1a.

```
max dc
ST
        dg = 0
        dd - dg <= 2
        df - dd <= 18
        da - df <= 5
        db - da <= 8
        dc - db <= 4
        de - df <= 2
        dg - de <= 7
        dd - de <= 9
        dh - dg <= 3
        db - dh <= 9
        da - dh <= 4
        df - da <= 10
        dc - df <= 3
END
LP OPTIMUM FOUND AT STEP      5

      OBJECTIVE FUNCTION VALUE

      1)     16.00000

 VARIABLE        VALUE          REDUCED COST
      DC        16.000000         0.000000
      DG         0.000000         0.000000
      DD         0.000000         0.000000
      DF        13.000000         0.000000
      DA         4.000000         0.000000
      DB        12.000000         0.000000
      DE         0.000000         0.000000
      DH         3.000000         0.000000


     ROW    SLACK OR SURPLUS      DUAL PRICES
      2)         0.000000          1.000000
      3)         2.000000          0.000000
      4)         5.000000          0.000000
      5)        14.000000          0.000000
      6)         0.000000          0.000000
      7)         0.000000          1.000000
      8)        15.000000          0.000000
      9)         7.000000          0.000000
     10)         9.000000          0.000000
     11)         0.000000          1.000000
     12)         0.000000          1.000000
     13)         3.000000          0.000000
```

14)	1.000000	0.000000
15)	0.000000	0.000000

NO. ITERATIONS= 5

1b. changed each max to the corresponding vertex to get the optimal value.

```
max da
ST
        dg = 0
        dd - dg <= 2
        df - dd <= 18
        da - df <= 5
        db - da <= 8
        dc - db <= 4
        de - df <= 2
        dg - de <= 7
        dd - de <= 9
        dh - dg <= 3
        db - dh <= 9
        da - dh <= 4
        df - da <= 10
        dc - df <= 3
        de - dd <= 25
        dd - de <= 9
        de - db <= 10
        dd - dc <= 3
        db - df <= 7
END
LP OPTIMUM FOUND AT STEP     4

     OBJECTIVE FUNCTION VALUE

     1)     7.000000

 VARIABLE       VALUE        REDUCED COST
     DA        7.000000        0.000000
     DG        0.000000        0.000000
     DD        0.000000        0.000000
     DF        2.000000        0.000000
     DB        0.000000        0.000000
     DC        0.000000        0.000000
     DE        0.000000        0.000000
     DH        3.000000        0.000000


    ROW   SLACK OR SURPLUS     DUAL PRICES
     2)        0.000000        1.000000
     3)        2.000000        0.000000
```

4)	16.000000	0.000000
5)	0.000000	0.000000
6)	15.000000	0.000000
7)	4.000000	0.000000
8)	4.000000	0.000000
9)	7.000000	0.000000
10)	9.000000	0.000000
11)	0.000000	1.000000
12)	12.000000	0.000000
13)	0.000000	1.000000
14)	15.000000	0.000000
15)	5.000000	0.000000
16)	25.000000	0.000000
17)	9.000000	0.000000
18)	10.000000	0.000000
19)	3.000000	0.000000
20)	9.000000	0.000000

NO. ITERATIONS= 4

---

steps for db

LP OPTIMUM FOUND AT STEP 2

OBJECTIVE FUNCTION VALUE

1) 12.00000

VARIABLE	VALUE	REDUCED COST
DB	12.000000	0.000000
DG	0.000000	0.000000
DD	0.000000	0.000000
DF	5.000000	0.000000
DA	7.000000	0.000000
DC	0.000000	0.000000
DE	0.000000	0.000000
DH	3.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	1.000000
3)	2.000000	0.000000
4)	13.000000	0.000000
5)	3.000000	0.000000
6)	3.000000	0.000000
7)	16.000000	0.000000
8)	7.000000	0.000000
9)	7.000000	0.000000
10)	9.000000	0.000000

11)	0.000000	1.000000
12)	0.000000	1.000000
13)	0.000000	0.000000
14)	12.000000	0.000000
15)	8.000000	0.000000
16)	25.000000	0.000000
17)	9.000000	0.000000
18)	22.000000	0.000000
19)	3.000000	0.000000
20)	0.000000	0.000000

