**ASSIGNMENT CL643**

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**NSF PANEL ASSIGNMENT(NSF.m and Script.m)**

GIVEN DATA:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | W | | | | |  |  |  |  |
|  | Rev 1 | Rev 2 | Rev 3 | Rev 4 | Rev 5 |  |  |  |  |
| Prop 1 | 3 | 1 | 10 | 3 | 0 |  | N | M | K |
| Prop 2 | 6 | 2 | 9 | 6 | 1 |  | 10 | 5 | 4 |
| Prop 3 | 4 | 3 | 8 | 4 | 4 |  |  |  |  |
| Prop 4 | 0 | 4 | 7 | 8 | 6 |  |  |  |  |
| Prop 5 | 1 | 5 | 6 | 1 | 2 |  |  |  |  |
| Prop 6 | 2 | 6 | 5 | 2 | 3 |  |  |  |  |
| Prop 7 | 8 | 7 | 4 | 8 | 5 |  |  |  |  |
| Prop 8 | 5 | 8 | 3 | 5 | 0 |  |  |  |  |
| Prop 9 | 10 | 9 | 2 | 8 | 7 |  |  |  |  |
| Prop 10 | 3 | 10 | 1 | 3 | 10 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

--:CODE FILES:--

**NSF.m**

function [N,M,K,w] = NSF ()

N = 10; %total proposals(i)

M = 5; %total reviewers(j)

K = 4; %no. of reviews needed for each proposal

w = [ 3 1 10 3 0

6 2 9 6 1

4 3 8 4 4

0 4 7 8 6

1 5 6 1 2

2 6 5 2 3

8 7 4 8 5

5 8 3 5 0

10 9 2 8 7

3 10 1 3 10] ;

end

**Script.m**

clc

clear all

[N,M,K,w] = NSF\_Ex1();

c = w';

ycoeff = c(:);

f = ycoeff;

for k=1:K

f = [f;zeros(N\*M,1)];

end

f = [f;zeros(N\*M\*M,1)];

X = [];

Q = [];

for k = 1:K+1

P = zeros(M,N\*M); %2 3 4 5 6 RHS

Y = [];

for j=1:M

y = zeros(N,M);

for i=1:N

if w(i,j)~=0

y(i,j) = 1;

end

end

y = y';

y = y(:);

Y = [Y;y'];

end

P(:,:,k) = Y;

Q((k-1)\*M+1:k\*M,:,k) = P(:,:,k);

end

X = reshape(Q,(K+1)\*M,(K+1)\*N\*M);

b = 1\*ceil(N\*K/M)\*ones(M,1);

b = [b;1\*ceil(N/M)\*ones(K\*M,1)];

Q = [];

for k = 1:K+1

P = zeros(M,N\*M); %2 3 4 5 6 LHS

Y = [];

for j=1:M

y = zeros(N,M);

for i=1:N

if w(i,j)~=0

y(i,j) = -1;

end

end

y = y';

y = y(:);

Y = [Y;y'];

end

P(:,:,k) = Y;

Q((k-1)\*M+1:k\*M,:,k) = P(:,:,k);

end

dd = reshape(Q,(K+1)\*M,(K+1)\*N\*M);

X = [X;dd];

b = [b;-1\*floor(N\*K/M)\*ones(M,1)];

b = [b;-1\*floor(N/M)\*ones(K\*M,1)];

%X\*y-b;

Y=[]; %13,14,15,16

Q = [];

P = [];

for k = 1:K

S = [];

for i=1:N

for j=1:M

if w(i,j)~=0

s = zeros(N,M);

s(i,j) = 1;

s = s';

s = s(:);

S = [S;s'];

y = zeros(N,M);

y(i,j) = -1;

y = y';

y = y(:);

Y = [Y;y'];

else

s = zeros(1,N\*M);

S = [S;s];

y = zeros(1,N\*M);

Y = [Y;y];

end

end

end

P(:,:,k) = S;

Q((k-1)\*M\*N+1:k\*N\*M,(k-1)\*M\*N+1:k\*N\*M,k) = P(:,:,k);

end

PP = 0;

for k=1:K

PP = PP+Q(:,:,k);

end

Q = [Y,PP];

