Example Homework Submission

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Our assignment was to minimize the cost of transporting three products from suppliers to customers in a network of cities.

Here is the model file:

{string} Cities = ...;

{string} Products = ...;

float Capacity = ...;

tuple tableRoutesType {

string p;

string o;

string d;

float cost;

}

{tableRoutesType} TableRoutes = ...;

tuple connection {

string o;

string d;

}

tuple route {

string p;

connection e;

}

{route} Routes = { < p,<o,d> > | <p,o,d,c> in TableRoutes };

{connection} Connections = { c | <p,c> in Routes };

tuple supply{

string p;

string o;

}

{supply} Supplies = { <p,c.o> | <p,c> in Routes };

float Supply[Supplies] = ...;

tuple customer {

string p;

string d;

}

{customer} Customers = { <p,c.d> | <p,c> in Routes };

float Demand[Customers] = ...;

float Cost[Routes] = [ <t.p,<t.o,t.d>>:t.cost | t in TableRoutes ];

{string} Orig[p in Products] = { c.o | <p,c> in Routes };

{string} Dest[p in Products] = { c.d | <p,c> in Routes };

{connection} CPs[p in Products] = { c | <p,c> in Routes };

assert forall( p in Products )

sum( o in Orig[p] )

Supply[<p,o>] == sum( d in Dest[p] ) Demand[<p,d>];

dvar float+ Trans[Routes];

constraint ctSupply[Products][Cities];

constraint ctDemand[Products][Cities];

minimize

sum( l in Routes ) Cost[l] \* Trans[l];

subject to {

forall( p in Products , o in Orig[p] )

ctSupply[p][o]:

sum( <o,d> in CPs[p] )

Trans[< p,<o,d> >] == Supply[<p,o>];

forall( p in Products , d in Dest[p] )

ctDemand[p][d]:

sum( <o,d> in CPs[p] )

Trans[< p,<o,d> >] == Demand[<p,d>];

forall( c in Connections )

ctCapacity:

sum( <p,c> in Routes )

Trans[<p,c>] <= Capacity;

}

execute DISPLAY {

writeln("Transport Amounts:");

for (var r in Routes) {

writeln(" ", r.p , ":" , r.e.o , "->" , r.e.d , " " , Trans[r] );

}

}

Here is the data file:

Cities = { GARY CLEV PITT FRA DET LAN WIN STL FRE LAF };

Products = { bands coils plate };

Capacity = 625;

