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OT LAB ASSIGNMENT 4

Question 1

$$\text{Maximize } Z = 2x_1 - 3x_2 + 6x_3$$

$$\text{s.t. } x_1 - 3x_3 \geq 4,$$
$$2x_1 - 8x_2 + 3x_3 \leq 4,$$
$$x_1 + x_2 \geq -7,$$
$$x_1, x_2, x_3 \geq 0$$

Code:

```matlab
%% Convert the problem into standard form
% Max z = 2x1-3x2+6x3
% s.t.x1-3x3>=4
%     2x1-8x2+3x3<=4
%     x1+x2>=-7
%     x1,x2,x3>=0

clc
clear all
close all
format short
 % phase 1 input parameteres
 c=[2 -3 6]; %cost of objectivve function
 A = [1 0 -3;2 -8 3;1 1 0];
 B=[4;4;-7];   %RHS of the constraint
 for i = 1:size(B,1)
     if B(i,:)<0
         A(i,:)=-A(i,:);
         B(i)=-B(i);
     end
 end


 % Phase 2 Identify <= or >= types constraint
 Ineqsign=[-1 1 1]; %-1 for greater than sign 1 for less than sign
 % Introduce slack and surplus variable
 s = eye(size(A,1));
 index = find(Ineqsign<0);
 s(index,:) = -s(index,:);

% Phase 4 To write standard form
objfun= array2table(c);
objfun.Properties.VariableNames(1:size(c,2))={'x1','x2','x3'};
Mat=[A s B];
const=array2table(Mat);
const.Properties.VariableNames(1:size(Mat,2))={'x1','x2','x3','s1','s2','s3','sol'
};
disp("The cost function:")
objfun
disp("The function in Standard Form:")
```

```
const
```

Output:

```
The cost function:

objfun =

  1×3 table

    x1     x2     x3

    __     __     __

    2      -3     6

The function in Standard Form:

const =

  3×7 table

    x1     x2     x3     s1     s2     s3     sol

    __     __     __     __     __     __     __

     1      0     -3     -1      0      0      4
     2     -8      3      0      1      0      4
    -1     -1      0      0      0      1      7
```

Question 2

$$\text{Maximize } Z = 3x_1 + 5x_2$$

$$\text{s.t. } x_1 + 2x_2 \le 20,$$
$$x_1 + x_2 \le 15,$$
$$x_2 \ge 6,$$
$$x_1, x_2 \ge 0$$

Code:

```
%% Convert the problem into standard form
% Max z = 3x1+5x2
%s.t. x1+2x2<=20
%     x1+x2<=15
%     x2>=6
%     x1,x2,x3>=0

clc
clear all
close all
format short
 % phase 1 input parameteres
```

```matlab
c=[3 5]; %cost of objectivve function
A = [1 2 ;1 1;0 1];
B=[20;15;6];   %RHS of the constraint
for i = 1:size(B,1)
    if B(i,:)<0
        A(i,:)=-A(i,:);
        B(i)=-B(i);
    end
end

% Phase 2 Identify <= or >= types constraint
Ineqsign=[1 1 -1]; %-1 for greater than sign 1 for less than sign
% Introduce slack and surplus variable
s = eye(size(A,1));
index = find(Ineqsign<0);
s(index,:) = -s(index,:);

% Phase 4 To write standard form
objfun= array2table(c);
objfun.Properties.VariableNames(1:size(c,2))={'x1','x2'};
Mat=[A s B];
const=array2table(Mat);
const.Properties.VariableNames(1:size(Mat,2))={'x1','x2','s1','s2','s3','sol'};
disp("The cost function:")
objfun
disp("The function in Standard Form:")
const
```

Output:

```
The cost function:

objfun =

  1×2 table

    x1     x2
    __     __

    3      5


The function in Standard Form:

const =

  3×6 table

    x1    x2    s1    s2    s3    sol
    __    __    __    __    __    ___

    1     2     1     0     0     20
    1     1     0     1     0     15
    0     1     0     0    -1      6
```

