IE 441

PLANNING FOR ENGINEERS

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THE CONSTRAİNTS AND OBJECTİVES ACCORDİNG TO OUR DATA

cons 1 6x1 +8x2 +2x3 +5x4 +x5 <= 1234

cons 2 8x1 <= 752

cons 3 8x2 <= 1040

cons 4 3x3 <= 318

cons 5 -6x4 <= 270

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max z1 = 3x1 -x3 -x5

max z2 =-2x1 +5x3

max z3 = 5x1 +5x4

max z4 = 3x2 -x4

max z5 = 5x2 -3x5

1. Using the weighting method find as many of the efficient extreme points of your problem as possible.

2. Using the Constraints method, find as many of the efficient extreme points of your problem as possible.

3. Is the solution set different than in part (2)? Why/why not?

1-)Weighting Method

We write our problem in CMPL program and firstly we calculated the our first efficient extreme point by taking Lambdas (in weighting method) 0.2 ;

parameters:

a[] :=(3,0,-1,0,-1); b[] :=(-2,0,5,0,0); c[] :=(5, 0, 0, 5, 0); d[] :=(0,3,0,-1,0); e[] :=(0,5,0,0,-3);

s[] :=(1234,752,1040,318,270);

A[, ] := ((6,8,2,5,1),(8,0,0,0,0),(0,8,0,0,0),(0,0,3,0,0),(0,0,0,-6,0));

variables:

x[1..5]: real;

objectives:

0.2\*a[]T\*x[]+0.2\*b[]T\*x[]+0.2\*c[]T\*x[]+0.2\*d[]T\*x[]+0.2\*e[]T\*x[]->max;

constraints:

A[,] \* x[] <= s[];

x[] >= 0;

And our solution is,

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Objective status optimal

**Objective value 289.2 (max!)**

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x[1] C 0 -Infinity Infinity 0

x[2] C 127.75 -Infinity Infinity 0

x[3] C 106 -Infinity Infinity 0

x[4] C 0 -Infinity Infinity 0

x[5] C 0 -Infinity Infinity 0

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|  |  |  |  |
| --- | --- | --- | --- |
| Variables | X2=127.75 | X3=106 | |
| Z1 | -21.2 | |  |
| Z2 | 106 | |  |
| Z3 | 0 | |  |
| Z4 | 76.65 | |  |
| Z5 | 127.6 | |  |

With another weighted objectives

objectives:

0.1\*a[]T\*x[]+0.05\*b[]T\*x[]+0.7\*c[]T\*x[]+0.05\*d[]T\*x[]+0.1\*e[]T\*x[]->max;

Solution is;

Objective status optimal

**Objective value 851.46 (max!)**

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x[1] C 0 -Infinity Infinity 0

x[2] C 0 -Infinity Infinity 0

x[3] C 0 -Infinity Infinity 0

x[4] C 246.8 -Infinity Infinity 0

x[5] C 0 -Infinity Infinity 0

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | X4=246.8 |  | |
| Z1 | 0 | |  |
| Z2 | 0 | |  |
| Z3 | 863.8 | |  |
| Z4 | -12.34 | |  |
| Z5 | 0 | |  |

With another weighted objectives

objectives:

0.3\*a[]T\*x[]+0.05\*b[]T\*x[]+0.2\*c[]T\*x[]+0.05\*d[]T\*x[]+0.4\*e[]T\*x[]->max;

Objective status optimal

**Objective value 349.262 (max!)**

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x[1] C 94 -Infinity Infinity 0

x[2] C 83.75 -Infinity Infinity 0

x[3] C 0 -Infinity Infinity 0

x[4] C 0 -Infinity Infinity 0

x[5] C 0 -Infinity Infinity 0

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | X1=94 | X2=83.75 | |
| Z1 | 84.6 | |  |
| Z2 | -9.4 | |  |
| Z3 | 94 | |  |
| Z4 | 12.5 | |  |
| Z5 | 167.5 | |  |

With another weighted objectives

objectives:

0.05\*a[]T\*x[]+0.4\*b[]T\*x[]+0.05\*c[]T\*x[]+0.1\*d[]T\*x[]+0.4\*e[]T\*x[]->max;

