Assignment Lab
01 :Due date 08/02/2023

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Question 1:

Generate a vector d of 20 random integers in the range 1 to 6

```
ranges = [1 6];
sizeOfMatrix = [1 20];
disp('Generate a vector d of 20 random integers in the range 1 to 6')
d = randi(ranges,sizeOfMatrix)
```

```
Generate a vector d of 20 random integers in the range 1 to 6

d =

  Columns 1 through 13

     4     2     5     2     5     2     3     4     5     1     6     5     3

  Columns 14 through 20

     3     3     2     4     4     5     5
```

Question 2:

```
A = [1 1 0; 0 1 1; 0 0 1];
B = [1i 1-1i 2+1i; 0 -1 3-1i; 0 0 -1i];
C = [1 1 1; 0 sqrt(2)*1i -sqrt(2)*1i;1 -1 -1];

% Calculations
disp('AB-BA')
Q2_1 = A*B-B*A
disp('A^2 + B^2 + C^2')
Q2_2 = A^2 + B^2 + C^2
```

```
disp('ABC')
Q2_3 = A*B*C
disp('sqrt(A) + sqrt(B) + sqrt(C)')
Q2_4 = sqrt(A) + sqrt(B) + sqrt(C)
disp('e^A*(e^B + e^C)')
Q2_5 = exp(A) * (exp(B) + exp(C))
% Rank
disp('Range along all Dimensions')
Q2_rangeA = range(A,'all')
Q2_rangeB = range(B,'all')
Q2_rangeC = range(C,'all')
% Inverse
disp('Inverse')
Q2_invA = inv(A)
Q2_invB = inv(B)
Q2_invC = inv(C)
% Trace
disp('Trace')
Q2_trcA = trace(A)
Q2_trcB = trace(B)
Q2_trcC = trace(C)
% Determinant
disp('Determinant')
Q2_detA = det(A)
Q2_detB = det(B)
Q2_detC = det(C)
% Condition Number
disp('Condition Number')
Q2_conA = cond(A)
Q2_conB = cond(B)
Q2_conC = cond(C)
% Singular value decomposition
disp('Singular value decomposition')
Q2_singA = svd(A)
Q2_singB = svd(B)
Q2_singC = svd(C)
```

```
AB-BA

Q2_1 =

   0.0000 + 0.0000i  -1.0000 - 1.0000i   2.0000 + 0.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   1.0000 - 1.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 0.0000i

A^2 + B^2 + C^2

Q2_2 =

   2.0000 + 0.0000i   2.0000 + 3.4142i   3.0000 - 5.4142i
   0.0000 - 1.4142i  -0.0000 + 1.4142i   0.0000 - 0.5858i
   0.0000 + 0.0000i   2.0000 - 1.4142i   2.0000 + 1.4142i

ABC
```

```
Q2_3 =

   5.0000 + 1.0000i  -3.5858 + 1.0000i  -6.4142 + 1.0000i
   3.0000 - 2.0000i  -3.0000 + 0.5858i  -3.0000 + 3.4142i
   0.0000 - 1.0000i   0.0000 + 1.0000i   0.0000 + 1.0000i

sqrt(A) + sqrt(B) + sqrt(C)

Q2_4 =

   2.7071 + 0.7071i   3.0987 - 0.4551i   2.4553 + 0.3436i
   0.0000 + 0.0000i   1.8409 + 1.8409i   3.5962 - 1.1257i
   1.0000 + 0.0000i   0.0000 + 1.0000i   1.7071 + 0.2929i

e^A*(e^B + e^C)

Q2_5 =

  18.0126 + 2.2874i  14.1732 - 3.5327i  49.0729 -32.5679i
  18.8025 + 0.8415i   9.3292 + 0.3977i  39.1027 -44.6975i
  15.3659 + 0.8415i   8.4291 - 1.2996i  20.1875 -13.9588i

Range along all Dimensions

Q2_rangeA =

     1


Q2_rangeB =

   3.0000 - 1.0000i


Q2_rangeC =

   0.0000 + 1.4142i

Inverse

Q2_invA =

     1    -1     1
     0     1    -1
     0     0     1


Q2_invB =

   0.0000 - 1.0000i  -1.0000 - 1.0000i  -4.0000 + 3.0000i
   0.0000 + 0.0000i  -1.0000 + 0.0000i   1.0000 + 3.0000i
   0.0000 + 0.0000i   0.0000 + 0.0000i   0.0000 + 1.0000i
```

```
Q2_invC =

   0.5000 + 0.0000i   0.0000 + 0.0000i   0.5000 + 0.0000i
   0.2500 + 0.0000i   0.0000 - 0.3536i  -0.2500 + 0.0000i
   0.2500 + 0.0000i   0.0000 + 0.3536i  -0.2500 + 0.0000i

Trace

Q2_trcA =

     3


Q2_trcB =

    -1


Q2_trcC =

   0.0000 + 1.4142i

Determinant

Q2_detA =

     1


Q2_detB =

    -1


Q2_detC =

   0.0000 - 5.6569i

Condition Number

Q2_conA =

    4.0489


Q2_conB =

   26.4765


Q2_conC =

    1.4142
```

```
Singular value decomposition

Q2_singA =

    1.8019
    1.2470
    0.4450


Q2_singB =

    4.2130
    1.4917
    0.1591


Q2_singC =

    2.0000
    2.0000
    1.4142
```

