

CS325 HW6

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I'm using LINDO software to solve the question 1-3.

1.

a)

Lindo code below:

max g

ST

a=0

h-g<=3

b-h<=9

a-h<=4

b-a<=8

f-a<=10

a-f<=5

b-f<=7

c-f<=3

c-b<=4

$$d-c \leq 3$$

$$f-d \leq 18$$

$$e-b \leq 10$$

$$d-e \leq 9$$

$$e-d \leq 25$$

$$d-g \leq 2$$

$$g-e \leq 7$$

$$e-f \leq 2$$

end

the shortest path from A to G is 19, the result screenshot below:

Reports Window

LP OPTIMUM FOUND AT STEP 3

OBJECTIVE FUNCTION VALUE

1) 19.00000

VARIABLE	VALUE	REDUCED COST
G	19.000000	0.000000
A	0.000000	0.000000
H	22.000000	0.000000
B	8.000000	0.000000
F	10.000000	0.000000
C	12.000000	0.000000
D	0.000000	0.000000
E	12.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	1.000000
3)	0.000000	0.000000
4)	23.000000	0.000000
5)	26.000000	0.000000
6)	0.000000	0.000000
7)	0.000000	1.000000
8)	15.000000	0.000000
9)	9.000000	0.000000
10)	1.000000	0.000000
11)	0.000000	0.000000
12)	15.000000	0.000000
13)	8.000000	0.000000
14)	6.000000	0.000000
15)	21.000000	0.000000
16)	13.000000	0.000000
17)	21.000000	0.000000
18)	0.000000	1.000000
19)	0.000000	1.000000

NO. ITERATIONS= 3

b)

the Lindo code below:

$$\max a+b+c+d+e+f+h$$

ST

$$a=0$$

$$h-g\leq 3$$

$$b-h\leq 9$$

$$a-h\leq 4$$

$$b-a\leq 8$$

$$f-a\leq 10$$

$$a-f\leq 5$$

$$b-f\leq 7$$

$$c-f\leq 3$$

$$c-b\leq 4$$

$$d-c\leq 3$$

$$f-d\leq 18$$

$$e-b\leq 10$$

$$d-e\leq 9$$

$$e-d \leq 25$$

$$d-g \leq 2$$

$$g-e \leq 7$$

$$e-f \leq 2$$

end

the result is :

a to a is 0

a to b is 8

a to c is 12

a to d is 15

a to e is 12

a to f is 10

a to h is 22

a to g is 19

screenshot list below:

Reports Window		
LP OPTIMUM FOUND AT STEP 7		
OBJECTIVE FUNCTION VALUE		
1)	79.000000	
VARIABLE	VALUE	REDUCED COST
A	0.000000	0.000000
B	8.000000	0.000000
C	12.000000	0.000000
D	15.000000	0.000000
E	12.000000	0.000000
F	10.000000	0.000000
H	22.000000	0.000000
G	19.000000	0.000000
ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	7.000000
3)	0.000000	1.000000
4)	23.000000	0.000000
5)	26.000000	0.000000
6)	0.000000	3.000000
7)	0.000000	3.000000
8)	15.000000	0.000000
9)	9.000000	0.000000
10)	1.000000	0.000000
11)	0.000000	2.000000
12)	0.000000	1.000000
13)	23.000000	0.000000
14)	6.000000	0.000000
15)	6.000000	0.000000
16)	28.000000	0.000000
17)	6.000000	0.000000
18)	0.000000	1.000000
19)	0.000000	2.000000

2.

type		selling	labor	material	Profit
silk	s	6.75	0.75	$0.125 \times 20 = 2.5$	$6.75 - 0.75 - 2.5 = 3.5$
polyester	p	3.50	0.75	$0.08 \times 6 = 0.48$	$3.50 - 0.75 - 0.48 = 2.27$
blend 1	b	4.31	0.75	$0.05 \times 6 + 0.05 \times 12 = 0.9$	$4.31 - 0.75 - 0.9 = 2.66$
blend 2	c	4.81	0.75	$0.03 \times 6 + 0.07 \times 12 = 1.02$	$4.81 - 0.75 - 1.02 = 3.04$

the Lindo code list below:

max 3.5s+2.27p+2.66b+3.04c

ST

0.125s<=1000

0.08p+0.05b+0.03c<=2050

0.05b+0.07c<=1250

s>=6000

s<=7000

p>=10000

p<=14000

b>=14000

b<=16000

c>=6000

c<=8500

end

GIN s

GIN p

GIN b

GIN c

The optimal number for s is 7000, for p is 13928, for b is 14001, for c is 7856. The result screenshot is below:

