

Operationeel Onderzoek

Opgave 6: oplossing

Oefening 1-

Let $y_1 = 1$ if NY is used, $y_2 = 1$ if LA is used, $y_3 = 1$ if Chicago is used, $y_4 = 1$ if Atlanta is used. Also $y_i = 0$ if city i is not used. Define x_{ij} = units shipped from warehouse in city i to region j

$$\min z = 400y_1 + 500y_2 + 300y_3 + 150y_4 + 20x_{11} + 40x_{12} + 50x_{13} + 48x_{21} + 15x_{22} + 26x_{23} + 26x_{31} + 35x_{32} + 18x_{33} + 24x_{41} + 50x_{42} + 35x_{43}$$

$$\text{st } x_{11} + x_{21} + x_{31} + x_{41} \geq 80, x_{12} + x_{22} + x_{32} + x_{42} \geq 70$$

$$x_{13} + x_{23} + x_{33} + x_{43} \geq 40, x_{11} + x_{12} + x_{13} \leq 100y_1$$

$$x_{21} + x_{22} + x_{23} \leq 100y_2, x_{31} + x_{32} + x_{33} \leq 100y_3,$$

$$x_{41} + x_{42} + x_{43} \leq 100y_4, y_1 \leq y_2, y_2 + y_4 \geq 1,$$

$$y_1 + y_2 + y_3 + y_4 \leq 2, \text{ All } x_{ij} \geq 0, \text{ all } y_i = 0 \text{ or } 1.$$

Oefening 2-

Let $X_{ij} = 1$ if machine i is used to do job j and $X_{ij} = 0$ otherwise. Also let $Y_i = 1$ if machine i is used at all and $Y_i = 0$ otherwise. The correct IP is on the LINDO printout.

Section 9.2 Problem 23

$$\begin{aligned} \text{IN } & 42 X_{11} + 70 X_{12} + 85 X_{22} + 45 X_{23} + 58 X_{31} + 37 X_{34} + 58 X_{41} \\ & + 55 X_{43} + 38 X_{45} + 60 X_{52} + 54 X_{54} + 30 Y_1 + 40 Y_2 + 50 Y_3 + 60 Y_4 \\ & + 20 Y_5 + 93 X_{13} \end{aligned}$$

SUBJECT TO

$$2) X_{11} + X_{31} + X_{41} = 1$$

$$3) X_{12} + X_{22} + X_{52} = 1$$

$$4) X_{23} + X_{43} + X_{13} = 1$$

$$5) X_{34} + X_{54} = 1$$

$$6) X_{45} = 1$$

$$7) X_{11} + X_{12} - 3 Y_1 + X_{13} \leq 0$$

$$8) X_{22} + X_{23} - 2 Y_2 \leq 0$$

$$9) X_{31} + X_{34} - 2 Y_3 \leq 0$$

$$10) X_{41} + X_{43} + X_{45} - 3 Y_4 \leq 0$$

$$11) X_{52} + X_{54} - 2 Y_5 \leq 0$$

END

TITLE SECTION 9-2 PROBLEM 23

INTE 17

OBJECTIVE FUNCTION VALUE

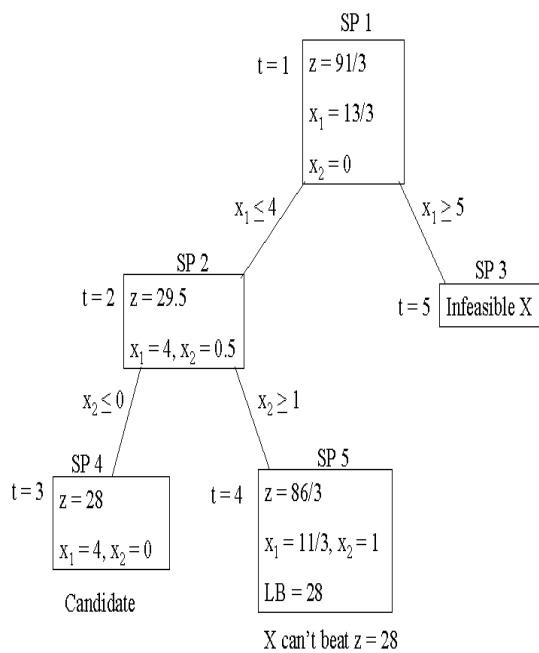
$$1) \quad 345.00000$$

VARIABLE	VALUE	REDUCED COST
X11	.000000	42.000000
X12	.000000	70.000000
X22	.000000	85.000000
X23	.000000	45.000000
X31	.000000	58.000000
X34	.000000	37.000000
X41	1.000000	58.000000
X43	1.000000	55.000000
X45	1.000000	38.000000

X52	1.000000	60.000000
X54	1.000000	54.000000
Y1	.000000	30.000000
Y2	.000000	40.000000
Y3	.000000	50.000000
Y4	1.000000	60.000000
Y5	1.000000	20.000000
X13	.000000	93.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	.000000	.000000
3)	.000000	.000000
4)	.000000	.000000
5)	.000000	.000000
6)	.000000	.000000
7)	.000000	.000000
8)	.000000	.000000
9)	.000000	.000000
10)	.000000	.000000
11)	.000000	.000000

Oefening 3-



Optimal Solution is $z = 28$, $x_1 = 4$, $x_2 = 0$.

Oefening 4-

Let X_i = number of units produced on machine i and

$Y_i = 1$ if machine i is used, $Y_i = 0$ otherwise. See LINDO printout for optimal solution.

Section 9.2 Problem 17 Printout

MIN $1000 Y_1 + 920 Y_2 + 800 Y_3 + 700 Y_4 + 20 X_1 + 24 X_2 + 16 X_3$
 $+ 28 X_4$

SUBJECT TO

2) $-900 Y_1 + X_1 \leq 0$

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3) - 1000 Y2 + X2 <= 0
4) - 1200 Y3 + X3 <= 0
5) - 1600 Y4 + X4 <= 0
6) X1 + X2 + X3 + X4 = 2000
END
INTE 4

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OBJECTIVE FUNCTION VALUE

1) 37000.00

VARIABLE	VALUE	REDUCED COST
Y1	1.000000	1000.000000
Y2	0.000000	920.000000
Y3	1.000000	-4000.000000
Y4	0.000000	700.000000
X1	800.000000	0.000000
X2	0.000000	4.000000
X3	1200.000000	0.000000
X4	0.000000	8.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	100.000000	0.000000
3)	0.000000	0.000000
4)	0.000000	4.000000
5)	0.000000	0.000000
6)	0.000000	-20.000000