Question 3:

```
disp('Random matrix of size 5x5 in range(0,1)')
Rm = rand([5 5]) % Random matrix of size 5x5 in range(0,1)
disp('Extraction of Submatrix')
subMatrix = Rm(2:4,3:4) %Extraction of Submatrix
% Delete 2 to 4 row and 5th column
delete = Rm;
delete(2:4,:) = [];
disp('Delete 2 to 4 row and 5th column')
delete(:,5) = []
% Exchange First and last row
exchangeRow = Rm;
disp('Exchange First and last row')
exchangeRow([1 end],:) = exchangeRow([end 1],:)
% Exchange First and last column
exchangeCol = Rm;
disp('Exchange First and last column')
exchangeCol(:,[1 end]) = exchangeCol(:,[end 1])
% insert column of ones to right
onesC = ones(size(Rm,1),1);
disp('insert column of ones to right')
RMCR = [Rm onesC]
% insert column of ones to left
disp('insert column of ones to left')
RMCL = [onesC Rm]
% insert 2 rows of ones on top
disp('insert 2 rows of ones on top')
onesR = ones(2,size(Rm,2));
```

```
RMR2U = [ onesR; Rm]
% insert 2 rows of ones at bottom
disp('insert 2 rows of ones at bottom')
RMR2B = [ Rm;onesR]
```

```
Random matrix of size 5x5 in range(0,1)

Rm =

    0.6443    0.9390    0.2077    0.1948    0.3111
    0.3786    0.8759    0.3012    0.2259    0.9234
    0.8116    0.5502    0.4709    0.1707    0.4302
    0.5328    0.6225    0.2305    0.2277    0.1848
    0.3507    0.5870    0.8443    0.4357    0.9049

Extraction of Submatrix

subMatrix =

    0.3012    0.2259
    0.4709    0.1707
    0.2305    0.2277

Delete 2 to 4 row and 5th column

delete =

    0.6443    0.9390    0.2077    0.1948
    0.3507    0.5870    0.8443    0.4357

Exchange First and last row

exchangeRow =

    0.3507    0.5870    0.8443    0.4357    0.9049
    0.3786    0.8759    0.3012    0.2259    0.9234
    0.8116    0.5502    0.4709    0.1707    0.4302
    0.5328    0.6225    0.2305    0.2277    0.1848
    0.6443    0.9390    0.2077    0.1948    0.3111

Exchange First and last column

exchangeCol =

    0.3111    0.9390    0.2077    0.1948    0.6443
    0.9234    0.8759    0.3012    0.2259    0.3786
    0.4302    0.5502    0.4709    0.1707    0.8116
    0.1848    0.6225    0.2305    0.2277    0.5328
    0.9049    0.5870    0.8443    0.4357    0.3507

insert column of ones to right

RMCR =
```

```
    0.6443    0.9390    0.2077    0.1948    0.3111    1.0000
    0.3786    0.8759    0.3012    0.2259    0.9234    1.0000
    0.8116    0.5502    0.4709    0.1707    0.4302    1.0000
    0.5328    0.6225    0.2305    0.2277    0.1848    1.0000
    0.3507    0.5870    0.8443    0.4357    0.9049    1.0000

insert column of ones to left

RMCL =

    1.0000    0.6443    0.9390    0.2077    0.1948    0.3111
    1.0000    0.3786    0.8759    0.3012    0.2259    0.9234
    1.0000    0.8116    0.5502    0.4709    0.1707    0.4302
    1.0000    0.5328    0.6225    0.2305    0.2277    0.1848
    1.0000    0.3507    0.5870    0.8443    0.4357    0.9049

insert 2 rows of ones on top

RMR2U =

    1.0000    1.0000    1.0000    1.0000    1.0000
    1.0000    1.0000    1.0000    1.0000    1.0000
    0.6443    0.9390    0.2077    0.1948    0.3111
    0.3786    0.8759    0.3012    0.2259    0.9234
    0.8116    0.5502    0.4709    0.1707    0.4302
    0.5328    0.6225    0.2305    0.2277    0.1848
    0.3507    0.5870    0.8443    0.4357    0.9049

insert 2 rows of ones at bottom

RMR2B =

    0.6443    0.9390    0.2077    0.1948    0.3111
    0.3786    0.8759    0.3012    0.2259    0.9234
    0.8116    0.5502    0.4709    0.1707    0.4302
    0.5328    0.6225    0.2305    0.2277    0.1848
    0.3507    0.5870    0.8443    0.4357    0.9049
    1.0000    1.0000    1.0000    1.0000    1.0000
    1.0000    1.0000    1.0000    1.0000    1.0000
```