Reports Window		
LAST INTEGER SOLUTION IS THE BEST FOUND RE-INSTALLING BEST SOLUTION...		
OBJECTIVE FUNCTION VALUE		
1)	117241.5	
VARIABLE	VALUE	REDUCED COST
S	7000.000000	-3.500000
P	13928.000000	-2.270000
B	14001.000000	-2.660000
C	7856.000000	-3.040000
ROW	SLACK OR SURPLUS	DUAL PRICES
2)	125.000000	0.000000
3)	0.030020	0.000000
4)	0.029987	0.000000
5)	1000.000000	0.000000
6)	0.000000	0.000000
7)	3928.000000	0.000000
8)	72.000000	0.000000
9)	1.000000	0.000000
10)	1999.000000	0.000000
11)	1856.000000	0.000000
12)	644.000000	0.000000
NO. ITERATIONS= 46		
BRANCHES= 8 DETERM. = 1.000E 0		

3.

a)

$$\min v1+v2+v3+v4$$

ST

$$v1+5v2+10v3+25v4=202$$

$$v1 \geq 0$$

$$v2 \geq 0$$

$$v3 \geq 0$$

$v_4 \geq 0$

end

gin v1

gin v2

gin v3

gin v4

2 '1' value and 8 '25' value will be used; the screenshot is below:

```
Reports Window

LP OPTIMUM FOUND AT STEP      1
OBJECTIVE VALUE =    8.07999992

FIX ALL VARS.(      2)  WITH RC >  0.000000E+00
SET      V1 TO >=      1 AT      1, BND=  -9.040      TWIN=-0.1000E+31      5
SET      V4 TO <=      8 AT      2, BND= -10.00      TWIN=-0.1000E+31      6

NEW INTEGER SOLUTION OF      10.0000000      AT BRANCH      2 PIVOT      6
BOUND ON OPTIMUM:  9.0000000
DELETE      V4 AT LEVEL      2
DELETE      V1 AT LEVEL      1
RELEASE FIXED VARIABLES
FIX ALL VARS.(      1)  WITH RC >  0.000000E+00
SET      V3 TO <=      1 AT      1, BND=  -9.000      TWIN=  -9.280      15
SET      V1 TO >=      1 AT      2, BND=  -9.640      TWIN=-0.1000E+31      18
DELETE      V1 AT LEVEL      2
DELETE      V3 AT LEVEL      1
RELEASE FIXED VARIABLES
FIX ALL VARS.(      1)  WITH RC >  0.000000E+00
SET      V3 TO <=      0 AT      1, BND=  -9.000      TWIN=  -9.480      25
SET      V2 TO >=      2 AT      2, BND=  -9.680      TWIN=-0.1000E+31      27
DELETE      V2 AT LEVEL      2
DELETE      V3 AT LEVEL      1
RELEASE FIXED VARIABLES
ENUMERATION COMPLETE. BRANCHES=      6 PIVOTS=      32

LAST INTEGER SOLUTION IS THE BEST FOUND
RE-INSTALLING BEST SOLUTION...

      OBJECTIVE FUNCTION VALUE
      1)      10.00000

      VARIABLE      VALUE      REDUCED COST
      V1      2.000000      1.000000
      V2      0.000000      1.000000
      V3      0.000000      1.000000
      V4      8.000000      1.000000

      ROW      SLACK OR SURPLUS      DUAL PRICES
      2)      0.000000      0.000000
      3)      2.000000      0.000000
      4)      0.000000      0.000000
      5)      0.000000      0.000000
      6)      8.000000      0.000000

NO. ITERATIONS=      32
BRANCHES=      6 DETERM.=  1.000E  0
```


b)

$$\min v1+v2+v3+v4+v5$$

ST

$$v1+3v2+7v3+12v4+27v5=293$$

$$v1 \geq 0$$

$$v2 \geq 0$$

$$v3 \geq 0$$

$$v4 \geq 0$$

$$v5 \geq 0$$

end

gin v1

gin v2

gin v3

gin v4

gin v5

the optimal solution would be 2 '7', 3 '12', 9 '27'

the result is below:

