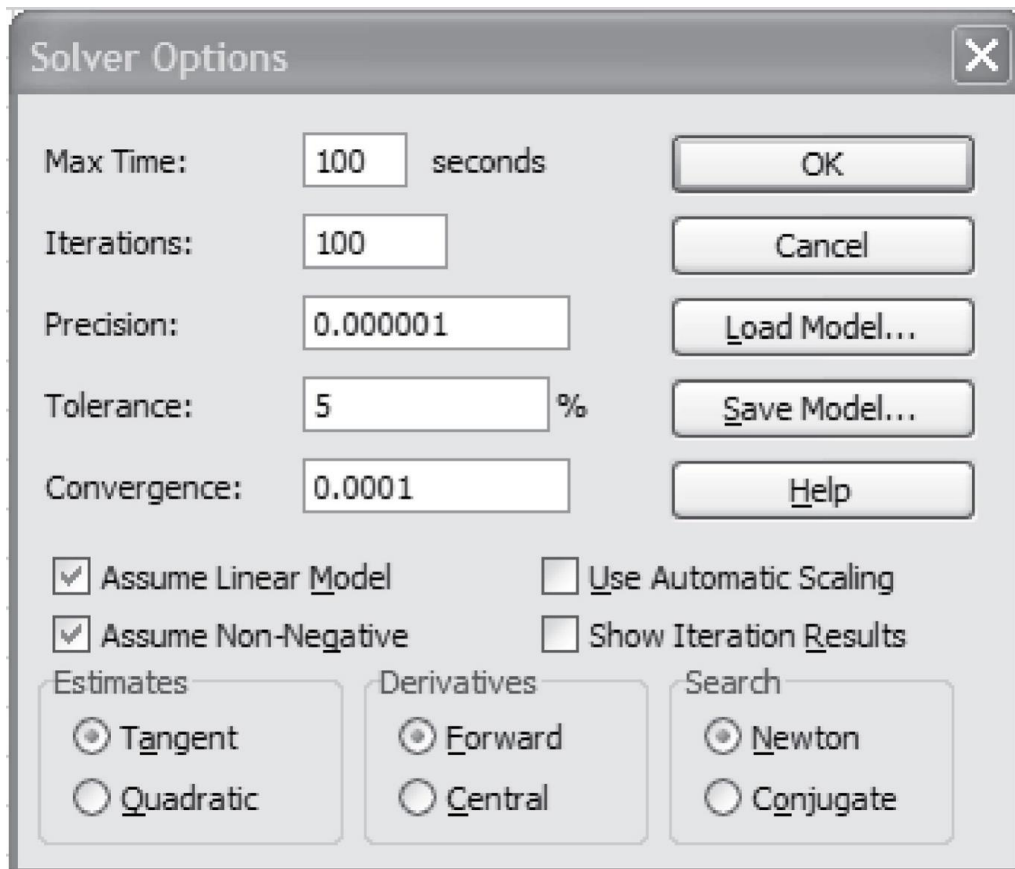
Add Constraint

Cell Reference:

Constraint:

<= < > >= int bin

Solving of the Reddy Mikks Model in Excel (Solver)



The image shows the 'Solver Options' dialog box in Microsoft Excel. The dialog box has a title bar with a close button (X). It contains several input fields and checkboxes. The 'Max Time' field is set to 100 seconds. The 'Iterations' field is set to 100. The 'Precision' field is set to 0.000001. The 'Tolerance' field is set to 5%. The 'Convergence' field is set to 0.0001. There are five buttons on the right: 'OK', 'Cancel', 'Load Model...', 'Save Model...', and 'Help'. Below these are four checkboxes: 'Assume Linear Model' (checked), 'Assume Non-Negative' (checked), 'Use Automatic Scaling' (unchecked), and 'Show Iteration Results' (unchecked). At the bottom, there are three groups of radio buttons: 'Estimates' with 'Tangent' (selected) and 'Quadratic' (unselected); 'Derivatives' with 'Forward' (selected) and 'Central' (unselected); and 'Search' with 'Newton' (selected) and 'Conjugate' (unselected).

Solver Options

Max Time: 100 seconds

Iterations: 100

Precision: 0.000001

Tolerance: 5 %

Convergence: 0.0001

☒ Assume Linear Model ☐ Use Automatic Scaling

☒ Assume Non-Negative ☐ Show Iteration Results

Estimates: ☒ Tangent ☐ Quadratic

Derivatives: ☒ Forward ☐ Central

Search: ☒ Newton ☐ Conjugate

Buttons: OK, Cancel, Load Model..., Save Model..., Help

Solving of the Reddy Mikks Model in Python (Gurobi)

```
#Import gurobi and name model
from gurobipy import *
model=Model("Reddy_Mikks_Company")

#Define decision variables
x1={}
x1=model.addVar(vtype=GRB.CONTINUOUS, lb=0, ub=GRB.INFINITY)

x2={}
x2=model.addVar(vtype=GRB.CONTINUOUS, lb=0, ub=GRB.INFINITY)

#Define objective function
z=5*x1+4*x2
model.setObjective(z)
model.modelSense=GRB.MAXIMIZE
model.update()

#Add constraints
model.addConstr(6*x1+4*x2<=24)
model.addConstr(x1+2*x2<=6)
model.addConstr((-1)*x1+x2<=1)
model.addConstr(x2<=2)

model.update()

#Solve the model
model.optimize()

#printing outputs
if model.status==GRB.OPTIMAL:
    print ("\n Optimal value (profit in USD thousands):", model.objVal)
    print ("--- Production quantities---")
    print ("x1", x1.x)
    print ("x2", x2.x)
```

Gurobi Optimizer version 9.0.3 build v9.0.3rc0 (win64)
Optimize a model with 4 rows, 2 columns and 7 nonzeros
Model fingerprint: 0x5633e080
Coefficient statistics:
Matrix range [1e+00, 6e+00]
Objective range [4e+00, 5e+00]
Bounds range [0e+00, 0e+00]
RHS range [1e+00, 2e+01]
Presolve removed 1 rows and 0 columns
Presolve time: 0.01s
Presolved: 3 rows, 2 columns, 6 nonzeros

Iteration	Objective	Primal Inf.	Dual Inf.	Time
0	2.4000000e+01	1.200000e+01	0.000000e+00	0s
3	2.1000000e+01	0.000000e+00	0.000000e+00	0s

Solved in 3 iterations and 0.01 seconds
Optimal objective 2.100000000e+01

Optimal value (profit in USD thousands): 21.0
--- Production quantities---
x1 3.0
x2 1.5



THANK YOU

QUESTIONS?

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