TableRoutes = {

<bands,GARY,FRA,30>

<bands,GARY,DET,10>

<bands,GARY,LAN,8>

<bands,GARY,WIN,10>

<bands,GARY,STL,11>

<bands,GARY,FRE,71>

<bands,GARY,LAF,6>

<bands,CLEV,FRA,22>

<bands,CLEV,DET,7>

<bands,CLEV,LAN,10>

<bands,CLEV,WIN, 7>

<bands,CLEV,STL,21>

<bands,CLEV,FRE,82>

<bands,CLEV,LAF,13>

<bands,PITT,FRA,19>

<bands,PITT,DET,11>

<bands,PITT,LAN,12>

<bands,PITT,WIN,10>

<bands,PITT,STL,25>

<bands,PITT,FRE,83>

<bands,PITT,LAF,15>

<coils,GARY,FRA,39>

<coils,GARY,DET,14>

<coils,GARY,LAN,11>

<coils,GARY,WIN,14>

<coils,GARY,STL,16>

<coils,GARY,FRE,82>

<coils,GARY,LAF,8>

<coils,CLEV,FRA,27>

<coils,CLEV,DET, 9>

<coils,CLEV,LAN,12>

<coils,CLEV,WIN, 9>

<coils,CLEV,STL,26>

<coils,CLEV,FRE,95>

<coils,CLEV,LAF,17>

<coils,PITT,FRA,24>

<coils,PITT,DET,14>

<coils,PITT,LAN,17>

<coils,PITT,WIN,13>

<coils,PITT,STL,28>

<coils,PITT,FRE,99>

<coils,PITT,LAF,20>

<plate,GARY,FRA,41>

<plate,GARY,DET,15>

<plate,GARY,LAN,12>

<plate,GARY,WIN,16>

<plate,GARY,STL,17>

<plate,GARY,FRE,86>

<plate,GARY,LAF, 8>

<plate,CLEV,FRA,29>

<plate,CLEV,DET, 9>

<plate,CLEV,LAN,13>

<plate,CLEV,WIN, 9>

<plate,CLEV,STL,28>

<plate,CLEV,FRE,99>

<plate,CLEV,LAF,18>

<plate,PITT,FRA,26>

<plate,PITT,DET,14>

<plate,PITT,LAN,17>

<plate,PITT,WIN,13>

<plate,PITT,STL,31>

<plate,PITT,FRE,104>

<plate,PITT,LAF,20>

};

Supply = #[

<bands GARY>: 400

<coils GARY>: 800

<plate GARY>: 200

<bands CLEV>: 700

<coils CLEV>: 1600

<plate CLEV>: 300

<bands PITT>: 800

<coils PITT>: 1800

<plate PITT>: 300

]#;

Demand = #[

<bands FRA>: 300

<coils FRA>: 500

<plate FRA>: 100

<bands DET>: 300

<coils DET>: 750

<plate DET>: 100

<bands LAN>: 100

<coils LAN>: 400

<plate LAN>: 0

<bands WIN>: 75

<coils WIN>: 250

<plate WIN>: 50

<bands STL>: 650

<coils STL>: 950

<plate STL>: 200

<bands FRE>: 225

<coils FRE>: 850

<plate FRE>: 100

<bands LAF>: 250

<coils LAF>: 500

<plate LAF>: 250

]#;

Here are the results (note that I added script at the end of transp4.mod to produce this output in the Scripting Output window):

// solution (optimal) with objective 199500

Transport Amounts:

bands:GARY->FRA 0

bands:GARY->DET 0

bands:GARY->LAN 0

bands:GARY->WIN 0

bands:GARY->STL 400

bands:GARY->FRE 0

bands:GARY->LAF 0

bands:CLEV->FRA 225

bands:CLEV->DET 0

bands:CLEV->LAN 0

bands:CLEV->WIN 0

bands:CLEV->STL 250

bands:CLEV->FRE 0

bands:CLEV->LAF 225

bands:PITT->FRA 75

bands:PITT->DET 300

bands:PITT->LAN 100

bands:PITT->WIN 75

bands:PITT->STL 0

bands:PITT->FRE 225

bands:PITT->LAF 25

coils:GARY->FRA 0

coils:GARY->DET 0

coils:GARY->LAN 0

coils:GARY->WIN 0

coils:GARY->STL 25

coils:GARY->FRE 625

coils:GARY->LAF 150

coils:CLEV->FRA 0

coils:CLEV->DET 525

coils:CLEV->LAN 400

coils:CLEV->WIN 250

coils:CLEV->STL 300

coils:CLEV->FRE 125

coils:CLEV->LAF 0

coils:PITT->FRA 500

coils:PITT->DET 225

coils:PITT->LAN 0

coils:PITT->WIN 0

coils:PITT->STL 625

coils:PITT->FRE 100

coils:PITT->LAF 350

plate:GARY->FRA 0

plate:GARY->DET 0

plate:GARY->LAN 0

plate:GARY->WIN 0

plate:GARY->STL 200

plate:GARY->FRE 0

plate:GARY->LAF 0

plate:CLEV->FRA 50

plate:CLEV->DET 100

plate:CLEV->LAN 0

plate:CLEV->WIN 50

plate:CLEV->STL 0

plate:CLEV->FRE 100

plate:CLEV->LAF 0

plate:PITT->FRA 50

plate:PITT->DET 0

plate:PITT->LAN 0

plate:PITT->WIN 0

plate:PITT->STL 0

plate:PITT->FRE 0

plate:PITT->LAF 250

The minimum cost is $199,500.