NO. ITERATIONS= 2

---

steps dd

LP OPTIMUM FOUND AT STEP 3

OBJECTIVE FUNCTION VALUE

1) 2.000000

VARIABLE	VALUE	REDUCED COST
DD	2.000000	0.000000
DG	0.000000	0.000000
DF	0.000000	0.000000
DA	5.000000	0.000000
DB	7.000000	0.000000
DC	0.000000	0.000000
DE	0.000000	0.000000
DH	3.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	1.000000
3)	0.000000	1.000000
4)	20.000000	0.000000
5)	0.000000	0.000000
6)	6.000000	0.000000
7)	11.000000	0.000000
8)	2.000000	0.000000
9)	7.000000	0.000000
10)	7.000000	0.000000
11)	0.000000	0.000000
12)	5.000000	0.000000
13)	2.000000	0.000000
14)	15.000000	0.000000
15)	3.000000	0.000000
16)	27.000000	0.000000
17)	7.000000	0.000000

18)	17.000000	0.000000
19)	1.000000	0.000000
20)	0.000000	0.000000

NO. ITERATIONS= 3

---

steps for de

LP OPTIMUM FOUND AT STEP 8

OBJECTIVE FUNCTION VALUE

1) 19.00000

VARIABLE	VALUE	REDUCED COST
DE	19.000000	0.000000
DG	0.000000	0.000000
DD	2.000000	0.000000
DF	17.000000	0.000000
DA	7.000000	0.000000
DB	9.000000	0.000000
DC	0.000000	0.000000
DH	3.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	1.000000
3)	0.000000	0.000000
4)	3.000000	0.000000
5)	15.000000	0.000000
6)	6.000000	0.000000
7)	13.000000	0.000000
8)	0.000000	1.000000
9)	26.000000	0.000000
10)	26.000000	0.000000
11)	0.000000	1.000000
12)	3.000000	0.000000
13)	0.000000	1.000000
14)	0.000000	1.000000
15)	20.000000	0.000000
16)	8.000000	0.000000
17)	26.000000	0.000000
18)	0.000000	0.000000
19)	1.000000	0.000000
20)	15.000000	0.000000

NO. ITERATIONS= 8

---

steps for df

LP OPTIMUM FOUND AT STEP 5

OBJECTIVE FUNCTION VALUE

1) 17.00000

VARIABLE	VALUE	REDUCED COST
DF	17.000000	0.000000
DG	0.000000	0.000000
DD	2.000000	0.000000
DA	7.000000	0.000000
DB	0.000000	0.000000
DC	4.000000	0.000000
DE	10.000000	0.000000
DH	3.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	1.000000
3)	0.000000	0.000000
4)	3.000000	0.000000
5)	15.000000	0.000000
6)	15.000000	0.000000
7)	0.000000	0.000000
8)	9.000000	0.000000
9)	17.000000	0.000000
10)	17.000000	0.000000
11)	0.000000	1.000000
12)	12.000000	0.000000
13)	0.000000	1.000000
14)	0.000000	1.000000
15)	16.000000	0.000000
16)	17.000000	0.000000
17)	17.000000	0.000000
18)	0.000000	0.000000
19)	5.000000	0.000000
20)	24.000000	0.000000

NO. ITERATIONS= 5

---

steps for dh

LP OPTIMUM FOUND AT STEP 2

OBJECTIVE FUNCTION VALUE

1) 3.000000

VARIABLE	VALUE	REDUCED COST

DH	3.000000	0.000000
DG	0.000000	0.000000
DD	2.000000	0.000000
DF	10.000000	0.000000
DA	0.000000	0.000000
DB	2.000000	0.000000
DC	6.000000	0.000000
DE	12.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	1.000000
3)	0.000000	0.000000
4)	10.000000	0.000000
5)	15.000000	0.000000
6)	6.000000	0.000000
7)	0.000000	0.000000
8)	0.000000	0.000000
9)	19.000000	0.000000
10)	19.000000	0.000000
11)	0.000000	1.000000
12)	10.000000	0.000000
13)	7.000000	0.000000
14)	0.000000	0.000000
15)	7.000000	0.000000
16)	15.000000	0.000000
17)	19.000000	0.000000
18)	0.000000	0.000000
19)	7.000000	0.000000
20)	15.000000	0.000000