X = [X;Q];

b = [b;zeros((K)\*N\*M,1)];

X = [X,zeros((N\*M\*K)+(M\*(K+1)\*2) , N\*M\*M)];

Q = []; %17,18,19

L = [];

S = [];

a=1;

for i = 1:N

for j = 1:M

for jdash = 1:M

if j~= jdash && w(i,j)~=0 && w(i,jdash)~=0

l = zeros(N,M);

s = zeros(N,M);

l(i,j)= 1;

s(i,jdash)=1;

l = l';

l = l(:);

s = s';

s = s(:);

L = [L;l'];

S = [S;s'];

xx(a,a) = 1;

pp(a) = 1;

a=a+1;

else

l = zeros(1,N\*M);

s = zeros(1,N\*M);

L = [L;l];

S = [S;s];

xx(a,a) = 0;

pp(a)=0;

a=a+1;

end

end

end

end

ZZ = [L,S];

for k=1:K-1

Q((k-1)\*M\*M\*N+1:(k)\*M\*M\*N,(k-1)\*M\*N+1:(k+1)\*M\*N) = ZZ;

end

y = zeros(N\*M\*M\*(K-1),N\*M);

Q = [y,Q];

xxx = [];

ppp = [];

for k = 1:K-1

xxx = [xxx;xx];

ppp = [ppp;pp'];

end

Q = [Q,-1\*xxx];

X = [X;Q];

b = [b;ppp];

Xeq = [];

Qeq = [];

for k = 1:K+1

P = zeros(N,N\*M); %7 8 9 10 11

Y = [];

for i=1:N

y = zeros(N,M);

for j=1:M

if w(i,j)~=0

y(i,j) = 1;

end

end

y = y';

y = y(:);

Y = [Y;y'];

end

P(:,:,k) = Y;

Qeq((k-1)\*N+1:k\*N,:,k) = P(:,:,k);

end

Xeq = reshape(Qeq,(K+1)\*N,(K+1)\*N\*M);

beq = K\*ones(N,1);

beq = [beq;1\*ones(K\*N,1)];

QQ = []; %12

for i=1:N

for j=1:M

if w(i,j)~=0

qq = zeros(N,M);

qq(i,j) = 1;

qq = qq';

qq = qq(:);

QQ = [QQ;qq'];

else

qq = zeros(1,N\*M);

QQ = [QQ;qq];

end

end

end

RR = [];

for k = 1:K

RR = [RR,QQ];

end

RR = [-1\*QQ,RR];

Xeq = [Xeq;RR];

beq = [beq;zeros(N\*M,1)];

Xeq = [Xeq,zeros(N\*(K+1)+N\*M,N\*M\*M)];

e = 0.001;

alpha = 1000;

[rows1,~] = size(X);

X = [X,zeros(rows1,N\*M\*M)];

[rows2,~] = size(Xeq);

Xeq = [Xeq,zeros(rows2,N\*M\*M)];

a = 1;

ww1 = zeros(1,N\*M\*M);

ww2 = zeros(1,N\*M\*M);

sl = zeros(N\*M\*M);

for i = 1:N

for j = 1:M

for jdash = 1:M

if j~=jdash && w(i,j)~=0 && w(i,jdash)~=0

%xx(a) = w(i,j)<=w(i,jdash);

ww1(a) = w(i,j);

ww2(a) = w(i,jdash);

sl(a,a) = 0;

epsilon(a) = e;

a = a+1; kks=0;

else

%xx(a) = 0;

ww1(a) = 0;

ww2(a) = 0;

sl(a,a) = 0;

epsilon(a) = 0;

a = a+1;

end

end

end

end

xx2 = N\*xx;

lhs1 = [zeros(N\*M\*M,N\*M\*(K+1)),xx2,-1\*sl];

rhs1 = -1\*ww1'+ww2'+N;

X = [X;lhs1];

b = [b;rhs1];

lhs2 = [zeros(N\*M\*M,N\*M\*(K+1)),-1\*xx2,sl];

rhs2 = ww1'-ww2'-epsilon';

