

# lab02\_HW

---

1. Identify what is wrong with the following MATLAB command sequences and/or answers.

(i)

```
>> x=0:10;  
>> y+1=x;
```

Wrong

Assignment should contain only one variable

```
y = x + 1  
y =  
1      2      3      4      5      6      7      8      9      10     11
```

(ii)

```
>> (2+7)\15+12  
ans = 0.3333
```

Wrong

This means  $15/9 + 12$

```
ans = 13.6667
```

(iii)

```
>> B=0:pi/2:5*pi;  
>> B(0)  
ans = 0
```

Wrong

Matlab is start at 1

```
>> B(1)  
ans = 0
```

(iv)

```
>> c=[5 8 7 ; 4 5 8]
c = 5 8 7; 4 5 8
```

Wrong. it should be matrix

```
c =

     5     8     7
     4     5     8
```

(v)

```
>> A=[4,8,1]; B=[5,9,6];
>> A*B
```

Wrong. Dimension error  
It should be same dimensions

```
>> A*B'
ans = 98
```

2. Make the following variables:

```
(1) a = [5 4.8 4.6 ... -4.8 -5]
>> a = 5:-0.2:-5
(2) b = [10^0 10^0.01 10^0.02 ... 10^0.99 10^1 ]
>> 10.^[0:0.01:1]
(3) c = Hello
>> c = "Hello"
```

3. Make the following matrices and calculate their eigenvalues and eigenvectors:

$$A = \begin{bmatrix} 2 & \dots & 2 \\ \vdots & \ddots & \vdots \\ 2 & \dots & 2 \end{bmatrix} \in \mathbb{R}^{9 \times 9}$$

```
>> A = ones(9, 9) * 2
>> [vect val] = eig(A) % eigenvector and eigenvalue
```

```
vect =
```

```
-0.8616  -0.0000  -0.0000      0      0  0.0000  0.2924  -0.2472  (
0.0922  -0.1826  -0.2236  0.2184  -0.7071  0.4498  -0.1927  -0.0997  (
0.0922  -0.1826  -0.2236  0.4176  0.0000  -0.7587  -0.1927  -0.0997  (
0.0922  -0.1826  -0.2236  -0.8545  -0.0000  -0.1409  -0.1927  -0.0997  (
0.0922  -0.1826  0.8944  0.0000  -0.0000  0.0000  -0.1927  -0.0997  (
0.0922  0.9129  0.0000      0  -0.0000  0.0000  -0.1927  -0.0997  (
0.0922  -0.1826  -0.2236  0.2184  0.7071  0.4498  -0.1927  -0.0997  (
0.4363  -0.0000  -0.0000      0      0  0.0000  0.8311  -0.0881  (
-0.1279  0.0000      0      0      0      0  0.0324  0.9335  (
```

```
val =
```

```
-0.0000      0      0      0      0      0      0      0
      0  -0.0000      0      0      0      0      0      0
      0      0  -0.0000      0      0      0      0      0
      0      0      0  -0.0000      0      0      0      0
      0      0      0      0  -0.0000      0      0      0
      0      0      0      0      0  0.0000      0      0
      0      0      0      0      0      0  0.0000      0
      0      0      0      0      0      0      0  0.0000
      0      0      0      0      0      0      0      0  1e
```