NO. ITERATIONS= 2

2. profit = selling price – labor – mat cost

silk tie

6.7 - .75 – 20(.12) = 6.7-3.25 profit = 3.45

poly

3.55 - .75- .48-= profit 2.32

b1

4.31-.75- .3-.45= profit =2.81

b2

4.81-.75-.18-.63profit = 3.25

the optimal number of each type of tie is: silk 7000, poly 13625, blend 1 13100, blend 2 8500.

max 3.45s + 2.32p + 2.81b + 3.25x

ST

s >= 6000

s <= 7000

```
        p >= 10000
        p <= 14000
        b >= 13000
        b <= 16000
        x >= 6000
        x <= 8500
        s.125 <= 1000
        .08p + .05b + .03x <= 2000
        .05b + .07x <= 1250
END
LP OPTIMUM FOUND AT STEP      0

      OBJECTIVE FUNCTION VALUE

      1)     120196.0

 VARIABLE        VALUE          REDUCED COST
       S      7000.000000         0.000000
       P     13625.000000         0.000000
       B     13100.000000         0.000000
       X      8500.000000         0.000000
   S.125         0.000000         0.000000


     ROW   SLACK OR SURPLUS     DUAL PRICES
      2)     1000.000000         0.000000
      3)        0.000000         3.450000
      4)     3625.000000         0.000000
      5)      375.000000         0.000000
      6)      100.000000         0.000000
      7)     2900.000000         0.000000
      8)     2500.000000         0.000000
      9)        0.000000         0.476000
     10)     1000.000000         0.000000
     11)        0.000000        29.000000
     12)        0.000000        27.200001

 NO. ITERATIONS=       0
```

3a. we get a min cost of 17100 the optimal shipping route are in the data below a-d are the plants e-g are warehouse and h-n are the retailers so if is says ae it is plant1->warehouse1.

```
 min 10ae + 15af + 11be + 8bf + 13ce + 8cf + 9cg + 14df + 8dg + 5eh + 6ei + 7ej + 10ek + 12fj + 8fk + 10fl +
14fm + 14gk + 12gl + 12gm +6gn
ST
ae + af + ag <= 150
be + bf + bg <= 450
ce + cf + cg <=250
```

```
de + df + dg <= 150
eh  >= 100
ei >= 150
ej + fj  >= 100
ek + fk + gk >= 200
fl + gl >= 200
fm + gm >= 150
gn >= 100
ae >= 0
af >= 0
ag >= 0
be >= 0
bf >= 0
bg >= 0
ce >= 0
cf >= 0
cg >= 0
de >= 0
df >= 0
dg >= 0
eh >= 0
ei >= 0
ej >= 0
ek >= 0
fj >= 0
fk >= 0
fl >= 0
fm >= 0
gk >= 0
gl >= 0
gm >= 0
gn>= 0
ae + be + ce - eh - ei - ej - ek >= 0
af + bf + cf + df- fj - fk - fl - fm >= 0
cg + dg - gk - gl - gm - gn >= 0
END

LP OPTIMUM FOUND AT STEP     13

      OBJECTIVE FUNCTION VALUE

      1)     17100.00

 VARIABLE       VALUE         REDUCED COST
      AE      150.000000         0.000000
      AF        0.000000         8.000000
      BE      200.000000         0.000000
      BF      250.000000         0.000000
```