Question 4:

```
A = [2 6; 3 9];
B = [1 2; 3 4];
C = [-5 5; 5 3];

% Diagonal Matrix of A,B,C
disp('Diagonal Matrix of A,B,C')
G = blkdiag(A,B,C)
% Delete Last row and Last column
G1 = G;
G1(end,:) = [];
```

```
disp('Delete Last row and Last column')
G1(:,end) = []
% Extract First 4x4 submatrix from G
disp('Extract First 4x4 submatrix from G')
G12 = G(1:4,1:4)
% Replace G(5,5) with 4
G2 = G;
disp('Replace G(5,5) with 4')
G2(5,5) = 4
% Calculate Eigen Vector and Eigen Value
disp('Eigen Vector and Eigne Values of Diagonalised Matrix G')
[EigenVector,EigenValues] = eig(G)
```

```
Diagonal Matrix of A,B,C

G =

     2     6     0     0     0     0
     3     9     0     0     0     0
     0     0     1     2     0     0
     0     0     3     4     0     0
     0     0     0     0    -5     5
     0     0     0     0     5     3

Delete Last row and Last column

G1 =

     2     6     0     0     0
     3     9     0     0     0
     0     0     1     2     0
     0     0     3     4     0
     0     0     0     0    -5

Extract First 4x4 submatrix from G

G12 =

     2     6     0     0
     3     9     0     0
     0     0     1     2
     0     0     3     4

Replace G(5,5) with 4

G2 =

     2     6     0     0     0     0
     3     9     0     0     0     0
     0     0     1     2     0     0
     0     0     3     4     0     0
     0     0     0     0     4     5
     0     0     0     0     5     3
```

```
Eigen Vector and Eigne Values of Diagonalised Matrix G

EigenVector =

   -0.9487   -0.5547         0         0         0         0
    0.3162   -0.8321         0         0         0         0
         0         0   -0.8246   -0.4160         0         0
         0         0    0.5658   -0.9094         0         0
         0         0         0         0   -0.9013   -0.4332
         0         0         0         0    0.4332   -0.9013


EigenValues =

         0         0         0         0         0         0
         0   11.0000         0         0         0         0
         0         0   -0.3723         0         0         0
         0         0         0    5.3723         0         0
         0         0         0         0   -7.4031         0
         0         0         0         0         0    5.4031
```

Question 5:

Steady State Current

```
R = 5;
C = 10;
L = 4;
E = 2;
W = 2;
disp('Compute the Steady state Current')
I = E/sqrt(R^2 + (2*pi*W*L -1/(2*pi*W*C))^2)
```

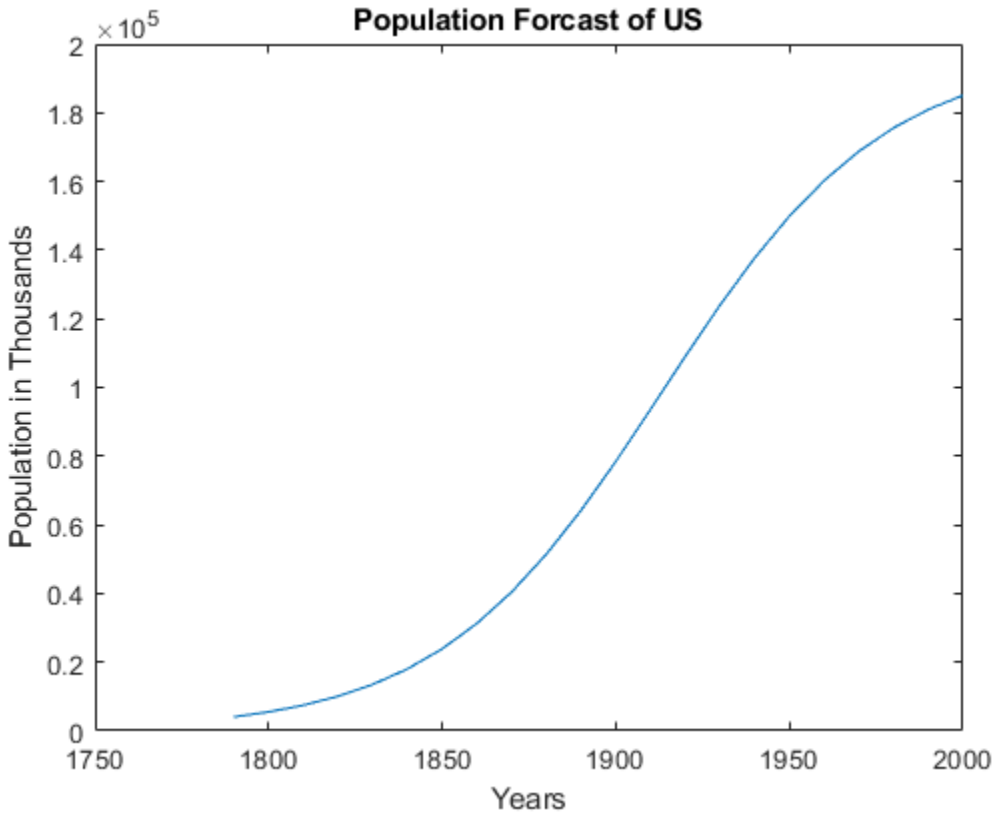
```
Compute the Steady state Current

I =

    0.0396
```

