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CS325 – HW6  
  
Problem 1:  
  
a) shortest path from g to c = 16**

max dc st  
 dg= 0  
 da – df <= 5  
 da – dh <= 4  
 db – da <= 8  
 db – df <= 7  
 db – dh <= 9  
 dc – db <= 4  
 dc – df <= 3  
 dd – dc <= 3  
 dd – de <= 9  
 dd – dg <= 2  
 de – db <= 10  
 de – dd <= 25  
 de – df <= 2  
 df – da <= 10  
 df – dd <= 18  
 dg – de <= 7  
 dh – dg <= 3  
 END  
  **b) shortest path to each:**

**DA 7.000000**

**DB 12.000000**

**DC 16.000000**

**DD 2.000000**

**DE 19.000000**

**DF 17.000000**

**DH 3.000000** max da + db + dc + dd + de + df + dg+ dh ST  
 dg= 0  
 da – df <= 5  
 da – dh <= 4  
 db – da <= 8  
 db – df <= 7  
 db – dh <= 9  
 dc – db <= 4  
 dc – df <= 3  
 dd – dc <= 3  
 dd – de <= 9  
 dd – dg <= 2  
 de – db <= 10  
 de – dd <= 25  
 de – df <= 2  
 df – da <= 10  
 df – dd <= 18  
 dg – de <= 7  
 dh – dg <= 3  
END  
  
**Problem 2:  
   
OBJECTIVE FUNCTION VALUE**

**120196.0**

**VARIABLE VALUE   
 X1 7000.000000 Silk   
 X2 13625.000000 Polyester  
 X3 13100.000000 Blend 1  
 X4 8500.000000 Blend 2**Max (6.70 – .75 – (20\*.125 +6 \* 0 + 9\*0))x1 + (3.55 - .75 – (20\*0 +6\* .08 +9\*0))x2 + (4.31 - .75 – (20\*0 + 6\*.05 +9\* .05))x3 + (4.81 - .75 – (20\*0 + 6\*.03 +9\*.07))x4  
  
*Simplified:*  
Max 3.45x1 + 2.32x2 + 2.81x3 + 3.25x4  
  
ST  
 .125x1 <= 1000  
 .08 x2 + .05 x3 + .03x4 <= 2000  
 .05x3 + .07x4 <= 1250  
 x1 <= 7000  
 x1 >= 6000  
 x2 <= 14000  
 x2 >= 10000  
 x3 <= 16000  
 x3 >= 13000  
 x4 <= 8500  
 x4 >= 6000  
 x1 >= 0  
 x2 >= 0  
 x3 >= 0  
 x4 >= 0  
END  
  
Max ∑ni=1  (si – li – (∑nj=1 cij \* aij))xi (sum of the selling price of product i minus the labor cost of i minus the sum of the cost of material j in i times amount of material i in j all times the amount of product i  
  
S.T.  
 bi <= xi <= ci (amount between min b of product i and max c of product i)  
 ∑ni=1 aij <= dj (sum of material j in each product i less than or equal to amount of material j available)  
 xi >= 0  
  
**Problem 3:**i = plant number  
j= warehouse number  
k = retailer number  
xij = amount shipped from plant i to warehouse j  
yjk = amount shipped from warehouse j to retailer k  
n = number of i  
m = number of j available to i   
c = cost, cij = cost plant i to warehouse j, cjk = cost warehouse to retailer  
l = number of k available to j  
bi = supply of i  
bk = demand of kmax ∑ni=1(∑mj=1(cijxij) + ∑li=1(cjk\*yjk)) (the sum of all the plant’s sum of costs of shipping to each warehouse added together with the sum of the shipping costs of the corresponding warehouses to each corresponding available retailer.)  
  
S.T.  
 ∑mj=1(xij) = bi (the sum of items shipped out of each plant must be equal to it’s supply)  
 ∑mj=1 (yjk) <= bk (the sum of all products arriving at a retailer must be greater than or equal to demand) xij, yjk >= 0 (non-negativity constraints)  
  
**a)**min 10X11 + 15X12 + 11X21 + 8X22 + 13X31 + 8X32 + 9X33 + 14X42 + 8X43 + 5Y11 + 6Y12 + 7Y13 + 10Y14 + 12Y23 + 8Y24 + 10Y25 + 14Y26 + 14Y34 + 12Y35 + 12Y36 + 6Y37