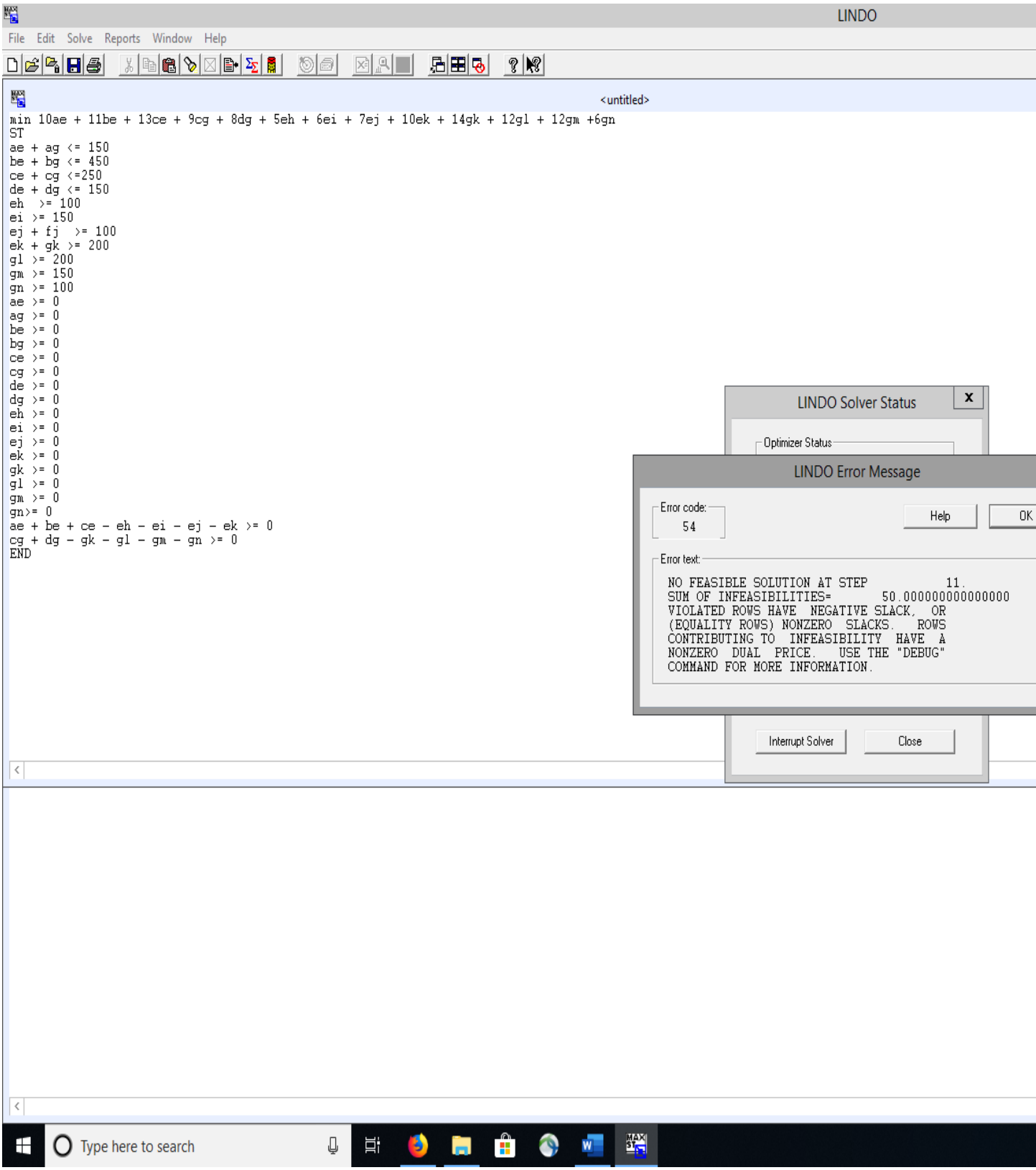
CE	0.000000	2.000000
CF	150.000000	0.000000
CG	100.000000	0.000000
DF	0.000000	7.000000
DG	150.000000	0.000000
EH	100.000000	0.000000
EI	150.000000	0.000000
EJ	100.000000	0.000000
EK	0.000000	5.000000
FJ	0.000000	2.000000
FK	200.000000	0.000000
FL	200.000000	0.000000
FM	0.000000	1.000000
GK	0.000000	7.000000
GL	0.000000	3.000000
GM	150.000000	0.000000
GN	100.000000	0.000000
AG	0.000000	1.000000
BG	0.000000	0.000000
DE	0.000000	1.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	1.000000
3)	0.000000	0.000000
4)	0.000000	0.000000
5)	0.000000	1.000000
6)	0.000000	-16.000000
7)	0.000000	-17.000000
8)	0.000000	-18.000000
9)	0.000000	-16.000000
10)	0.000000	-18.000000
11)	0.000000	-21.000000
12)	0.000000	-15.000000
13)	150.000000	0.000000
14)	0.000000	0.000000
15)	0.000000	0.000000
16)	200.000000	0.000000
17)	250.000000	0.000000
18)	0.000000	0.000000
19)	0.000000	0.000000
20)	150.000000	0.000000
21)	100.000000	0.000000
22)	0.000000	0.000000
23)	0.000000	0.000000
24)	150.000000	0.000000
25)	100.000000	0.000000
26)	150.000000	0.000000

