**Golf\_sport.mod**

#decision variables

**var** x{i **in** 1..9,j **in** 1..3,k **in** 1..2}>=0;# number of components i produced in plant j in month k

**var** y{i **in** 1..9,j **in** 1..3,k **in** 1..2}>=0;

#for month 1: number of components i left after assembling sets except inventory in plant j in month 1

#for month 1: number of sets i assembled besides inventory in plant j in month 1 for i=6,…,9 j=1,2,3

#for month 2: number of components i left after assembling sets in plant j in month 2for i=1,…,5 j=1,2,3

#for month 2: number of sets i assembled in plant j in month 2 for i=6,…,9 j=1,2,3

**var** z{i **in** 1..9,j **in** 1..3,k **in** 1..2}>=0;#number of components and sets i sold in plant j in month k for i=1,…,9 j=1,2,3 k=1,2

**var** I{i **in** 1..9,j **in** 1..3}>=0;#number of components and sets I inventoried in plant j for i=1,…,9 j=1,2,3

#parameters

**param** t{i **in** 1..3};# Assembly times for the sets at each plant j

**param** m{i **in** 1..3};# Monthly Availability times for the sets at each plant j

**param** l{i **in** 1..5,j **in** 1..3};# Labor times for the components i at each plant j

**param** p{i **in** 1..5,j **in** 1..3};# Packing times for the components i at each plant j

**param** a{i **in** 1..5,j **in** 1..3};#Advertising fees for the components i at each plant j

**param** L{i **in** 1..3};# Monthly availability of labor times at each plant j

**param** P{i **in** 1..3};# Monthly availability of packing times at each plant j

**param** mind{i **in** 1..9,j **in** 1..3};# Minimum product demand per month for the components i at each plant j

**param** maxd{i **in** 1..9,j **in** 1..3};# Maximum product demand per month for the components i at each plant j

**param** c{i **in** 1..9,j **in** 1..3};# Material,Production and Assembly costs per part for the components i at each plant j

**param** r{i **in** 1..9,j **in** 1..3};# Revenue per part for the components i at each plant j

#objective function

**maximize** profit:**sum**{i **in** 1..9,j **in** 1..3,k **in** 1..2}(z[i,j,k]\*r[i,j])-**sum**{i **in** 1..9,j **in** 1..3}((y[i,j,1]+I[i,j]+y[i,j,2]\*1.25)\*c[i,j])-**sum**{i **in** 1..9,j **in** 1..3}(I[i,j]\*c[i,j]\*0.05);

# profit=income-production cost for sets and components - cost for keep the inventory

#constraints

**subject** **to** assembly\_set1{j **in** 1..3}:t[j]\***sum**{i **in** 6..9}(y[i,j,1]+I[i,j])<=m[j];

**subject** **to** assembly\_set2{j **in** 1..3}:t[j]\***sum**{i **in** 6..9}y[i,j,2]<=m[j];

# the sum of assembly time should not be bigger than the capacity for each plant;

**subject** **to** labor{j **in** 1..3,k **in** 1..2}:**sum**{i **in** 1..5}(x[i,j,k]\*l[i,j])<=L[j];

**subject** **to** packing1{j **in** 1..3}:**sum**{i **in** 1..5}((y[i,j,1]+I[i,j])\*p[i,j])<=P[j];

**subject** **to** packing2{j **in** 1..3}:**sum**{i **in** 1..5}(y[i,j,2]\*p[i,j])<=P[j];

**subject** **to** advertising{k **in** 1..2}:**sum**{i **in** 1..5,j **in** 1..3}(x[i,j,k]\*a[i,j])<=22000;

# the sum of labor/packing/advertising cost should not be bigger than the capacity or resource available;

**subject** **to** assembly\_x\_to\_y11{j **in** 1..3}:y[1,j,1]+I[1,j]+13\*(y[6,j,1]+I[6,j]+y[7,j,1]+I[7,j])-x[1,j,1]=0;

**subject** **to** assembly\_x\_to\_y12{j **in** 1..3}:y[2,j,1]+I[2,j]+13\*(y[8,j,1]+I[8,j]+y[9,j,1]+I[9,j])-x[2,j,1]=0;

**subject** **to** assembly\_x\_to\_y13{j **in** 1..3}:y[3,j,1]+I[3,j]+10\***sum**{i **in** 6..9}(y[i,j,1]+I[i,j])-x[3,j,1]=0;

**subject** **to** assembly\_x\_to\_y14{j **in** 1..3}:y[4,j,1]+I[4,j]+3\*(y[6,j,1]+I[6,j]+y[8,j,1]+I[8,j])-x[4,j,1]=0;

**subject** **to** assembly\_x\_to\_y15{j **in** 1..3}:y[5,j,1]+I[5,j]+3\*(y[7,j,1]+I[7,j]+y[9,j,1]+I[9,j])-x[5,j,1]=0;

# for month 1, take x as ingredients, y and i as products, distribute x into y and i: y(1-5)+i(1-5)+n\*(y(6-9)+i(6-9))=x(1-5)

