Chanas's Approach - A Nonsymmetric Model

SOLUTION:
STEP 1: The LPP formulation is as follows:
Max z = 206x1 + 971x2 + 519x3 + 5552x4
s.t.
g1(x) = 252x1 + 4 x2 + 13x3 + 80x4 <= 99377
g2(x) = x1 + x2 + x3 + x4 <= 100000
g3(x) = x1 + x2 + x3 + x4 <= 103488
x1,x2,x3,x4 >= 0

On solving in TORA, the solution obtained is: x* = (0,24844.25,0,0) and the optimal solution z0 = 24123766.75

Now let us formulate the above problem into the following fuzzy linear programming model:
Max z = = 206x1 + 971x2 + 519x3 + 5552x4

s.t.
g1(x) =252x1 + 4 x2 + 13x3 + 80x4 <= 99377

g2(x) = x1 + x2 + x3 + x4 <= 100000
g3(x) = x1 + x2 + x3 + x4 <= 103488
x1,x2,x3,x4 >= 0

STEP 2. Suppose the maximal tolerance b0 is 2650000 p0 = 200000, p1=4968.85, p2=5000 and p3= 5174.40 (pi's are 5% of bi's) then the parametric programming version becomes:

Max z = 206x1 + 971x2 + 519x3 + 5552x4

s.t.
g1(x) =252x1 + 4 x2 + 13x3 + 80x4 <= 99377 +4968θ
g2(x) = x1 + x2 + x3 + x4 <= 100000+5000θ
g3(x) = x1 + x2 + x3 + x4 <= 103488+5174.40θ

x1,x2,x3,x4 >= 0 and θ ϵ [0,1].

Step 1. Suppose the maximal tolerance for the constraint is $200000, then the parametric programming version becomes

Max z = 206x1 + 971x2 + 519x3 + 5552x4

4968.85(252x1 + 4 x2 + 13x3 + 80x4)
+5000(x1 + x2 + x3 + x4)+
5174.4(x1 + x2 + x3 + x4)<=2650000+20000000θ
xi>=0, and 0 E [0, 1].

i.e.
1262324.4x1 + 30049.4x2 + 74769.05x3 + 407682x4 <= 2650000+20000000θ

The optimal solution x· = (2650000 + 200000θ/30049.4) and z*·(theta) = 971(2650000 + 200000θ/30049.4).

Step 2. For simplicity, assume that Z0= 2700000 is the goal of the objective.

theta= z0-z*theta/p0

On solving this we get the value of theta =0.91
[2700000-971(2650000+200000θ)/200000θ]/300049.4 =theta

alpha=1-theta = 0.09

x2=88.7
x1,x3,x4=0
b1=354.8 , b2 = 88.7 , b3 = 88.7