27)	100.000000	0.000000
28)	0.000000	0.000000
29)	0.000000	0.000000
30)	200.000000	0.000000
31)	200.000000	0.000000
32)	0.000000	0.000000
33)	0.000000	0.000000
34)	0.000000	0.000000
35)	150.000000	0.000000
36)	100.000000	0.000000
37)	0.000000	-11.000000
38)	0.000000	-8.000000
39)	0.000000	-9.000000

NO. ITERATIONS= 13

3b closing warehouse 2 would make it unfeasible to ship all the refrigerators. the supply from plant 3 and 4 are 400 these will all have to go to warehouse 3, since warehouse 3 can only ship to retailers 5-7 and there demand is 450. Based on the closing of warehouse 2 we can not meet the demand for those retailers and it is unfeasible



3c I added a constraint to limit the amount shipped from the plant to the warehouse of af + bf + cf + df <= 100, so this feasible but our optimal solution increased to 18300

LP OPTIMUM FOUND AT STEP 2

OBJECTIVE FUNCTION VALUE

1) 18300.00

VARIABLE	VALUE	REDUCED COST
AE	150.000000	0.000000
AF	0.000000	8.000000
BE	350.000000	0.000000
BF	100.000000	0.000000
CE	0.000000	4.000000
CF	0.000000	2.000000
CG	250.000000	0.000000
DF	0.000000	9.000000
DG	150.000000	0.000000
EH	100.000000	0.000000
EI	150.000000	0.000000
EJ	100.000000	0.000000
EK	150.000000	0.000000
FJ	0.000000	7.000000
FK	50.000000	0.000000
FL	50.000000	0.000000
FM	0.000000	4.000000
GK	0.000000	4.000000
GL	150.000000	0.000000
GM	150.000000	0.000000
GN	100.000000	0.000000
AG	0.000000	1.000000
BG	0.000000	0.000000
DE	0.000000	3.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	1.000000
3)	0.000000	0.000000
4)	0.000000	2.000000
5)	0.000000	3.000000
6)	0.000000	-16.000000
7)	0.000000	-17.000000
8)	0.000000	-18.000000
9)	0.000000	-21.000000
10)	0.000000	-23.000000
11)	0.000000	-23.000000
12)	0.000000	-17.000000
13)	150.000000	0.000000
14)	0.000000	0.000000
15)	0.000000	0.000000
16)	350.000000	0.000000

17)	100.000000	0.000000
18)	0.000000	0.000000
19)	0.000000	0.000000
20)	0.000000	0.000000
21)	250.000000	0.000000
22)	0.000000	0.000000
23)	0.000000	0.000000
24)	150.000000	0.000000
25)	100.000000	0.000000
26)	150.000000	0.000000
27)	100.000000	0.000000
28)	150.000000	0.000000
29)	0.000000	0.000000
30)	50.000000	0.000000
31)	50.000000	0.000000
32)	0.000000	0.000000
33)	0.000000	0.000000
34)	150.000000	0.000000
35)	150.000000	0.000000
36)	100.000000	0.000000
37)	0.000000	-11.000000
38)	0.000000	-13.000000
39)	0.000000	5.000000
40)	0.000000	-11.000000

NO. ITERATIONS= 2

RANGES IN WHICH THE BASIS IS UNCHANGED:

	OBJ COEFFICIENT RANGES		
VARIABLE	CURRENT COEF	ALLOWABLE INCREASE	ALLOWABLE DECREASE
AE	10.000000	1.000000	INFINITY
AF	15.000000	INFINITY	8.000000
BE	11.000000	INFINITY	1.000000
BF	8.000000	2.000000	INFINITY
CE	13.000000	INFINITY	4.000000
CF	8.000000	INFINITY	2.000000
CG	9.000000	2.000000	INFINITY
DF	14.000000	INFINITY	9.000000
DG	8.000000	3.000000	INFINITY
EH	5.000000	INFINITY	16.000000
EI	6.000000	INFINITY	17.000000
EJ	7.000000	7.000000	18.000000
EK	10.000000	INFINITY	2.000000
FJ	12.000000	INFINITY	7.000000
FK	8.000000	2.000000	INFINITY

FL	10.000000	4.000000	2.000000
FM	14.000000	INFINITY	4.000000
GK	14.000000	INFINITY	4.000000
GL	12.000000	2.000000	4.000000
GM	12.000000	4.000000	23.000000
GN	6.000000	INFINITY	17.000000
AG	0.000000	INFINITY	1.000000
BG	0.000000	INFINITY	0.000000
DE	0.000000	INFINITY	3.000000

RIGHTHAND SIDE RANGES

ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
2	150.000000	350.000000	0.000000
3	450.000000	INFINITY	0.000000
4	250.000000	50.000000	0.000000
5	150.000000	50.000000	0.000000
6	100.000000	0.000000	100.000000
7	150.000000	0.000000	150.000000
8	100.000000	0.000000	100.000000
9	200.000000	0.000000	150.000000
10	200.000000	0.000000	50.000000
11	150.000000	0.000000	50.000000
12	100.000000	0.000000	50.000000
13	0.000000	150.000000	INFINITY
14	0.000000	0.000000	INFINITY
15	0.000000	0.000000	INFINITY
16	0.000000	350.000000	INFINITY
17	0.000000	100.000000	INFINITY
18	0.000000	0.000000	INFINITY
19	0.000000	0.000000	INFINITY
20	0.000000	0.000000	INFINITY
21	0.000000	250.000000	INFINITY
22	0.000000	0.000000	INFINITY
23	0.000000	0.000000	INFINITY
24	0.000000	150.000000	INFINITY
25	0.000000	100.000000	INFINITY
26	0.000000	150.000000	INFINITY
27	0.000000	100.000000	INFINITY
28	0.000000	150.000000	INFINITY
29	0.000000	0.000000	INFINITY
30	0.000000	50.000000	INFINITY
31	0.000000	50.000000	INFINITY
32	0.000000	0.000000	INFINITY
33	0.000000	0.000000	INFINITY
34	0.000000	150.000000	INFINITY
35	0.000000	150.000000	INFINITY
36	0.000000	100.000000	INFINITY

```
      37       0.000000        0.000000      350.000000
      38       0.000000        0.000000      150.000000
      39     100.000000      150.000000       50.000000
      40       0.000000        0.000000       50.000000
```

4a Minimum coins are 10 and the coins are 8 25s and 2 1s

```
min a + b + c + d
ST
   a + 5b + 10c + 25d = 202
END
GIN a
GIN b
GIN c
GIN d

LP OPTIMUM FOUND AT STEP      1
 OBJECTIVE VALUE =   8.07999992

 FIX ALL VARS.(    2)  WITH RC >  0.000000E+00
 SET       A TO >=     1 AT    1, BND=  -9.040     TWIN=-0.1000E+31      5
 SET       D 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:  9.000000
 DELETE       D AT LEVEL     2
 DELETE       A AT LEVEL     1
 RELEASE FIXED VARIABLES
 FIX ALL VARS.(    2)  WITH RC >  0.000000E+00
 SET       C TO >=     2 AT    1, BND=  -9.280     TWIN=-0.1000E+31     12
 DELETE       C AT LEVEL     1
 RELEASE FIXED VARIABLES
 FIX ALL VARS.(    1)  WITH RC >  0.000000E+00
 SET       A TO <=     0 AT    1, BND=  -9.000     TWIN= -9.840        19
 SET       B TO >=     2 AT    2, BND=  -9.680     TWIN=-0.1000E+31     21
 DELETE       B AT LEVEL     2
 DELETE       A AT LEVEL     1
 RELEASE FIXED VARIABLES
 ENUMERATION COMPLETE. BRANCHES=     5 PIVOTS=      26

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

      OBJECTIVE FUNCTION VALUE

      1)     10.00000

  VARIABLE       VALUE          REDUCED COST
       A        2.000000         1.000000
```

```
      B        0.000000         1.000000
      C        0.000000         1.000000
      D        8.000000         1.000000


     ROW   SLACK OR SURPLUS     DUAL PRICES
      2)        0.000000         0.000000

 NO. ITERATIONS=      26
 BRANCHES=    5 DETERM.=  1.000E    0
```

