**Problem: Maxflowhw2**

**#Model**

set S = 1..10;

param xmax{S};

var x{S} >= 0;

Con1: x [1] = x [4] + x [5];

Con2: x [10] = x [3] + x [4] + x [8];

Con3: x [2] = x [7] + x [9] + x [8];

Con4: x [6] = x [7] + x [5];

Con5 {i in S}: x [i] <= xmax [i];

option solver cplex;

maximize Maxflow : x [6] + x [9] + x [10];

**#Data**

param xmax := 1 5 2 4 3 3 4 1 5 3 6 5 7 3 8 3 9 3 10 8;

**#OUTPUT**

sw: ample

sw: ampl

ampl: #RESET

reset;

#LOAD THE MODEL

model D:\Users\Administrator\Desktop\eg\2Maxflowhw2.mod;

#Input Data

data D:\Users\Administrator\Desktop\eg\2Maxflowhw2.dat;

#Solver Change

option solver cplex;

option presolve 0;

solve;

CPLEX 12.6.1.0: optimal solution; objective 11

0 dual simplex iterations (0 in phase I)

ampl: display x;

x [\*] :=

1 4

2 4

3 3

4 1

5 3

6 3

7 0

8 3

9 1

10 7

;

ampl: display Con1.dual;

Con1.dual = 0

ampl: display Con2;

Con2 = 1

ampl: display Con3.dual;

Con3.dual = -1

ampl: display Con4.dual;

Con4.dual = 1

ampl: display Con5.dual;

Con5.dual [\*] :=

1 0

2 1

3 1

4 1

5 1

6 0

7 0

8 0

9 0

10 0

;

**Problem: Maxflow dual hw2**

**#Model**

set S = 1..14;

set T = 5..14;

var u{S};

variableCon { i in T }: u [i] >= 0;

Con1: u [1] + u [5] >= 0;

Con2: u [3] + u [6] >= 0;

Con3: u [2] + u [7] >= 0;

Con4: - u [1] + u [2] + u [8] >= 0;

Con5: - u [1] + u [4] + u [9] >= 0;

Con6: - u [4] + u [10] >= 1;

Con7: - u [3] + u [4] + u [11] >= 0;

Con8: - u [3] + u [2] + u [12] >= 0;

Con9: - u [3] + u [13] >= 1;

Con10: - u [2] + u [14] >= 1;

option solver cplex;

minimize mincut: 5 \* u [5] + 4 \* u [6] + 3 \* u [7] + u [8] + 3 \* u [9] + 5 \* u [10] + 3 \* u [11] + 3 \* u [12] + 3 \* u [13] + 8 \* u [14];

**#OUTPUT**

ampl: #RESET

reset;

#LOAD THE MODEL

model D:\Users\Administrator\Desktop\eg\2Maxflowhw2dual.mod;

#Solver Change

option solver cplex;

option presolve 0;

solve;

CPLEX 12.6.1.0: optimal solution; objective 11

3 dual simplex iterations (0 in phase I)

ampl: display u;

u [\*] :=

1 0

2 -1

3 -1

4 -1

5 0

6 1

7 1

8 1

9 1

10 0

11 0

12 0

13 0

14 0

;

ampl: display Con1.dual;

Con1.dual = 4

ampl: display Con2.dual;

Con2.dual = 4

ampl: display Con3.dual;

Con3.dual = 3

ampl: display Con4.dual;

Con4.dual = 1

ampl: display Con5.dual;

Con5.dual = 3

ampl: display Con6.dual;

Con6.dual = 5

ampl: display Con7.dual;

Con7.dual = 2

ampl: display Con8.dual;

Con8.dual = 2

ampl: display Con9.dual;

Con9.dual = 0

ampl: display Con10.dual;

Con10.dual = 6

**Problem: ShortestPath hw2**

**#Model**

set S = 1..7;

set T = 1..7;

set R = 2..6;

param c{S,T};

param a{S,T};

var x{S,T} >= 0;

minimize ShortestPath: sum{i in S, j in T} c[i,j] \* x[i,j];

Con{i in R}: sum {j in T} a[i,j] \* x[i,j] = sum {j in T} a[j,i] \* x[j,i];

Con1: sum {j in T} a[1,j] \* x[1,j] = 1 + sum {j in T} a[j,1] \* x[j,1];