X = [X;lhs2];

b = [b;rhs2];

intcon = (1:((K+1)\*N\*M+N\*M\*M));

lb = zeros(1,((K+1)\*N\*M)+2\*N\*M\*M);

ub = ones(1,((K+1)\*N\*M+N\*M\*M));

f = [f;alpha\*pp']

[c,fval,exitflag] = intlinprog(f,intcon,X,b,Xeq,beq,lb,ub);

if exitflag==-2

X = [];

Q = [];

for k = 1:K+1

P = zeros(M,N\*M); %2 3 4 5 6 RHS

Y = [];

for j=1:M

y = zeros(N,M);

for i=1:N

if w(i,j)~=0

y(i,j) = 1;

end

end

y = y';

y = y(:);

Y = [Y;y'];

end

P(:,:,k) = Y;

Q((k-1)\*M+1:k\*M,:,k) = P(:,:,k);

end

X = reshape(Q,(K+1)\*M,(K+1)\*N\*M);

b = 1\*ceil(N\*K/M)\*ones(M,1);

b = [b;1\*ceil(N/M)\*ones(K\*M,1)];

Q = [];

for k = 1:K+1

P = zeros(M,N\*M); %2 3 4 5 6 LHS

Y = [];

for j=1:M

y = zeros(N,M);

for i=1:N

if w(i,j)~=0

y(i,j) = -1;

end

end

y = y';

y = y(:);

Y = [Y;y'];

end

P(:,:,k) = Y;

Q((k-1)\*M+1:k\*M,:,k) = P(:,:,k);

end

dd = reshape(Q,(K+1)\*M,(K+1)\*N\*M);

X = [X;dd];

b = [b;-1\*floor(N\*K/M)\*ones(M,1)];

b = [b;-1\*floor(N/M)\*ones(K\*M,1)];

%X\*y-b;

Y=[]; %13,14,15,16

Q = [];

P = [];

for k = 1:K

S = [];

for i=1:N

for j=1:M

if w(i,j)~=0

s = zeros(N,M);

s(i,j) = 1;

s = s';

s = s(:);

S = [S;s'];

y = zeros(N,M);

y(i,j) = -1;

y = y';

y = y(:);

Y = [Y;y'];

else

s = zeros(1,N\*M);

S = [S;s];

y = zeros(1,N\*M);

Y = [Y;y];

end

end

end

P(:,:,k) = S;

Q((k-1)\*M\*N+1:k\*N\*M,(k-1)\*M\*N+1:k\*N\*M,k) = P(:,:,k);

end

PP = 0;

for k=1:K

PP = PP+Q(:,:,k);

end

Q = [Y,PP];

X = [X;Q];

b = [b;zeros((K)\*N\*M,1)];

X = [X,zeros((N\*M\*K)+(M\*(K+1)\*2) , N\*M\*M)];

Q = []; %17,18,19

L = [];

S = [];

a=1;

for i = 1:N

for j = 1:M

for jdash = 1:M

if j~= jdash && w(i,j)~=0 && w(i,jdash)~=0

l = zeros(N,M);

s = zeros(N,M);

l(i,j)= 1;

s(i,jdash)=1;

l = l';

l = l(:);

s = s';

s = s(:);

L = [L;l'];

S = [S;s'];

xx(a,a) = 1;

pp(a) = 1;

a=a+1;

else

l = zeros(1,N\*M);

s = zeros(1,N\*M);

L = [L;l];

S = [S;s];

xx(a,a) = 0;

pp(a)=0;

a=a+1;

end

end

end

end

ZZ = [L,S];

for k=1:K-1

Q((k-1)\*M\*M\*N+1:(k)\*M\*M\*N,(k-1)\*M\*N+1:(k+1)\*M\*N) = ZZ;

end

y = zeros(N\*M\*M\*(K-1),N\*M);

Q = [y,Q];

xxx = [];

ppp = [];

for k = 1:K-1

xxx = [xxx;xx];

ppp = [ppp;pp'];

end

Q = [Q,-1\*xxx];

X = [X;Q];

b = [b;ppp];

Xeq = [];

Qeq = [];

for k = 1:K+1

P = zeros(N,N\*M); %7 8 9 10 11

Y = [];

for i=1:N

y = zeros(N,M);

for j=1:M

if w(i,j)~=0

y(i,j) = 1;

end

end

y = y';

y = y(:);

