
```
clear all;
close all;
clc;
%2401030116
%Nishika
%Batch-B12
%postlab

%Exercise 1: Matrix Creation

matA = randi([-5 5],4,4);
disp('Matrix A:');
disp(matA);

diagB = diag(diag(matA));
disp('Diagonal Matrix B:');
disp(diagB);

upperMat = triu(matA);
lowerMat = tril(matA);

disp('Upper Triangular Matrix:');
disp(upperMat);

disp('Lower Triangular Matrix:');
disp(lowerMat);

% Exercise 2: Matrix Arithmetic and Logic

X = rand(3,3);
Y = rand(3,3);

disp('Matrix X:');
disp(X);
disp('Matrix Y:');
disp(Y);

mulMat = X * Y;
disp('Matrix Multiplication X*Y:');
disp(mulMat);

elemMul = X .* Y;
disp('Element-wise Multiplication X.*Y:');
disp(elemMul);

greaterXY = X > Y;
disp('X greater than Y (Logical Matrix):');
disp(greaterXY);

% Exercise 3: Vectorized Computations
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x = -2:0.1:2;
y = x.^3 - 4*x + 1;

[maxVal, maxIndex] = max(y);
[minVal, minIndex] = min(y);

disp('Maximum value of y and its index:');
disp(maxVal);
disp(maxIndex);

disp('Minimum value of y and its index:');
disp(minVal);
disp(minIndex);

% Exercise 4: Matrix Indexing and Modification

M = randi([1 20],5,5);
disp('Original Matrix M:');
disp(M);

M(mod(M,2)==0) = 0;
disp('After replacing even elements with zero:');
disp(M);

M(M>10) = sqrt(M(M>10));
disp('After replacing elements greater than 10:');
disp(M);

% Exercise 5: Linear System of Equations

A = [ 3 2 -1; 2 -2 4; -1 0.5 -1];
B = [1; -2; 0];

X = A\B;
disp('Solution of AX = B:');
disp(X);

disp('Verification (A*X):');
disp(A*X);

% Exercise 6: Loop vs Vectorization
N = 100000;

tic;
sumLoop = 0;
for i = 1:N
    sumLoop = sumLoop + i^2;
end
timeLoop = toc;

tic;
sumVec = sum((1:N).^2);
timeVec = toc;

```

```
disp('Sum using for-loop:');
disp(sumLoop);
disp('Time using for-loop:');
disp(timeLoop);

disp('Sum using vectorization:');
disp(sumVec);
disp('Time using vectorization:');
disp(timeVec);

% Exercise 7: User-Defined Function (same file)

data = randi(50,1,10);
[mn, sd, mx, mnmm] = statsCalc(data);

disp('Data Vector:');
disp(data);
disp('Mean:');
disp(mn);
disp('Standard Deviation:');
disp(sd);
disp('Maximum Value:');
disp(mx);
disp('Minimum Value:');
disp(mnmm);

% Exercise 8: Conditional Logic

nums = randi([-10 10],1,20);

positiveCount = sum(nums > 0);
negativeCount = sum(nums < 0);
zeroCount = sum(nums == 0);

disp('Generated Numbers:');
disp(nums);
disp('Positive count:');
disp(positiveCount);
disp('Negative count:');
disp(negativeCount);
disp('Zero count:');
disp(zeroCount);

% Exercise 9: Plotting and Analysis
x = 0:0.01:5;
y = exp(-x).*sin(2*pi*x);

figure;
plot(x,y,'b','LineWidth',2);
grid on;
title('P2401030116_y = exp(-x) sin(2\pi x)');
xlabel('x');
ylabel('y');
legend('y = exp(-x) sin(2\pi x)');
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[maxY, idx] = max(y);
hold on;
plot(x(idx), maxY, 'ro', 'MarkerSize', 8);
hold off;

% Exercise 10: Mini Challenge

randMat = randi([1 9],6,6);
disp('Original Matrix:');
disp(randMat);

if isequal(randMat, randMat')
    disp('Matrix is symmetric');
    symMat = randMat;
else
    disp('Matrix is not symmetric');
    symMat = (randMat + randMat')/2;
end

disp('Symmetric Matrix:');
disp(symMat);

% Function Definition

function [meanVal, stdVal, maxVal, minVal] = statsCalc(v)
meanVal = mean(v);
stdVal = std(v);
maxVal = max(v);
minVal = min(v);
end

```

Matrix A:

5	-4	-3	-1
2	1	-1	5
1	5	-5	-1
-2	-4	2	1

Diagonal Matrix B:

5	0	0	0
0	1	0	0
0	0	-5	0
0	0	0	1

Upper Triangular Matrix:

5	-4	-3	-1
0	1	-1	5
0	0	-5	-1
0	0	0	1

Lower Triangular Matrix:

5	0	0	0
2	1	0	0
1	5	-5	0

-2 -4 2 1

Matrix X:

0.1544	0.7581	0.6855
0.3813	0.8711	0.2941
0.1611	0.3508	0.5306

Matrix Y:

0.8324	0.2992	0.3596
0.5975	0.4526	0.5583
0.3353	0.4226	0.7425

Matrix Multiplication X*Y:

0.8113	0.6790	0.9878
0.9366	0.6327	0.8419
0.5216	0.4312	0.6478

Element-wise Multiplication X.*Y:

0.1285	0.2268	0.2465
0.2279	0.3943	0.1642
0.0540	0.1483	0.3940

X greater than Y (Logical Matrix):

0	1	1
0	1	0
0	0	0

Maximum value of y and its index:

4.0720

9

Minimum value of y and its index:

-2.0720

33

Original Matrix M:

9	7	5	3	17
9	14	16	14	4
3	20	16	10	4
1	19	15	5	14
6	10	15	2	18

After replacing even elements with zero:

9	7	5	3	17
9	0	0	0	0
3	0	0	0	0
1	19	15	5	0
0	0	15	0	0

After replacing elements greater than 10:

9.0000	7.0000	5.0000	3.0000	4.1231
9.0000	0	0	0	0

3.0000	0	0	0	0
1.0000	4.3589	3.8730	5.0000	0
0	0	3.8730	0	0

Solution of $AX = B$:

1.0000
-2.0000
-2.0000

Verification (A^*X):

1.0000
-2.0000
-0.0000

Sum using for-loop:

3.3334e+14

Time using for-loop:

0.0084

Sum using vectorization:

3.3334e+14

Time using vectorization:

4.7400e-04

Data Vector:

26	36	8	48	28	34	2	41	38	7
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Mean:

26.8000

Standard Deviation:

15.9011

Maximum Value:

48

Minimum Value:

2

Generated Numbers:

Columns 1 through 13

1	-4	1	-2	-2	-7	-5	-10	9	3	9	-7	9
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Columns 14 through 20

6	2	-1	-5	5	-6	-9
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Positive count:

9

Negative count:

11

Zero count:

0

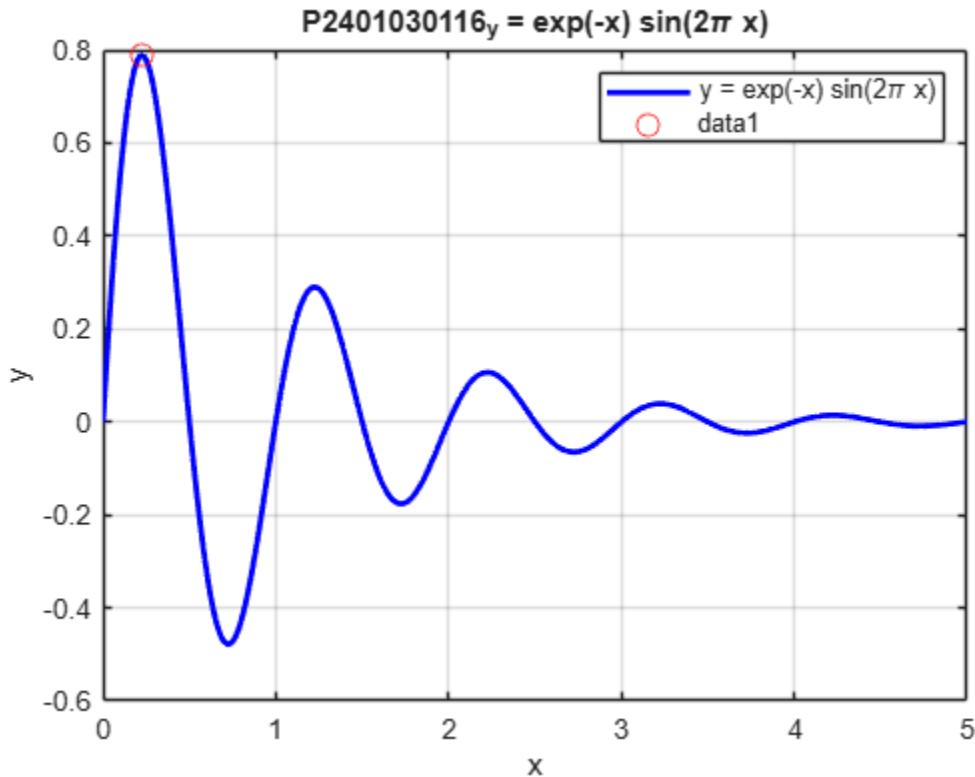
Original Matrix:

7	8	6	4	2	8
7	3	9	9	1	7
7	8	4	3	4	6
6	8	1	6	2	2
4	8	8	6	7	9
4	5	6	4	4	3

Matrix is not symmetric

Symmetric Matrix:

7.0000	7.5000	6.5000	5.0000	3.0000	6.0000
7.5000	3.0000	8.5000	8.5000	4.5000	6.0000
6.5000	8.5000	4.0000	2.0000	6.0000	6.0000
5.0000	8.5000	2.0000	6.0000	4.0000	3.0000
3.0000	4.5000	6.0000	4.0000	7.0000	6.5000
6.0000	6.0000	6.0000	3.0000	6.5000	3.0000



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