Question 3

$$\text{Minimize } Z = x_1 - 3x_2 + 2x_3$$

$$\text{s.t. } 3x_1 - x_2 + 2x_3 \le 7,$$
$$-2x_1 + 4x_2 \le 2,$$
$$-4x_1 + 3x_2 + 2x_3 \ge 4,$$
$$x_1, x_2, x_3 \ge 0$$

Code:

```matlab
%% Convert the problem into standard form
% Min z = x1-3x2+2x3
%s.t. 3x1-x2+2x3<=7
%      -2x1+4x2<=2
%      -4x1+3x2+2x3>=4
%      x1,x2,x3>=0

clc
clear all
close all
format short
 % phase 1 input parameteres
 c=[1,-3,2]; %cost of objectivve function
 A = [3,-1,2;-2,4,0;-4,3,2];
 B=[7;2;4];  %RHS of the constraint
 for i = 1:size(B,1)
     if B(i,:)<0
         A(i,:)=-A(i,:);
         B(i)=-B(i);
     end
 end

 % Phase 2 Identify <= or >= types constraint
 Ineqsign=[1,1,-1]; %-1 for greater than sign 1 for lss than sign
 % Introduce slack and surplus variable
 s = eye(size(A,1));
 index = find(Ineqsign<0);
 s(index,:) = -s(index,:);

% Phase 4 To write standard form
objfun= array2table(c);
objfun.Properties.VariableNames(1:size(c,2))={'x1','x2','x3'};
Mat=[A s B];
const=array2table(Mat);
const.Properties.VariableNames(1:size(Mat,2))={'x1','x2','x3','s1','s2','s3','sol'
};
disp("The cost function:")
objfun
disp("The function in Standard Form:")
const
```

Output:

```
The cost function:

objfun =

  1×3 table

    x1      x2      x3

    —       —       —

    1      -3       2

The function in Standard Form:

const =

  3×7 table

    x1      x2      x3      s1      s2      s3      sol

    —       —       —       —       —       —       —

     3      -1       2       1       0       0       7
    -2       4       0       0       1       0       2
    -4       3       2       0       0      -1       4
```

Question 4

$$\text{Minimize } Z = 40x_1 + 24x_2 + 12x_3$$

$$\text{s.t. } 20x_1 + 50x_2 + 10x_3 \geq 480,$$
$$8x_1 + 5x_2 + 2x_3 \leq 72,$$
$$4x_1 + 5x_2 + 3x_3 \leq 7,$$
$$x_1, x_2, x_3 \geq 0$$

Code:

```matlab
%% Convert the problem into standard form
% Min z = 40x1+24x2+12x3
%s.t. 20x1+50x2+10x3>=480
%      8x1+5x2+2x3<=72
%      4x1+5x2+3x3<=7
%      x1,x2,x3>=0

clc
clear all
close all
format short
 % phase 1 input parameteres
 c=[40,24,12]; %cost of objectivve function
 A = [20,50,10;8,5,2;4,5,3];
 B=[480;72;7];   %RHS of the constraint
 for i = 1:size(B,1)
     if B(i,:)<0
         A(i,:)=-A(i,:);
         B(i)=-B(i);
```

```matlab
      end
  end

  % Phase 2 Identify <= or >= types constraint
  Ineqsign=[-1 1 1]; %-1 for greater than sign 1 for less than sign
  % Introduce slack and surplus variable
  s = eye(size(A,1));
  index = find(Ineqsign<0);
  s(index,:) = -s(index,:);

% Phase 4 To write standard form
objfun= array2table(c);
objfun.Properties.VariableNames(1:size(c,2))={'x1','x2','x3'};
Mat=[A s B];
const=array2table(Mat);
const.Properties.VariableNames(1:size(Mat,2))={'x1','x2','x3','s1','s2','s3','sol'
};
disp("The cost function:")
objfun
disp("The function in Standard Form:")
const
```

Output:

```
The cost function:

objfun =

  1×3 table

    x1     x2     x3
    __     __     __

    40     24     12


The function in Standard Form:

const =

  3×7 table

    x1     x2     x3     s1     s2     s3     sol
    __     __     __     __     __     __     ___

    20     50     10     -1      0      0     480
     8      5      2      0      1      0      72
     4      5      3      0      0      1       7
```