4b minimum coins used 14 coins 2 7's, 3 12's, 9 27's

```
min a + b + c + d + e
ST
   a + 3b + 7c + 12d + 27e = 293
END
GIN a
GIN b
GIN c
GIN d
GIN e

LP OPTIMUM FOUND AT STEP      1
 OBJECTIVE VALUE =   10.8518515

 FIX ALL VARS.(    2)  WITH RC >  0.000000E+00
 SET       A TO <=     0 AT    1, BND=  -12.33     TWIN= -12.83         8
 SET       E TO <=     9 AT    2, BND=  -13.17     TWIN=-0.1000E+31     10
 SET       D TO >=     5 AT    3, BND=  -13.63     TWIN=-0.1000E+31     12
 SET       E TO <=     8 AT    4, BND=  -13.63     TWIN=-0.1000E+31     12
 SET       D TO >=     7 AT    5, BND=  -14.74     TWIN=-0.1000E+31     16
 SET       E TO <=     7 AT    6, BND=  -15.67     TWIN=-0.1000E+31     18
 SET       D TO >=     9 AT    7, BND=  -15.85     TWIN=-0.1000E+31     20
 SET       E TO <=     6 AT    8, BND=  -16.92     TWIN=-0.1000E+31     22
 SET       D TO >=    11 AT    9, BND=  -16.96     TWIN=-0.1000E+31     24
 SET       E TO <=     5 AT   10, BND=  -18.17     TWIN=-0.1000E+31     26
 SET       D TO >=    14 AT   11, BND=  -18.63     TWIN=-0.1000E+31     28
 SET       E TO <=     4 AT   12, BND=  -19.42     TWIN=-0.1000E+31     30
 SET       D TO >=    16 AT   13, BND=  -19.74     TWIN=-0.1000E+31     32
 SET       E TO <=     3 AT   14, BND=  -20.67     TWIN=-0.1000E+31     34
 SET       D TO >=    18 AT   15, BND=  -20.85     TWIN=-0.1000E+31     36
 SET       E TO <=     2 AT   16, BND=  -21.92     TWIN=-0.1000E+31     38
 SET       D TO >=    20 AT   17, BND=  -21.96     TWIN=-0.1000E+31     40
 SET       E TO <=     1 AT   18, BND=  -23.17     TWIN=-0.1000E+31     42
 SET       D TO >=    23 AT   19, BND=  -23.63     TWIN=-0.1000E+31     44
 SET       E TO <=     0 AT   20, BND=  -24.42     TWIN=-0.1000E+31     45
 DELETE        D AT LEVEL    21
 DELETE        E AT LEVEL    20
```

```
DELETE       D AT LEVEL    19
DELETE       E AT LEVEL    18
DELETE       D AT LEVEL    17
DELETE       E AT LEVEL    16
DELETE       D AT LEVEL    15
DELETE       E AT LEVEL    14
DELETE       D AT LEVEL    13
DELETE       E AT LEVEL    12
DELETE       D AT LEVEL    11
DELETE       E AT LEVEL    10
DELETE       D AT LEVEL     9
DELETE       E AT LEVEL     8
DELETE       D AT LEVEL     7
DELETE       E AT LEVEL     6
DELETE       D AT LEVEL     5
DELETE       E AT LEVEL     4
DELETE       D AT LEVEL     3
DELETE       E AT LEVEL     2
FLIP       A TO >=        1 AT    1 WITH BND=   -12.833333
SET        D TO <=     1 AT    2, BND=  -22.00     TWIN= -12.93        48

NEW INTEGER SOLUTION OF    22.0000000     AT BRANCH     21 PIVOT      48
BOUND ON OPTIMUM:  12.00000
FLIP       D TO >=        2 AT    2 WITH BND=   -12.925926
SET        E TO <=     9 AT    3, BND=  -14.08     TWIN=-0.1000E+31     50