**subject** **to** assembly\_x\_to\_y21{j **in** 1..3}:y[1,j,2]+13\*(y[6,j,2]+y[7,j,2])-x[1,j,2]=0;

**subject** **to** assembly\_x\_to\_y22{j **in** 1..3}:y[2,j,2]+13\*(y[8,j,2]+y[9,j,2])-x[2,j,2]=0;

**subject** **to** assembly\_x\_to\_y23{j **in** 1..3}:y[3,j,2]+10\***sum**{i **in** 6..9}y[i,j,2]-x[3,j,2]=0;

**subject** **to** assembly\_x\_to\_y24{j **in** 1..3}:y[4,j,2]+3\*(y[6,j,2]+y[8,j,2])-x[4,j,2]=0;

**subject** **to** assembly\_x\_to\_y25{j **in** 1..3}:y[5,j,2]+3\*(y[7,j,2]+y[9,j,2])-x[5,j,2]=0;

#for month 2, take x as ingredients, y as products, distribute x into y: y(1-5)+n\*y(6-9)=x(1-5)

**subject** **to** amount\_of\_sold1{i **in** 1..9,j **in** 1..3}:z[i,j,1]-y[i,j,1]=0;

**subject** **to** amount\_of\_sold2{i **in** 1..9,j **in** 1..3}:z[i,j,2]-y[i,j,2]-I[i,j]=0;

#for month 1, the amount of sold components and sets equal to y;

#for month 2, the amount of sold components and sets equal to y+i;

**subject** **to** graphite{k **in** 1..2}:**sum**{j **in** 1..3}(x[2,j,k]\*4/16)<=1125.94;

#graphit constraint

**subject** **to** demand\_max\_1{i **in** 1..9, j **in** 1..3,k **in** 1..2}:z[i,j,k]<=maxd[i,j];

**subject** **to** demand\_min\_1{i **in** 1..9, j **in** 1..3,k **in** 1..2}:z[i,j,k]>=mind[i,j];

#demand constraint;

#subject to demand\_min\_1{i in 1..9, j in 1..3,k in 1..2}:z[i,j,k]>=1.5\*mind[i,j];

#demand constraint for the question c

**subject** **to** cost\_calculation:b=**sum**{i **in** 1..5,j **in** 1..3}((x[i,j,1]+x[i,j,2]\*1.25)\*c[i,j]);

**golf\_sport.dat**

#parameters

**param** t:=1 65 2 60 3 65;

**param** m:=1 5500 2 5000 3 6000;

**param** l:=[1,1] 1 [2,1] 1.5 [3,1] 1.5 [4,1] 3 [5,1] 4 [1,2] 3.5 [2,2] 3.5 [3,2] 4.5 [4,2] 4.5 [5,2] 5 [1,3] 3 [2,3] 3.5 [3,3] 4 [4,3] 4.5 [5,3] 5.5;

**param** p:=[1,1] 4 [2,1] 4 [3,1] 5 [4,1] 6 [5,1] 6 [1,2] 7 [2,2] 7 [3,2] 8 [4,2] 9 [5,2] 7 [1,3] 7.5 [2,3] 7.5 [3,3] 8.5 [4,3] 9.5 [5,3] 8;

**param** a:=[1,1] 1 [2,1] 1.5 [3,1] 1.1 [4,1] 1.5 [5,1] 1.9 [1,2] 1.1 [2,2] 1.1 [3,2] 1.1 [4,2] 1.2 [5,2] 1.9 [1,3] 1.3 [2,3] 1.3 [3,3] 1.3 [4,3] 1.3 [5,3] 1.9;

**param** L:=1 12000 2 15000 3 22000;

**param** P:=1 20000 2 40000 3 35000;

**param** mind:=[1,1] 0 [1,2] 0 [1,3] 0 [2,1] 100 [2,2] 100 [2,3] 50 [3,1] 200 [3,2] 200 [3,3] 100 [4,1] 30 [4,2] 30 [4,3] 100 [5,1] 100 [5,2] 100 [5,3] 100 [6,1] 0 [6,2] 0 [6,3] 0 [7,1] 0 [7,2] 0 [7,3] 0 [8,1] 0 [8,2] 0 [8,3] 0 [9,1] 0 [9,2] 0 [9,3] 0;

**param** maxd:=[1,1] 2000 [1,2] 2000 [1,3] 2000 [2,1] 2000 [2,2] 2000 [2,3] 2000 [3,1] 2000 [3,2] 2000 [3,3] 2000 [4,1] 2000 [4,2] 2000 [4,3] 2000 [5,1] 2000 [5,2] 2000 [5,3] 2000 [6,1] 200 [6,2] 200 [6,3] 200 [7,1] 100 [7,2] 100 [7,3] 100 [8,1] 300 [8,2] 300 [8,3] 300 [9,1] 400 [9,2] 400 [9,3] 400;

**param** c:=[1,1] 6 [1,2] 5 [1,3] 7 [2,1] 19 [2,2] 18 [2,3] 20 [3,1] 4 [3,2] 5 [3,3] 5 [4,1] 10 [4,2] 11 [4,3] 12 [5,1] 26 [5,2] 24 [5,3] 27 [6,1] 178 [6,2] 175 [6,3] 180 [7,1] 228 [7,2] 220 [7,3] 240 [8,1] 350 [8,2] 360 [8,3] 370 [9,1] 420 [9,2] 435 [9,3] 450;

**param** r:=[1,1] 10 [1,2] 10 [1,3] 12 [2,1] 25 [2,2] 25 [2,3] 30 [3,1] 8 [3,2] 8 [3,3] 10 [4,1] 18 [4,2] 18 [4,3] 22 [5,1] 40 [5,2] 40 [5,3] 45 [6,1] 290 [6,2] 290 [6,3] 310 [7,1] 380 [7,2] 380 [7,3] 420 [8,1] 560 [8,2] 560 [8,3] 640 [9,1] 650 [9,2] 650 [9,3] 720;