$$B = \begin{bmatrix} 1 & 11 & \dots & 91 \\ 2 & 12 & \ddots & 92 \\ \vdots & \vdots & \ddots & \vdots \\ 10 & 20 & \dots & 100 \end{bmatrix}$$

```
>> B = reshape(1:100, 10, 10)
>> [vect val] = eig(B) % eigenvector and eigenvalue
```

```
vect =
```

```
Columns 1 through 6
```

```
-0.2885 + 0.0000i -0.5865 + 0.0000i -0.7920 + 0.0000i -0.6304 + 0.0000i -0.0851 + 0.0000i
-0.2945 + 0.0000i -0.4901 + 0.0000i  0.2928 + 0.0000i  0.4149 + 0.0000i  0.1581 + 0.0000i
-0.3006 + 0.0000i -0.3937 + 0.0000i  0.2424 + 0.0000i  0.3468 + 0.0000i -0.0170 + 0.0000i
-0.3067 + 0.0000i -0.2973 + 0.0000i  0.2642 + 0.0000i  0.0929 + 0.0000i -0.0321 + 0.0000i
-0.3127 + 0.0000i -0.2009 + 0.0000i  0.3055 + 0.0000i -0.3416 + 0.0000i  0.4350 + 0.0000i
-0.3188 + 0.0000i -0.1045 + 0.0000i  0.0349 + 0.0000i  0.2424 + 0.0000i -0.5865 + 0.0000i
-0.3248 + 0.0000i -0.0081 + 0.0000i  0.0289 + 0.0000i  0.0228 + 0.0000i  0.0555 + 0.0000i
-0.3309 + 0.0000i  0.0883 + 0.0000i -0.0982 + 0.0000i  0.1740 + 0.0000i -0.2021 + 0.0000i
-0.3370 + 0.0000i  0.1847 + 0.0000i -0.0535 + 0.0000i -0.3085 + 0.0000i  0.2190 + 0.0000i
-0.3430 + 0.0000i  0.2811 + 0.0000i -0.2250 + 0.0000i -0.0133 + 0.0000i  0.0541 + 0.0000i
```

```
Columns 7 through 10
```

```
 0.5316 + 0.0000i  0.5316 + 0.0000i -0.3036 + 0.0000i -0.2627 + 0.0000i
-0.0876 - 0.0137i -0.0876 + 0.0137i  0.1573 + 0.0000i  0.1581 + 0.0000i
-0.4564 - 0.0156i -0.4564 + 0.0156i  0.2232 + 0.0000i  0.2370 + 0.0000i
-0.2302 - 0.0567i -0.2302 + 0.0567i  0.0354 + 0.0000i  0.1344 + 0.0000i
-0.0793 + 0.3087i -0.0793 - 0.3087i  0.4896 + 0.0000i -0.3922 + 0.0000i
 0.3347 - 0.2176i  0.3347 + 0.2176i -0.6628 + 0.0000i -0.3024 + 0.0000i
-0.1749 + 0.1585i -0.1749 - 0.1585i -0.1905 + 0.0000i  0.2060 + 0.0000i
-0.0324 - 0.2385i -0.0324 + 0.2385i  0.0862 + 0.0000i  0.4547 + 0.0000i
 0.1389 - 0.1125i  0.1389 + 0.1125i  0.3013 + 0.0000i  0.2773 + 0.0000i
 0.0555 + 0.1874i  0.0555 - 0.1874i -0.1361 + 0.0000i -0.5102 + 0.0000i
```

```
val =
```

```
1.0e+02 *
```

```
Columns 1 through 6
```

```
5.2084 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i -0.1584 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i -0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i -0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i  0.0000 + 0.0000i
```

Columns 7 through 10

0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 - 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	-0.0000 + 0.0000i	0.0000 + 0.0000i
0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i	0.0000 + 0.0000i

$$C = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 3 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 4 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 5 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 4 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 3 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

```
>> C = diag([1:5, 4:-1:1])
>> [vect val] = eig(C) % eigenvector and eigenvalue
vect =
```

```

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

```
val =
```

```

1      0      0      0      0      0      0      0      0
0      1      0      0      0      0      0      0      0
0      0      2      0      0      0      0      0      0
0      0      0      2      0      0      0      0      0
0      0      0      0      3      0      0      0      0
0      0      0      0      0      3      0      0      0
0      0      0      0      0      0      4      0      0
0      0      0      0      0      0      0      4      0
0      0      0      0      0      0      0      0      5
```

4. An M-by-M matrix X is given. Without using loops, extract values from matrix X to create the following:

Let's set

```
>> X = reshape(1:81, 9, 9) % use this to check answer
>> n = 9;
```

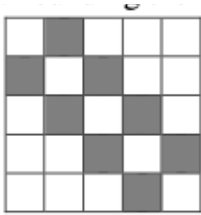
i) matrix A – composed of all values in odd columns AND odd rows

```
>> X(1:2:n, 1:2:n)
```

ii) matrix B – composed of all entries of X, except for the outside rows and columns

```
>> X(2:n-1, 2:n-1)
```

iii) matrix C – composed of diagonals surrounding the middle diagonal of matrix X



```
>> X .* (diag(ones(1, 8), 1) + diag(ones(1, 8), -1))
```

5. Without using loops, calculate the sum of the following series

$1 - 1/2 + 1/3 - 1/4 + 1/5 \dots$

for the first 10,000 terms.

We can do it for only one line

```
>> sum([arrayfun(@(x)1/x, [1:2:10000]) , arrayfun(@(x)-1/x, [2:2:10000])])
ans =
0.6931
```

The answer is same as  $\ln(2)$

6. (1) Load the image 02Lena.bmp by typing:

```
A = imread('02Lena.png');
```

What is the type of variable A?

```
>> class(A) % get the type
ans =
'uint8'
```

(2) Display the image by typing:

```
imshow(A);
```

Now multiply the entries of A to 1.5. Display the image and report what you observe.

```
>> subplot(1,2,1)
>> title("Original")
>> imshow(A)
>> title("Original")
>> subplot(1,2,2)
>> imshow(A * 1.5)
>> title("Original * 1.5")
```

And you will notice that multiply 1.5 will be brighter

**Original**



**Original \* 1.5**