SET        D TO <=     4 AT    4, BND=  -15.00     TWIN= -14.59        53

NEW INTEGER SOLUTION OF    15.0000000     AT BRANCH     23 PIVOT      53
BOUND ON OPTIMUM:  12.00000
DELETE       D AT LEVEL     4
DELETE       E AT LEVEL     3
DELETE       D AT LEVEL     2
DELETE       A AT LEVEL     1
RELEASE FIXED VARIABLES
FIX ALL VARS.(    2)  WITH RC >  0.000000E+00
SET        D TO <=     1 AT    1, BND=  -12.57     TWIN= -12.70        63
SET        C TO >=     2 AT    2, BND=  -12.75     TWIN=-0.1000E+31     65
SET        D TO >=     1 AT    3, BND=  -12.89     TWIN= -13.29        67
SET        E TO <=     9 AT    4, BND=  -12.89     TWIN=-0.1000E+31     67
SET        E TO >=     9 AT    5, BND=  -15.43     TWIN=-0.1000E+31     69
DELETE       C AT LEVEL     6
DELETE       E AT LEVEL     5
DELETE       E AT LEVEL     4
FLIP       D TO <=        0 AT    3 WITH BND=   -13.285714
SET        C TO >=     4 AT    4, BND=  -13.81     TWIN=-0.1000E+31     71
SET        C TO <=     4 AT    5, BND=  -13.81     TWIN=-0.1000E+31     71
DELETE       E AT LEVEL     6
DELETE       C AT LEVEL     5
```

```
DELETE       C AT LEVEL    4
DELETE       D AT LEVEL    3
DELETE       C AT LEVEL    2
FLIP       D TO >=        2 AT    1 WITH BND=   -12.703704
SET        E TO <=     9 AT    2, BND=  -13.58     TWIN=-0.1000E+31     73
SET        E TO >=     9 AT    3, BND=  -13.58     TWIN=-0.1000E+31     73
SET        D TO <=     3 AT    4, BND=  -14.00     TWIN=-0.1000E+31     74

NEW INTEGER SOLUTION OF    14.0000000     AT BRANCH     31 PIVOT      74
BOUND ON OPTIMUM:  12.33333
DELETE       D AT LEVEL    4
DELETE       E AT LEVEL    3
DELETE       E AT LEVEL    2
DELETE       D AT LEVEL    1
RELEASE FIXED VARIABLES
FIX ALL VARS.(    2)  WITH RC >  0.000000E+00
SET        D TO >=     2 AT    1, BND=  -12.85     TWIN= -14.67        83
SET        D TO <=     2 AT    2, BND=  -12.85     TWIN=-0.1000E+31     83
SET        E TO <=     9 AT    3, BND=  -19.67     TWIN=-0.1000E+31     85
DELETE       E AT LEVEL    3
DELETE       D AT LEVEL    2
DELETE       D AT LEVEL    1
RELEASE FIXED VARIABLES
SET        C TO <=     0 AT    1, BND=  -13.58     TWIN= -13.08        97
DELETE       C AT LEVEL    1
ENUMERATION COMPLETE. BRANCHES=    34 PIVOTS=      97

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

     OBJECTIVE FUNCTION VALUE

     1)     14.00000

 VARIABLE       VALUE         REDUCED COST
       A        0.000000         1.000000
       B        0.000000         1.000000
       C        2.000000         1.000000
       D        3.000000         1.000000
       E        9.000000         1.000000


     ROW   SLACK OR SURPLUS     DUAL PRICES
     2)        0.000000         0.000000

NO. ITERATIONS=      97
BRANCHES=   34 DETERM.=  1.000E    0
```