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JIA Jiyuan 20210122 HW#05-2 Class 01

```
clear;clc;
```

Problem 1:

```
clear; clc;
A = [7 9 -9;3 2 -4;1 5 -1];
B = [22; 12; -2];
r1 = rank(A);
r2 = rank([A,B]);
disp("rank(A) is "+r1);
disp("rank([A,B]) is "+r2);
disp("singular matrix");
disp("one possible answer")
X = A\B;
disp(X);
```

```
rank(A) is 2
rank([A,B]) is 2
singular matrix
one possible answer
##: ########################RCOND =  6.745286e-18#
   -1.1940
   -1.0448
   -4.4179
```

Problem 2:

a.

```
clear; clc;
A = [1 1 1;16 4 1;25 5 1];
B = [4; 73; 120];
r1 = rank(A);
r2 = rank([A,B]);
disp("rank(A) is "+r1);
disp("rank([A,B]) is "+r2);
X = A\B;
disp(X);
```

```
% b.
A = [1 1 1 1;64 16 4 1;125 25 5 1];
B = [4; 73; 120];
r1 = rank(A);
r2 = rank([A,B]);
disp("rank(A) is "+r1);
disp("rank([A,B]) is "+r2);
disp("singular matrix");
disp("one possible answer")
X = A\B;
disp(X);
```

```
rank(A) is 3
rank([A,B]) is 3
    6.0000
   -7.0000
    5.0000

rank(A) is 3
rank([A,B]) is 3
singular matrix
one possible answer
    0.2414
    3.5862
         0
    0.1724
```

Problem 3:

```
clear; clc;
Ta = 150;
Tb = 20;
A = [1 -1/3 -1/3 0;-0.5 1 0 -0.5;-0.5 0 1 -0.5; 0 -1/3 -1/3 1];
B = [1/3*Ta; 0; 0; 1/3*Tb];
r1 = rank(A);
r2 = rank([A,B]);
disp("rank(A) is "+r1);
disp("rank([A,B]) is "+r2);
X = A\B;
disp(X);
```

```
rank(A) is 4
rank([A,B]) is 4
  106.6667
   85.0000
   85.0000
   63.3333
```

Problem 4:

the temperature of each subsquare is the average of the temperatures in the adjacent

```
clear; clc;
Ta = 150;
Tb = 20;
A = [3 -1 0 -1 0 0 0 0 0;
    -1 3 -1 0 -1 0 0 0 0;
     0 -1 2 0 0 -1 0 0 0;
     -1 0 0 3 -1 0 -1 0 0;
     0 -1 0 -1 4 -1 0 -1 0;
     0 0 -1 0 -1 3 0 0 -1;
     0 0 0 -1 0 0 2 -1 0;
     0 0 0 0 -1 0 -1 3 -1;
     0 0 0 0 0 -1 0 -1 3];
B = [Ta;0;0;0;0;0;0;0;Tb];
r1 = rank(A);
r2 = rank([A,B]);
disp("rank(A) is "+r1);
disp("rank([A,B]) is "+r2);
X = A\B;
disp(X);
```

```
rank(A) is 9
rank([A,B]) is 9
  112.8571
   94.2857
   85.0000
   94.2857
   85.0000
   75.7143
   85.0000
   75.7143
   57.1429
```

Problem 5:

a.

```
clear;clc;
A = [6 2 10;3 5 2];
B = [35; 40];
r1 = rank(A);
r2 = rank([A,B]);
disp("rank(A) is "+r1);
disp("rank([A,B]) is "+r2);
C = rref([A,B]);
disp(C);
% b.
disp("x = -1.9167*z + 3.9583");
disp("y = -0.75*z + 5.625");
fprintf("0 <= z <= %.5f\n",3.9583/1.9167);
fprintf("0 <= y <= 5.625\n");
fprintf("0 <= x <= 3.9583\n");
% c.
f = [-200 -300 -100];
```

```
lb = [0 0 0];
[x,fval] = linprog(f, A,B,[],[],lb,[]);
disp("value of x y z")
disp(x);
disp("maximum profit")
disp(-fval);
% d.
f = [-200 -500 -100];
lb = [0 0 0];
[x,fval] = linprog(f, A,B,[],[],lb,[]);
disp("value of x y z")
disp(x);
disp("maximum profit")
disp(-fval);
```

```
rank(A) is 2
rank([A,B]) is 2
    1.0000         0    1.9167    3.9583
         0    1.0000   -0.7500    5.6250

x = -1.9167*z + 3.9583
y = -0.75*z + 5.625
0 <= z <= 2.06516
0 <= y <= 5.625
0 <= x <= 3.9583

Optimal solution found.

value of x y z
    3.9583
    5.6250
         0

maximum profit
   2.4792e+03


Optimal solution found.

value of x y z
     0
     8
     0

maximum profit
        4000
```

Problem 6:

```
clear; clc;
A = [1 0 1 0 0 0 0;
     1 -1 0 -1 0 0 0;
```

```
     0 1 0 0 1 0 0;
     0 0 1 0 0 1 0;
     0 0 0 1 0 -1 1;
     0 0 0 0 1 0 1];
B = [300;-300;600;400;200;600];
r1 = rank(A);
r2 = rank([A,B]);
disp("rank(A) is "+r1);
disp("rank([A,B]) is "+r2);
C = rref([A,B]);
disp(C);
disp("2 sensors are needed");
```

```
rank(A) is 5
rank([A,B]) is 5
     1     0     0     0     0    -1     0  -100
     0     1     0     0     0     0    -1     0
     0     0     1     0     0     1     0   400
     0     0     0     1     0    -1     1   200
     0     0     0     0     1     0     1   600
     0     0     0     0     0     0     0     0

2 sensors are needed
```

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