Con7: sum {j in T} a[7,j] \* x[7,j] = -1 + sum {j in T} a[j,7] \* x[j,7];

option solver cplex;

**#Data**

param a:

1 2 3 4 5 6 7 :=

1 0 1 0 1 1 0 0

2 1 0 1 1 0 0 0

3 0 1 0 1 0 0 1

4 1 1 1 0 1 1 1

5 1 0 0 1 0 1 0

6 0 0 0 1 1 0 1

7 0 0 1 1 0 1 0;

param c:

1 2 3 4 5 6 7 :=

1 0 3 0 10 4 0 0

2 3 0 4 4 0 0 0

3 0 4 0 5 0 0 5

4 10 4 5 0 4 1 1

5 4 0 0 4 0 2 0

6 0 0 0 1 2 0 10

7 0 0 5 1 0 10 0;

**#OUTPUT**

ampl: #RESET

reset;

#LOAD THE MODEL

model D:\Users\Administrator\Desktop\eg\shortpath.mod;

#Input Data

data D:\Users\Administrator\Desktop\eg\shortpath.dat;

#Solver Change

option solver cplex;

option presolve 0;

solve;

CPLEX 12.6.1.0: optimal solution; objective 8

6 dual simplex iterations (0 in phase I)

ampl: display x;

x [\*,\*]

: 1 2 3 4 5 6 7 :=

1 0 1 0 0 0 0 0

2 0 0 0 1 0 0 0

3 0 0 0 0 0 0 0

4 0 0 0 0 0 0 1

5 0 0 0 0 0 0 0

6 0 0 0 0 0 0 0

7 0 0 0 0 0 0 0

;

ampl: display Con1.dual;

Con1.dual = 8

ampl: display Con.dual;

Con.dual [\*] :=

2 5

3 1

4 1

5 4

6 2

;

ampl: display Con7.dual;

Con7.dual = 0

**Problem: ShortestPath dual hw2**

**#Model**

set S = 1..7;

var u{S};

maximize ShortestPath: u [1] - u [7];

con1: u[1] - u[2] <=3;

con2: u[2] - u[1] <=3;

con3: u[1] - u[4] <=10;

con4: u[4] - u[1] <=10;

con5: u[1] - u[5] <=4;

con6: u[5] - u[1] <=4;

con7: u[2] - u[3] <=4;

con8: u[3] - u[2] <=4;

con9: u[2] - u[4] <=4;

con10: u[4] - u[2] <=4;

con11: u[3] - u[4] <=5;

con12: u[4] - u[3] <=5;

con13: u[3] - u[7] <=5;

con14: u[7] - u[3] <=5;

con15: u[4] - u[5] <=4;

con16: u[5] - u[4] <=4;

con17: u[4] - u[6] <=1;

con18: u[6] - u[4] <=1;

con19: u[4] - u[7] <=1;

con20: u[7] - u[4] <=1;

con21: u[5] - u[6] <=2;

con22: u[6] - u[5] <=2;

con23: u[6] - u[7] <=10;

con24: u[7] - u[6] <=10;

**#OUTPUT**

ampl: #RESET

reset;

#LOAD THE MODEL

model D:\Users\Administrator\Desktop\eg\shortpathdual.mod;

#Solver Change

option solver cplex;

option presolve 0;

solve;

CPLEX 12.6.1.0: optimal solution; objective 8

5 dual simplex iterations (0 in phase I) on the dual problem

ampl: display u;

u [\*] :=

1 7

2 4

3 0

4 0

5 3

6 1

7 -1

;

ampl: display con1.dual;

con1.dual = 1

ampl: display con2.dual;

con2.dual = 0

ampl: display con3.dual;

con3.dual = 0

ampl: display con4.dual;

con4.dual = 0

ampl: display con5.dual;

con5.dual = 0

ampl: display con6.dual;

con6.dual = 0

ampl: display con7.dual;

con7.dual = 0

ampl: display con8.dual;

con8.dual = 0

ampl: display con9.dual;

con9.dual = 1

ampl: display con10.dual;

con10.dual = 0

ampl: display con11.dual;

con11.dual = 0

ampl: display con12.dual;

con12.dual = 0

ampl: display con13.dual;

con13.dual = 0

ampl: display con14.dual;

con14.dual = 0

ampl: display con15.dual;