Question 6:

Population Forcast

```
t = 1790:10:2000;
p = 197273000./(1+exp(-0.03134*(t-1913.25)));
for i = 1:size(t,2)
    fprintf('Population of %d year = %d \n',t(i),p(i))
end
plot(t,p/1000)
xlabel('Years')
ylabel('Population in Thousands')
title('Population Forcast of US')
```

```
Population of 1790 year = 4.059822e+06
Population of 1800 year = 5.512360e+06
Population of 1810 year = 7.464516e+06
Population of 1820 year = 1.007170e+07
Population of 1830 year = 1.352463e+07
Population of 1840 year = 1.804722e+07
Population of 1850 year = 2.388555e+07
Population of 1860 year = 3.128294e+07
Population of 1870 year = 4.043701e+07
Population of 1880 year = 5.143966e+07
Population of 1890 year = 6.421038e+07
Population of 1900 year = 7.844615e+07
Population of 1910 year = 9.361753e+07
Population of 1920 year = 1.090308e+08
Population of 1930 year = 1.239473e+08
Population of 1940 year = 1.377195e+08
Population of 1950 year = 1.498938e+08
Population of 1960 year = 1.602485e+08
Population of 1970 year = 1.687704e+08
Population of 1980 year = 1.755962e+08
Population of 1990 year = 1.809455e+08
Population of 2000 year = 1.850665e+08
```



Question 7:

Evaluate the integral at m = pi/4

```
m = pi/4;
Km = @(theta) (1./sqrt(1-(m^2*(sin(theta)).^2)));
thetamin = 0;
thetamax = pi/2;
disp('integral at m = pi/4')
integrated = integral(Km,thetamin,thetamax)
```

```
integral at m = pi/4

integrated =

    1.9682
```

Question 8:

Conversion table of Degrees to Radians

```
Degrees = 0:10:360;
Radians = (pi/180)*Degrees;
disp('Conversion table of Degrees to Radians')
DOC = [Degrees' Radians']
```

```
Conversion table of Degrees to Radians

DOC =

         0         0
   10.0000    0.1745
   20.0000    0.3491
   30.0000    0.5236
   40.0000    0.6981
   50.0000    0.8727
   60.0000    1.0472
   70.0000    1.2217
   80.0000    1.3963
   90.0000    1.5708
  100.0000    1.7453
  110.0000    1.9199
  120.0000    2.0944
  130.0000    2.2689
  140.0000    2.4435
  150.0000    2.6180
  160.0000    2.7925
  170.0000    2.9671
  180.0000    3.1416
  190.0000    3.3161
  200.0000    3.4907
  210.0000    3.6652
  220.0000    3.8397
  230.0000    4.0143
  240.0000    4.1888
  250.0000    4.3633
  260.0000    4.5379
```

```
  270.0000    4.7124
  280.0000    4.8869
  290.0000    5.0615
  300.0000    5.2360
  310.0000    5.4105
  320.0000    5.5851
  330.0000    5.7596
  340.0000    5.9341
  350.0000    6.1087
  360.0000    6.2832
```

Question 9:

Calulate the value of function (x^2 + y^2) at x = 1 & y =2

```
fun = @(x,y) (x^2 + y^2);
disp('Calulate the value of function (x^2 + y^2) at x = 1 & y =2')
fun(1,2)
```

```
Calulate the value of function (x^2 + y^2) at x = 1 & y =2

ans =

     5
```

Question 10:

Solve the differential Equation dy/dt = ty

```
syms y(t)
ode = diff(y,t) == t*y;
disp('Solve the differential Equation dy/dt = ty')
ysol(t) = dsolve(ode)
```

```
Solve the differential Equation dy/dt = ty

ysol(t) =

C1*exp(t^2/2)
```

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