

SOLUTIONS TO MIDTERM EXAM 2

Answer 1

We have that $x_1 \leq 2 \rightarrow x_1 < 3$ (or $3 - x_1 > 0$) implies $x_2 \leq 3$ (or $3 - x_2 \geq 0$). (10 pts.)

The following constraints are needed: (15 pts.)

$$x_2 - 3 \leq M y$$

$$3 - x_1 \leq M (1 - y)$$

$$y = 0 \text{ or } 1$$

M is a large positive number

Answer 2 (25 pts.)

$$\begin{aligned} \max & 10y_1 + 8y_2 + 5y_3 \\ \text{s.t.} & y_1 + 2y_2 \leq 3 \\ & -2y_1 + 2y_3 \leq 5 \\ & -2y_1 - 4y_2 = 8 \\ & 2y_3 \leq 1 \\ & y_1 \leq 0, y_2 \text{ urs}, y_3 \geq 0 \end{aligned}$$

Answer 3

Formulation: (15 pts.)

```
MIN    3 X1 + 5 X2 + 8 X3 + X4
SUBJECT TO
    2) X1 - 2 X2 - 2 X3 <= 10
    3) 2 X1 - 4 X3 = 8
    4) 2 X2 + 2 X4 >= 5
END
GIN    4
FREE    X3
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Solution: (5 pts.)

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LP OPTIMUM FOUND AT STEP    0
OBJECTIVE VALUE = -13.5000000
FIX ALL VARS.( 2) WITH RC > 4.00000
NEW INTEGER SOLUTION OF -13.0000000 AT BRANCH    0 PIVOT    1
BOUND ON OPTIMUM: -13.00000
ENUMERATION COMPLETE. BRANCHES=    0 PIVOTS=    1
LAST INTEGER SOLUTION IS THE BEST FOUND
RE-INSTALLING BEST SOLUTION...
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OBJECTIVE FUNCTION VALUE

1) -13.00000

VARIABLE	VALUE	REDUCED COST
X1	0.000000	3.000000
X2	0.000000	5.000000
X3	-2.000000	8.000000
X4	3.000000	1.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	6.000000	0.000000
3)	0.000000	0.000000
4)	1.000000	0.000000

NO. ITERATIONS= 1
 BRANCHES= 0 DETERM.= 1.000E 0

Hence the executive summary for the optimal solution is (5 pts.)

$z = -13$, $x_1 = x_2 = 0$, $x_3 = -2$, $x_4 = 3$

Answer 4

Customer 1 may buy two paintings so she gets supply points 1 and 1' (10 pts.).

Convert the given problem to a minimization problem.

Add a dummy painting.

	P1	P2	P3	P4	Dummy
A	-8	-11	0	0	0
A'	-8	-11	0	0	0
B	-9	-13	-12	-7	0
C	-9	0	-11	0	0
D	0	0	-12	-9	0

We obtain an optimal assignment $x_{44}=1$, $x_{33}=1$, $x_{22}=1$, $x_{1'1}=1$, and $x_{14}=1$.

Thus A purchases Painting 1, B purchases Painting 2, C purchases Painting 3, and D purchases Painting 4. (5 pts.)

Alternative optimal solution: A purchases Painting 2, B purchases Painting 3, C purchases Painting 1, and D purchases Painting 4. (5 pts.)

Total revenue is \$41,000 ($8+13+11+9=41$ or $11+12+9+9$). (5 pts.)