ST

X11 + X12 = 150

X21 + X22 = 450

X31 + X32 + X33 = 250

X42 + X43 = 150

Y11 >= 100

Y12 >= 150

Y13 + Y23 >= 100

Y14 + Y24 + Y34 >= 200

Y25 + Y35 >= 200

Y26 + Y36 >=150

Y37 >= 100

X11 >= 0

X12 >= 0

X21 >= 0

X22 >= 0

X31 >= 0

X32 >= 0

X33 >= 0

X42 >= 0

X43 >= 0

Y11 >= 0

Y12 >= 0

Y13 >= 0

Y14 >= 0

Y23 >= 0

Y24 >= 0

Y25 >= 0

Y26 >= 0

Y34 >= 0

Y35 >= 0

Y36 >= 0

Y37 >= 0

END  
  
 OBJECTIVE FUNCTION VALUE

1) 16400.00

VARIABLE VALUE REDUCED COST

X11 150.000000 0.000000

X12 0.000000 5.000000

X21 0.000000 3.000000

X22 450.000000 0.000000

X31 0.000000 5.000000

X32 250.000000 0.000000

X33 0.000000 1.000000

X42 0.000000 6.000000

X43 150.000000 0.000000

Y11 100.000000 0.000000

Y12 150.000000 0.000000

Y13 100.000000 0.000000

Y14 0.000000 2.000000

Y23 0.000000 5.000000

Y24 200.000000 0.000000

Y25 200.000000 0.000000

Y26 0.000000 2.000000

Y34 0.000000 6.000000

Y35 0.000000 2.000000

Y36 150.000000 0.000000

Y37 100.000000 0.000000  
  
**b)**It is still possible because both warehouse 1 and 3 are able to receive from all the plants and able to ship to all the retailers.  
  
min 10X11 + 11X21 + 13X31 + 9X33 + 8X43 + 5Y11 + 6Y12 + 7Y13 + 10Y14 + 14Y34 + 12Y35 + 12Y36 + 6Y37

ST

X11 = 150

X21 = 450

X31 + X33 = 250

X43 = 150

Y11 >= 100

Y12 >= 150

Y13 >= 100

Y14 + Y34 >= 200

Y35 >= 200

Y36 >=150

Y37 >= 100

X11 >= 0

X21 >= 0

X31 >= 0

X33 >= 0

X43 >= 0

Y11 >= 0

Y12 >= 0

Y13 >= 0

Y14 >= 0

Y34 >= 0

Y35 >= 0

Y36 >= 0

Y37 >= 0

END  
  
 OBJECTIVE FUNCTION VALUE

1) 18800.00

VARIABLE VALUE REDUCED COST

X11 150.000000

X21 450.000000

X31 0.000000

X33 250.000000

X43 150.000000

Y11 100.000000

Y12 150.000000

Y13 100.000000

Y14 200.000000

Y34 0.000000

Y35 200.000000

Y36 150.000000

Y37 100.000000   
  
**c)**min 10X11 + 15X12 + 11X21 + 8X22 + 13X31 + 8X32 + 9X33 + 14X42 + 8X43 + 5Y11 + 6Y12 + 7Y13 + 10Y14 + 12Y23 + 8Y24 + 10Y25 + 14Y26 + 14Y34 + 12Y35 + 12Y36 + 6Y37

ST

X11 + X12 = 150

X21 + X22 = 450

X31 + X32 + X33 = 250

X42 + X43 = 150

X12 + X22 + X32 + X42 = 100

Y11 >= 100

Y12 >= 150

Y13 + Y23 >= 100

Y14 + Y24 + Y34 >= 200

Y25 + Y35 >= 200

Y26 + Y36 >=150

Y37 >= 100

X11 >= 0

X12 >= 0

X21 >= 0

X22 >= 0

X31 >= 0

X32 >= 0

X33 >= 0

X42 >= 0

X43 >= 0

Y11 >= 0

Y12 >= 0

Y13 >= 0

Y14 >= 0

Y23 >= 0

Y24 >= 0

Y25 >= 0

Y26 >= 0

Y34 >= 0

Y35 >= 0

Y36 >= 0

Y37 >= 0

END

OBJECTIVE FUNCTION VALUE

1) 17700.00

VARIABLE VALUE REDUCED COST

X11 150.000000

X12 0.000000

X21 350.000000

X22 100.000000

X31 0.000000

X32 0.000000

X33 250.000000

X42 0.000000

X43 150.000000

Y11 100.000000

Y12 150.000000

Y13 100.000000

Y14 0.000000

Y23 0.000000

Y24 200.000000

Y25 200.000000

Y26 0.000000

Y34 0.000000

Y35 0.000000

Y36 150.000000

Y37 100.000000

**Problem 4:**max ∑ni-1 xiST  
 ∑ni=1 cixi = d  
 xi >= 0  
 xi ∈ Z  
   
Minimize: A + B + C + D + E + F ST

1.00A+.50B+.25C+.10D+.05E+.01F = Desired Change   
 A,B,C,D,E,F >= 0   
 A,B,C,D,E,F = Integers   
  
xi = amount of currency i  
ci = value of currency i  
Z = set of integers  
A = Amount for which to find change  
min ∑ni=1 xi  
ST  
 ∑ni=1 cixi = A  
 xi >= 0  
 xi ∈ Z  
  
**a)**  
min a + b + c + d

ST

1a + 5b + 10c + 25d = 202

a >= 0

b >= 0

c >= 0

d >= 0

END

GIN a

GIN b

GIN c

GIN d  
  
OBJECTIVE FUNCTION VALUE

1) 10.00000

VARIABLE VALUE

A 2.000000

B 0.000000

C 0.000000

D 8.000000

**b)**min a + b + c + d + e

ST

1a + 3b + 7c + 12d + 27e= 293

a >= 0

b >= 0

c >= 0

d >= 0

END

GIN a

GIN b

GIN c

GIN d

GIN e  
  
OBJECTIVE FUNCTION VALUE

1) 14.00000

VARIABLE VALUE

A 0.000000

B 0.000000

C 2.000000

D 3.000000

E 9.000000