Y = [Y;y'];

end

P(:,:,k) = Y;

Qeq((k-1)\*N+1:k\*N,:,k) = P(:,:,k);

end

Xeq = reshape(Qeq,(K+1)\*N,(K+1)\*N\*M);

beq = K\*ones(N,1);

beq = [beq;1\*ones(K\*N,1)];

QQ = []; %12

for i=1:N

for j=1:M

if w(i,j)~=0

qq = zeros(N,M);

qq(i,j) = 1;

qq = qq';

qq = qq(:);

QQ = [QQ;qq'];

else

qq = zeros(1,N\*M);

QQ = [QQ;qq];

end

end

end

RR = [];

for k = 1:K

RR = [RR,QQ];

end

RR = [-1\*QQ,RR];

Xeq = [Xeq;RR];

beq = [beq;zeros(N\*M,1)];

Xeq = [Xeq,zeros(N\*(K+1)+N\*M,N\*M\*M)];

e = 0.001;

alpha = 1000;

[rows1,~] = size(X);

X = [X,zeros(rows1,N\*M\*M)];

[rows2,~] = size(Xeq);

Xeq = [Xeq,zeros(rows2,N\*M\*M)];

a = 1;

ww1 = zeros(1,N\*M\*M);

ww2 = zeros(1,N\*M\*M);

sl = zeros(N\*M\*M);

for i = 1:N

for j = 1:M

for jdash = 1:M

if j~=jdash && w(i,j)~=0 && w(i,jdash)~=0

ww1(a) = w(i,j);

ww2(a) = w(i,jdash);

sl(a,a) = 1;

epsilon(a) = e;

a = a+1; kks=0;

else

ww1(a) = 0;

ww2(a) = 0;

sl(a,a) = 0;

epsilon(a) = 0;

a = a+1;

end

end

end

end

xx2 = N\*xx;

lhs1 = [zeros(N\*M\*M,N\*M\*(K+1)),xx2,-1\*sl];

rhs1 = -1\*ww1'+ww2'+N;

X = [X;lhs1];

b = [b;rhs1];

lhs2 = [zeros(N\*M\*M,N\*M\*(K+1)),-1\*xx2,sl];

rhs2 = ww1'-ww2'-epsilon';

X = [X;lhs2];

b = [b;rhs2];

intcon = (1:((K+1)\*N\*M+N\*M\*M));

lb = zeros(1,((K+1)\*N\*M)+2\*N\*M\*M);

ub = ones(1,((K+1)\*N\*M+N\*M\*M));

[c,fval,exitflag] = intlinprog(f,intcon,X,b,Xeq,beq,lb,ub);

