تکلیف در منزل

موضوع: تحلیل حساسیت

نام درس: مدل‌سازی ریاضی

استاد درس: مسعود براتی

1 HAL produces two types of computers: PCs and VAXes. The computers are produced in two locations: New York and Los Angeles. New York can produce up to 800 computers and Los Angeles up to 1,000 computers. HAL can sell up to 900 PCs and 900 VAXes. The profit associated with each production site and computer sale is as follows: New York—PC, $600; VAX, $800; Los Angeles—PC, $1,000; VAX, $1,300. The skilled labor required to build each computer at each location is as follows: New York—PC, 2 hours; VAX, 2 hours; Los Angeles—PC, 3 hours; VAX, 4 hours. A total of 4,000 hours of labor are available. Labor is purchased at a cost of $20 per hour. Let

XNP = PCs produced in New York

XLP = PCs produced in Los Angeles

XNV = VAXes produced in New York

XLV = VAXes produced in Los Angeles

Use the LINDO printout in Figure 17 to answer the following questions:

a If 3,000 hours of skilled labor were available, what would be HAL's profit?

b Suppose an outside contractor offers to increase the capacity of New York to 850 computers at a cost of $5,000. Should HAL hire the contractor?

c By how much would the profit for a VAX produced in Los Angeles have to increase before HAL would want to produce VAXes in Los Angeles?

d What is the most HAL should pay for an extra hour of labor?

FIGURE 17

LINDO Output for HAL

```
MAX       600  XNP + 1000 XLP + 800 XNV
                           + 1300 XLV - 20 L
SUBJECT TO
       2)     2 XNP + 3 XLP + 2 XNV
                          + 4 XLV - L <=    0
       3)     XNP  +  XNV   <=   800
       4)     XLP  +  XLV   <=  1000
       5)     XNP  +  XLP   <=   900
       6)     XNV  +  XLV   <=   900
       7)     L   <=    4000
END

LP OPTIMUM FOUND AT STEP              3

                OBJECTIVE FUNCTION VALUE

                1)  1360000.00

VARIABLE          VALUE        REDUCED COST
     XNP        .000000          200.000000
     XLP     800.000000            .000000
     XNV     800.000000            .000000
     XLV        .000000          33.333370
       L    4000.000000            .000000


     ROW   SLACK OR SURPLUS    DUAL PRICES
      2)        .000000         333.333300
      3)        .000000         133.333300
      4)     200.000000            .000000
      5)     100.000000            .000000
      6)     100.000000            .000000
      7)        .000000         313.333300

NO. ITERATIONS=         3

RANGES IN WHICH THE BASIS IS UNCHANGED:

                    OBJ COEFFICIENT RANGES
VARIABLE     CURRENT     ALLOWABLE       ALLOWABLE
              COEF       INCREASE        DECREASE
     XNP  600.000000    200.000000        INFINITY
     XLP 1000.000000    200.000000       25.000030
     XNV  800.000000      INFINITY      133.333300
     XLV 1300.000000     33.333370        INFINITY
       L  -20.000000      INFINITY      313.333300

                RIGHTHAND SIDE RANGES
     ROW  CURRENT       ALLOWABLE      ALLOWABLE
            RHS          INCREASE       DECREASE
       2     .000000   300.000000    2400.000000
       3  800.000000   100.000000     150.000000
       4 1000.000000     INFINITY     200.000000
       5  900.000000     INFINITY     100.000000
       6  900.000000     INFINITY     100.000000
       7 4000.000000   300.000000    2400.000000
```

2 Vivian's Gem Company produces two types of gems: Types 1 and 2. Each Type 1 gem contains 2 rubies and 4 diamonds. A Type 1 gem sells for \$10 and costs \$5 to produce. Each Type 2 gem contains 1 ruby and 1 diamond. A Type 2 gem sells for \$6 and costs \$4 to produce. A total of 30 rubies and 50 diamonds are available. All gems that are produced can be sold, but marketing considerations dictate that at least 11 Type 1 gems be produced. Let x_1 = number of Type 1 gems produced and x_2 = number of Type 2 gems produced. Assume that Vivian wants to maximize profit. Use the LINDO printout in Figure 18 to answer the following questions:

a What would Vivian's profit be if 46 diamonds were available?

b If Type 2 gems sold for only \$5.50, what would be the new optimal solution to the problem?

c What would Vivian's profit be if at least 12 Type 1 gems had to be produced?

FIGURE 18
LINDO Output for Vivian's Gem

```
MAX        5  X1 + 2  X2
SUBJECT TO
       2)      2  X1  +  X2 <=  30
       3)      4  X1  +  X2 <=  50
       4)      X1  >=     11
END

LP OPTIMUM FOUND AT STEP               2

                OBJECTIVE FUNCTION VALUE

                1)  67.0000000

VARIABLE          VALUE          REDUCED COST
      X1        11.000000             .000000
      X2         6.000000             .000000


     ROW     SLACK OR SURPLUS    DUAL PRICES
      2)         2.000000           0.000000
      3)          .000000           2.000000
      4)          .000000          -3.000000

NO. ITERATIONS=          2

RANGES IN WHICH THE BASIS IS UNCHANGED:

                     OBJ COEFFICIENT RANGES
VARIABLE    CURRENT       ALLOWABLE        ALLOWABLE
             COEF         INCREASE         DECREASE
      X1    5.000000      3.000000         INFINITY
      X2    2.000000      INFINITY          .750000

                    RIGHTHAND SIDE RANGES
     ROW    CURRENT       ALLOWABLE        ALLOWABLE
              RHS         INCREASE         DECREASE
       2   30.000000      INFINITY         2.000000
       3   50.000000      2.000000         6.000000
       4   11.000000      1.500000         1.000000
```