Reports Window

```

LP OPTIMUM FOUND AT STEP      99
OBJECTIVE VALUE = 10.8518515

FIX ALL VARS.(      2) WITH RC > 0.000000E+00
SET      V1 TO <=      0 AT      1. BND= -12.33      TWIN= -12.83      106
SET      V5 TO <=      9 AT      2. BND= -13.17      TWIN=-0.1000E+31      108
SET      V5 TO >=      9 AT      3. BND= -13.17      TWIN=-0.1000E+31      108
DELETE    V4 AT LEVEL      4
DELETE    V5 AT LEVEL      3
DELETE    V5 AT LEVEL      2
FLIP      V1 TO >=      1 AT      1 WITH BND= -12.833333
SET      V4 TO >=      2 AT      2. BND= -12.93      TWIN= -22.00      110
SET      V5 TO <=      9 AT      3. BND= -14.08      TWIN=-0.1000E+31      112
DELETE    V5 AT LEVEL      3
DELETE    V4 AT LEVEL      2
DELETE    V1 AT LEVEL      1
RELEASE FIXED VARIABLES
FIX ALL VARS.(      2) WITH RC > 0.000000E+00
SET      V4 TO <=      1 AT      1. BND= -12.57      TWIN= -12.70      120
SET      V3 TO <=      2 AT      2. BND= -12.75      TWIN=-0.1000E+31      121
SET      V4 TO >=      1 AT      3. BND= -12.89      TWIN= -13.29      123
SET      V5 TO <=      9 AT      4. BND= -12.89      TWIN=-0.1000E+31      123
SET      V5 TO >=      9 AT      5. BND= -15.43      TWIN=-0.1000E+31      126
DELETE    V3 AT LEVEL      6
DELETE    V5 AT LEVEL      5
DELETE    V5 AT LEVEL      4
FLIP      V4 TO <=      0 AT      3 WITH BND= -13.285714
SET      V3 TO >=      4 AT      4. BND= -13.81      TWIN=-0.1000E+31      128
SET      V3 TO <=      4 AT      5. BND= -13.81      TWIN=-0.1000E+31      128
DELETE    V5 AT LEVEL      6
DELETE    V3 AT LEVEL      5
DELETE    V3 AT LEVEL      4
DELETE    V4 AT LEVEL      3
DELETE    V3 AT LEVEL      2
FLIP      V4 TO >=      2 AT      1 WITH BND= -12.703704
SET      V5 TO <=      9 AT      2. BND= -13.58      TWIN=-0.1000E+31      130
SET      V5 TO >=      9 AT      3. BND= -13.58      TWIN=-0.1000E+31      130
SET      V4 TO <=      3 AT      4. BND= -14.00      TWIN=-0.1000E+31      131

NEW INTEGER SOLUTION OF 14.0000000 AT BRANCH 47 PIVOT 131
BOUND ON OPTIMUM: 12.33333
DELETE    V4 AT LEVEL      4
DELETE    V5 AT LEVEL      3
DELETE    V5 AT LEVEL      2
DELETE    V4 AT LEVEL      1
RELEASE FIXED VARIABLES
FIX ALL VARS.(      1) WITH RC > 0.583333
SET      V3 TO <=      0 AT      1. BND= -12.67      TWIN=-0.1000E+31      141
SET      V4 TO >=      2 AT      2. BND= -12.85      TWIN= -14.67      143
SET      V4 TO <=      2 AT      3. BND= -12.85      TWIN=-0.1000E+31      143
SET      V5 TO <=      9 AT      4. BND= -19.67      TWIN=-0.1000E+31      145
DELETE    V5 AT LEVEL      4
DELETE    V4 AT LEVEL      3
DELETE    V4 AT LEVEL      2
DELETE    V3 AT LEVEL      1
ENUMERATION COMPLETE. BRANCHES= 49 PIVOTS= 145

LAST INTEGER SOLUTION IS THE BEST FOUND
RE-INSTALLING BEST SOLUTION...

OBJECTIVE FUNCTION VALUE
1) 14.00000

VARIABLE      VALUE      REDUCED COST
V1      0.000000      1.000000
V2      0.000000      1.000000
V3      2.000000      1.000000
V4      3.000000      1.000000
V5      9.000000      1.000000

ROW      SLACK OR SURPLUS      DUAL PRICES
2)      0.000000      0.000000
3)      0.000000      0.000000
4)      0.000000      0.000000
5)      2.000000      0.000000
6)      3.000000      0.000000
7)      9.000000      0.000000

NO. ITERATIONS= 145
BRANCHES= 49 DETERM.= 1.000E 0

```

4.

$$x_1 + x_2 - x_3 + s_1 \leq 14 \text{ (slack)}$$

$$6x_1 - x_2 - s_2 \geq 8 \text{ (surplus)}$$

$$-x_1 + 2x_2 + 2x_3 - s_3 \geq 0 \text{ (surplus)}$$

Slack form:

Maximize $2x_1 - 6x_3$

Subject to

$$S_1 = 14 - x_1 - x_2 + x_3$$

$$S_2 = -8 + 6x_1 - x_2$$

$$S_3 = -x_1 + 2x_2 + 3x_3$$

$$X_1 \geq 0$$

$$X_2 \geq 0$$

$$X_3 \geq 0$$

$$S_1 \geq 0$$

$$S_2 \geq 0$$

$$S_3 \geq 0$$

End

Basic variable: s_1 , s_2 and s_3 .

Non-basic variable: x_1 , x_2 and x_3 .

