

```
% HW 8 Question 8
```

```
% 8.(a)
```

```
A = [0 0 0 0 1 1 0 0 0;
      0 0 1 0 1 1 0 0 0;
      0 1 0 0 0 1 1 0 0;
      0 0 0 0 0 0 0 1 0;
      1 1 0 0 0 1 0 0 0;
      1 1 1 0 1 0 1 0 0;
      0 0 1 0 0 1 0 1 0;
      0 0 0 1 0 0 1 0 1;
      0 0 0 0 0 0 0 1 0]
```

```
A =
```

```

      0      0      0      0      1      1      0      0      0
      0      0      1      0      1      1      0      0      0
      0      1      0      0      0      1      1      0      0
      0      0      0      0      0      0      0      1      0
      1      1      0      0      0      1      0      0      0
      1      1      1      0      1      0      1      0      0
      0      0      1      0      0      1      0      1      0
      0      0      0      1      0      0      1      0      1
      0      0      0      0      0      0      0      1      0
```

```
d = 3.2607
```

```
d =
```

```
3.2607
```

```
v = [ .2892 .4115 .3988 .0384 .3858 .5572 .3316 .1253 .0384]'
```

```
v =
```

```

0.2892
0.4115
0.3988
0.0384
0.3858
0.5572
0.3316
0.1253
0.0384
```

```
v = v/.5572
```

```
v =
```

```

0.5190
0.7385
0.7157
0.0689
0.6924
1.0000
0.5951
0.2249
0.0689
```

```
k = 0
```

```

k =

    0

x = [1 1 1 1 1 1 1 1 1]'

x =

    1
    1
    1
    1
    1
    1
    1
    1
    1

x = A * x;
[maxAbs, eigenvalueIndex] = max(abs(x));
eigenvalue = v(eigenvalueIndex)

eigenvalue =

    1

x = (1.0/eigenvalue) * x;
d = 0;
while (abs(eigenvalue - d) > .0001)
    k = k + 1
    d = eigenvalue;
    x
    x = A * x;
    [maxAbs, eigenvalueIndex] = max(abs(x));
    eigenvalue = x(eigenvalueIndex)
    x = (1.0/eigenvalue) * x;
end

k =

    1

x =

    2
    3
    3
    1
    3
    5
    3
    3
    1

eigenvalue =

    14

k =

```

2

x =

0.5714
0.7857
0.7857
0.2143
0.7143
1.0000
0.7857
0.3571
0.2143

eigenvalue =

3.6429

k =

3

x =

0.4706
0.6863
0.7059
0.0980
0.6471
1.0000
0.5882
0.3333
0.0980

eigenvalue =

3.0980

k =

4

x =

0.5316
0.7595
0.7342
0.1076
0.6962
1.0000
0.6582
0.2532
0.1076

eigenvalue =

3.3797

k =

5

x =

0.5019
0.7191
0.7154
0.0749
0.6779
1.0000
0.5880
0.2584
0.0749

eigenvalue =

3.2022

k =

6

x =

0.5240
0.7474
0.7205
0.0807
0.6936
1.0000
0.6164
0.2304
0.0807

eigenvalue =

3.3018

k =

7

x =

0.5129
0.7311
0.7159

```
0.0698
0.6879
1.0000
0.5909
0.2356
0.0698
```

eigenvalue =

```
3.2388
```

k =

```
8
```

x =

```
0.5212
0.7422
0.7169
0.0727
0.6929
1.0000
0.6025
0.2255
0.0727
```

eigenvalue =

```
3.2757
```

k =

```
9
```

x =

```
0.5168
0.7357
0.7158
0.0688
0.6910
1.0000
0.5930
0.2283
0.0688
```

eigenvalue =

```
3.2522
```

k =

```
10
```

x =

0.5199
0.7400
0.7160
0.0702
0.6926
1.0000
0.5978
0.2247
0.0702

eigenvalue =

3.2664

k =

11

x =

0.5182
0.7374
0.7157
0.0688
0.6919
1.0000
0.5941
0.2260
0.0688

eigenvalue =

3.2573

k =

12

x =

0.5194
0.7391
0.7158
0.0694
0.6925
1.0000
0.5961
0.2246
0.0694

eigenvalue =

3.2629

k =

13

x =

0.5187
0.7381
0.7157
0.0688
0.6922
1.0000
0.5947
0.2252
0.0688

eigenvalue =

3.2593

k =

14

x =

0.5192
0.7388
0.7157
0.0691
0.6924
1.0000
0.5955
0.2247
0.0691

eigenvalue =

3.2616

k =

15

x =

0.5189
0.7383
0.7157
0.0689
0.6923

```
1.0000
0.5949
0.2250
0.0689
```

eigenvalue =

```
3.2601
```

k =

```
16
```

x =

```
0.5191
0.7386
0.7157
0.0690
0.6924
1.0000
0.5953
0.2248
0.0690
```

eigenvalue =

```
3.2610
```

k =

```
17
```

x =

```
0.5190
0.7384
0.7157
0.0689
0.6923
1.0000
0.5950
0.2249
0.0689
```

eigenvalue =

```
3.2605
```

k =

```
18
```


x =

0.5190
0.7385
0.7157
0.0690
0.6924
1.0000
0.5952
0.2248
0.0690

eigenvalue =

3.2608

k =

19

x =

0.5190
0.7385
0.7157
0.0689
0.6923
1.0000
0.5951
0.2248
0.0689

eigenvalue =

3.2606

k =

20

x =

0.5190
0.7385
0.7157
0.0690
0.6924
1.0000
0.5951
0.2248
0.0690

eigenvalue =

3.2607

k =

21

x =

0.5190
0.7385
0.7157
0.0689
0.6923
1.0000
0.5951
0.2248
0.0689

eigenvalue =

3.2606

% -----

% 8. (b)