end

**=============JOBSHOP=================**

Given Data:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Orders | Duration | | | | |  |  | Cost | | | | |
| M1 | M2 | M3 | M4 | M5 | Relese | Due | M1 | M2 | M3 | M4 | M5 |
| 1 | 5 | 7 | 6 | 5 | 6 | 2 | 33 | 10 | 6 | 8 | 9 | 9 |
| 2 | 3 | 4 | 3 | 3 | 4 | 3 | 34 | 8 | 5 | 6 | 7 | 7 |
| 3 | 2 | 4 | 3 | 2 | 3 | 4 | 31 | 12 | 7 | 10 | 11 | 10 |
| 4 | 3 | 6 | 4 | 3 | 4 | 5 | 33 | 10 | 6 | 8 | 9 | 8 |
| 5 | 2 | 4 | 3 | 2 | 2 | 10 | 34 | 8 | 5 | 6 | 7 | 7 |
| 6 | 1 | 3 | 2 | 2 | 2 | 1 | 34 | 12 | 7 | 10 | 11 | 10 |
| 7 | 1 | 2 | 1 | 1 | 1 | 2 | 33 | 12 | 10 | 11 | 12 | 11 |
| 8 | 2 | 5 | 4 | 3 | 3 | 4 | 25 | 9 | 5 | 7 | 9 | 8 |
| 9 | 4 | 6 | 6 | 5 | 5 | 10 | 38 | 10 | 6 | 8 | 9 | 8 |
| 10 | 2 | 5 | 3 | 2 | 3 | 1 | 37 | 8 | 5 | 6 | 7 | 6 |
| 11 | 2 | 3 | 2 | 2 | 2 | 5 | 30 | 15 | 9 | 12 | 14 | 13 |
| 12 | 2 | 6 | 4 | 3 | 3 | 2 | 20 | 13 | 7 | 10 | 12 | 11 |
| 13 | 1 | 3 | 3 | 2 | 2 | 4 | 32 | 9 | 5 | 6 | 8 | 7 |
| 14 | 2 | 5 | 5 | 2 | 3 | 6 | 20 | 10 | 6 | 8 | 10 | 9 |
| 15 | 4 | 7 | 6 | 4 | 5 | 2 | 25 | 8 | 5 | 6 | 7 | 7 |
| 16 | 2 | 4 | 3 | 2 | 3 | 2 | 34 | 9 | 5 | 7 | 9 | 8 |
| 17 | 3 | 6 | 4 | 3 | 4 | 3 | 37 | 10 | 6 | 8 | 9 | 8 |
| 18 | 2 | 4 | 3 | 2 | 2 | 7 | 38 | 8 | 5 | 6 | 7 | 6 |
| 19 | 1 | 3 | 2 | 2 | 2 | 6 | 32 | 15 | 9 | 12 | 14 | 13 |
| 20 | 1 | 2 | 1 | 1 | 1 | 0 | 30 | 13 | 7 | 10 | 12 | 11 |

Code:

**GAMS:Jobshop.gms**

Set

I 'jobs' / A, B, C, D, E, F, G /

J 'stages' / 1\*5 /;

Alias (I,K), (J,M);

Set L(I,K,J) 'subset to prevent clashes at stage j between stage j and k'

/ A.B.3, A.B.5, A.C.1, A.D.3, A.E.3, A.E.5, A.F.1, A.F.3, A.G.5

B.C.2, B.D.2, B.D.3, B.E.2, B.E.3, B.E.5, B.F.3, B.G.2, B.G.5

C.D.2, C.D.4, C.E.2, C.F.1, C.F.4, C.G.2, C.G.4

D.E.2, D.E.3, D.F.3, D.F.4, D.G.2, D.G.4

E.F.3, E.G.2, E.G.5

F.G.4 /;

Table TAU(I,J) 'processing time of job i in stage j'

1 2 3 4 5

A 3 5 2

B 3 4 3

C 6 3 6

D 8 5 1

E 4 6 2

F 2 5 7

G 8 5 4;

Variable MS 'makespan';

Binary Variable Y(I,K,J) 'sequencing variable between jobs i and k';

Positive Variable T(I);

Equation

FEAS(I) 'makespan greater than all processing times'

NOCLASH1(I,K,J) 'when i precedes k'

NOCLASH2(I,K,J) 'when k precedes i'

DUMMY;

FEAS(I).. MS =g= T(I) + sum(M, TAU(I,M));

NOCLASH1(I,K,J)$((ord(I) < ord(K)) and L(I,K,J))..

T(I) + sum(M$(ord(M) <= ord(J)), TAU(I,M)) =l=

T(K) + sum(M$(ord(M) < ord(J)), TAU(K,M));

NOCLASH2(I,K,J)$((ord(I) < ord(K)) and L(I,K,J))..

T(K) + sum(M$(ord(M) <= ord(J)), TAU(K,M)) =l=

T(I) + sum(M$(ord(M) < ord(J)), TAU(I,M));

DUMMY..

sum((I,K,J)$((ord(I) < ord(K)) and L(I,K,J)), Y(I,K,J)) =g= 0;

Model JOBSHOP / all /;

\* Find a quick and dirty BigM to overwrite LOGMIP's default

Scalar BIGM;

BIGM = sum((I,J), TAU(I,J));

File fx /"%lm.info%"/;

putClose fx 'default bigm' BIGM 'disjunction Y NOCLASH1 else NOCLASH2';

option optCr = 0.0, optCa = 0.0, emp = logmip;

solve JOBSHOP minimizing MS using emp;

display Y.l, T.l;