Objective status optimal

**Objective value 500.525 (max!)**

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x[1] C 0 -Infinity Infinity 0

x[2] C 127.75 -Infinity Infinity 0

x[3] C 106 -Infinity Infinity 0

x[4] C 0 -Infinity Infinity 0

x[5] C 0 -Infinity Infinity 0

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|  |  |  |  |
| --- | --- | --- | --- |
| Variables | X2=127.75 | X3=106 | |
| Z1 | -5.3 | |  |
| Z2 | 212 | |  |
| Z3 | 0 | |  |
| Z4 | 38.3 | |  |
| Z5 | 255.5 | |  |

With another weighted objectives

objectives:

0.3\*a[]T\*x[]+0.005\*b[]T\*x[]+0.65\*c[]T\*x[]+0.04\*d[]T\*x[]+0.005\*e[]T\*x[]->max;

Objective status optimal

**Objective value 819.3 (max!)**

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x[1] C 94 -Infinity Infinity 0

x[2] C 0 -Infinity Infinity 0

x[3] C 0 -Infinity Infinity 0

x[4] C 134 -Infinity Infinity 0

x[5] C 0 -Infinity Infinity 0

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|  |  |  |  |
| --- | --- | --- | --- |
| Variables | X1=94 | X4=134 | |
| Z1 | 84.6 | |  |
| Z2 | -0.94 | |  |
| Z3 | 741 | |  |
| Z4 | -5.3 | |  |
| Z5 | 0 | |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| (X1,X2,X3,X4,X5) | Z1 | Z2 | Z3 | Z4 | Z5 |
| (94,0,0,0,0) | 282 | -186 | 470 | 0 | 0 |
| (0,0,106,0,0) | -106 | 530 | 0 | 0 | 0 |
| (0,0,0,246,8,0) | 0 | 0 | 1234 | -246.8 | 0 |
| (0,130,0,0,0) | 0 | 0 | 0 | 390 | 650 |
| (0,130,0,0,0) | 0 | 0 | 0 | 390 | 650 |

2-)CONSTRAİNT METHOD

N1=-106 N2=-186 N3=0 N4=-246 N5=0

M1=282 M2=530 M3=1234 M4=390 M5=650

Keep Z1 constant arbitrarily

LET R=4

L2=-186 +(t/3)\*(530+186) For t=0,1,2,3

L2={-186,52,291,530}

a-)-2x1 +5x3 >=-186

b-)-2x1 +5x3 >=52

c-)-2x1 +5x3 >=291

d-)-2x1 +5x3 <=530

L3=0+(t/3)\*(1234-0)

L3={0,411,822,1234}

a-) 5x1 +5x4 >= 0

b-) 5x1 +5x4 >= 411

c-) 5x1 +5x4 >= 822

d-) 5x1 +5x4 <=1234

L4=-246 +(t/3)\*(390+246)

L4={-246,-34,178,390}

a-)3x2 -x4 >=-246

b-)3x2 -x4 >=-34

c-)3x2 -x4 >=178

d-)3x2 -x4 <=390

L5=0+(t/3)\*(650-0)

L5{0,216,433,650}

a-)5x2 -3x5 >=0

b-)5x2 -3x5 >=216

c-)5x2 -3x5 >=433

d-)5x2 -3x5 <=650

Keep Z2 arbitrarily

We will find the range of Z1

L1=-106 +(t/3)\*(282+106)

L1={-106,23,152,282}

a-) 3x1 -x3 -x5 >=-106

b-) 3x1 -x3 -x5 >=23

c-) 3x1 -x3 -x5 >=152

d-) 3x1 -x3 -x5 <=282

3-) Is the solution set different than in part (1)? Why/why not?

Even if the solutions are not the same ,the values that we found in the first question are in the same region that we found in part 2.The solution set that is founded with constraint method is the same solution set as the first one that is founded by using weighted method because in part 1,we found some optimal values for the objectives with respond to our lambda’s and in Part 2 we found feasible ranges for the objectives from the minimum value to maximum value.