con15.dual = 0

ampl: display con16.dual;

con16.dual = 0

ampl: display con17.dual;

con17.dual = 0

ampl: display con18.dual;

con18.dual = 0

ampl: display con19.dual;

con19.dual = 1

ampl: display con20.dual;

con20.dual = 0

ampl: display con21.dual;

con21.dual = 0

ampl: display con22.dual;

con22.dual = 0

ampl: display con23.dual;

con23.dual = 0

ampl: display con24.dual;

con24.dual = 0

**Problem: hw2\_3\_1**

**#Model**

var x3 >=0;

var x2 >=0;

var x1 <=0;

var x4 <=0;

minimize v: x1 + 3 \* x2 + x3 - x4;

con1: x1 + x2 + x3 + x4 >= 0;

con2: x1 + x2 - x3 - x4 >= 1;

**#OUTPUT**

sw: ampl

ampl: #RESET

reset;

#LOAD THE MODEL

model D:\Users\Administrator\Desktop\eg\hw2\_3\_1.mod;

#Solver Change

option solver cplex;

option presolve 0;

solve;

CPLEX 12.6.1.0: optimal solution; objective 2

3 dual simplex iterations (1 in phase I)

ampl: display x1;

x1 = 0

ampl: display x2;

x2 = 0.5

ampl: display x3;

x3 = 0

ampl: display x4;

x4 = -0.5

ampl: display con1.dual;

con1.dual = 1

ampl: display con2.dual;

con2.dual = 2

**Problem: hw2\_3\_2 dual**

**#Model**

var u1 >=0;

var u2 >=0;

maximize v: u2;

con1: u1+u2 >= 1;

con2: u1+u2 <= 3;

con3: u1-u2 <= 1;

con4: u1-u2 >= -1;

**#OUTPUT**

ampl: #RESET

reset;

#LOAD THE MODEL

model D:\Users\Administrator\Desktop\eg\hw2\_3\_1dual.mod;

#Solver Change

option solver cplex;

option presolve 0;

solve;

CPLEX 12.6.1.0: optimal solution; objective 2

2 dual simplex iterations (1 in phase I)

ampl: display u1;

u1 = 1

ampl: display u2;

u2 = 2

ampl: display con1.dual;

con1.dual = 0

ampl: display con2.dual;

con2.dual = 0.5

ampl: display con3.dual;

con3.dual = 0

ampl: display con4.dual;

con4.dual = -0.5

**Problem: hw2\_3\_2**

**#MODEL**

var x3 >=0;

var x2 >=0;

var x1 <=0;

var x4 <=0;

minimize v: x1 + 3 \* x2 + x3 - x4;

con1: x1 + x2 + x3 + x4 >= 0;

con2: x1 + x2 - x3 - x4 >= -1;

**#OUTPUT**

ampl: #RESET

reset;

#LOAD THE MODEL

model D:\Users\Administrator\Desktop\eg\hw2\_3.mod;

#Solver Change

option solver cplex;

option presolve 0;

solve;

CPLEX 12.6.1.0: optimal solution; objective 0

1 dual simplex iterations (1 in phase I)

ampl: display x1;

x1 = 0

ampl: display x2;

x2 = 0

ampl: display x3;

x3 = 0

ampl: display x4;

x4 = 0

ampl: display con1.dual;

con1.dual = 1

ampl: display con2.dual;

con2.dual = 0

**Problem: hw2\_3\_2 dual**

**#MODEL**

var u1 >=0;

var u2 >=0;

maximize v: -u2;

con1: u1+u2 >= 1;

con2: u1+u2 <= 3;

con3: u1-u2 <= 1;

con4: u1-u2 >= -1;

**#OUTPUT**

ampl: #RESET

reset;

#LOAD THE MODEL

model D:\Users\Administrator\Desktop\eg\hw2\_3dual.mod;

#Solver Change

option solver cplex;

option presolve 0;

solve;

CPLEX 12.6.1.0: optimal solution; objective 0

1 dual simplex iterations (0 in phase I)

ampl: display u1;

u1 = 1

ampl: display u2;

u2 = 0

ampl: display con1.dual;

con1.dual = 0

ampl: display con2.dual;

con2.dual = 0

ampl: display con3.dual;

con3.dual = 0

ampl: display con4.dual;

con4.dual = 0