x = [1 1 1 1 1 1 1 1 1]

x =

1
1
1
1
1
1
1
1
1
1

k = -1;

x = x/norm(x, 2);

eigenvalue = 10000;

d = 0;

while (abs(eigenvalue - d) > .0001)

d = eigenvalue;

k = k + 1

x

y = A * x;

eigenvalue = dot(x, y)

x = y / norm(y, 2);

end

k =

0

x =

0.3333
0.3333
0.3333

0.3333
0.3333
0.3333
0.3333
0.3333
0.3333

eigenvalue =

2.6667

k =

1

x =

0.2294
0.3441
0.3441
0.1147
0.3441
0.5735
0.3441
0.3441
0.1147

eigenvalue =

3.1053

k =

2

x =

0.2891
0.3974
0.3974
0.1084
0.3613
0.5058
0.3974
0.1807
0.1084

eigenvalue =

3.2141

k =

3

x =

0.2679
0.3907
0.4018
0.0558
0.3684
0.5693
0.3349
0.1898
0.0558

eigenvalue =

3.2457

k =

4

x =

0.2882
0.4117
0.3979
0.0583
0.3774
0.5420
0.3568
0.1372
0.0583

eigenvalue =

3.2556

k =

5

x =

0.2821
0.4043
0.4022
0.0421
0.3811
0.5622
0.3306
0.1453
0.0421

eigenvalue =

3.2589

k =

6

x =

0.2894
0.4127
0.3979
0.0446
0.3830
0.5522
0.3404
0.1272
0.0446

eigenvalue =

3.2600

k =

7

x =

0.2868
0.4089
0.4003
0.0390
0.3847
0.5592
0.3304
0.1317
0.0390

eigenvalue =

3.2604

k =

8

x =

0.2895
0.4123
0.3982
0.0404
0.3849

```

0.5555
0.3347
0.1253
0.0404

```

```
eigenvalue =
```

```
3.2606
```

```
k =
```

```
9
```

```
x =
```

```

0.2884
0.4105
0.3994
0.0384
0.3856
0.5580
0.3309
0.1274
0.0384

```

```
eigenvalue =
```

```
3.2606
```

```
% -----
```

```
% Question 9
```

```
% 9.(a)
```

```

A= [2.0475 3.1849 0.5783
2.1421 3.1736 0.5775
2.0479 3.1536 0.5687
2.0483 3.1362 0.5715
2.1075 3.1872 0.5701
2.0975 3.1812 0.5815
2.0832 3.1675 0.5829
2.0553 3.1732 0.5734
2.0499 3.1559 0.5691
2.0563 3.1652 0.5873]

```

```
A =
```

```

2.0475    3.1849    0.5783
2.1421    3.1736    0.5775
2.0479    3.1536    0.5687
2.0483    3.1362    0.5715
2.1075    3.1872    0.5701
2.0975    3.1812    0.5815
2.0832    3.1675    0.5829
2.0553    3.1732    0.5734
2.0499    3.1559    0.5691
2.0563    3.1652    0.5873

```

```
rec = 999999;
```

```

rec1 = 0;
recr = 0;
for i = 1:9
    for j = (i+1):9
        a = [A(i,1:3)]';
        b = [A(j,1:3)]';
        ra = acos(dot(a,b)/(norm(a) * norm(b)));
        if (ra < rec)
            rec = ra;
            rec1 = i;
            recr = j;
        end
    end
end
[rec1, recr]

```

```
ans =
```

```
3    9
```

```
rec
```

```
rec =
```

```
1.1255e-04
```

```
% -----
```

```
% 9.(b)
```

```

rec = 0;
rec1 = 0;
recr = 0;
for i = 1:9
    for j = (i+1):9
        a = [A(i,1:3)]';
        b = [A(j,1:3)]';
        ra = acos(dot(a,b)/(norm(a) * norm(b)));
        if (ra > rec)
            rec = ra;
            rec1 = i;
            recr = j;
        end
    end
end
[rec1, recr]

```

```
ans =
```

```
1    2
```

```
rec
```

```
rec =
```

```
0.0222
```

```
% -----
```

```
% Question 10
```

```
% 10.(a)
```

```
a1 = [2 -3; 3 2] \ [5; 2]
```

```
a1 =
```

```
1.2308
-0.8462

a2 = [2 -3; 2.1 -3] \ [5; 2]
a2 =

-30.0000
-21.6667

% 10.(b)
b1 = [2.01 -3; 3 2] \ [5; 2]
b1 =

1.2289
-0.8433

b2 = [2.01 -3; 2.1 -3] \ [5; 2]
b2 =

-33.3333
-24.0000

% 10.(c)
c1 = norm(a1 - b1)
c1 =

0.0034

c2 = norm(a2 - b2)
c2 =

4.0689

% 10.(d)
cond1 = cond([2 -3 5;
3 2 2])
cond1 =

1.7974

cond2 = cond([2 -3 5;
2.1 -3 2])
cond2 =

4.7801

% 10.(e)
% There exists a significant difference between the two distances in 10.(c)
% Because the condition number of system (2) is much greater than the condition
% number of system (1). This would be result in that even just a small same amount
% change on one coefficient for each system, the solution for system (2) would have
% more changes compared with the corresponding change of system (1)'s solution
```