Code examples and exercises: MATLAB programming

Code examples:

Matrix creation

```
A = []                          % Create an empty matrix

A = [1 2; 3 4]                  % Create a 2-by-2 matrix
A = [1:2:100]                   % Create an array from 1 to 100, with an
interval of 2
A = zeros(4,5)                  % 4-by-5 matrix of all zeros
B = ones (2,3)                  % 2-by-3 matrix of all ones
C = rand(3,3)                   % 3-by-3 matrix of uniform random numbers in
[0,1]
D = randn(2,5)                  % 2-by-5 matrix of standard normally
distributed numbers
[E,F] = meshgrid(1:5)           % 5-by-5 grids of numbers
[X,Y] = meshgrid(1:3,10:14)     % Create a full grid from two monotonically
increasing grid vectors
M = magic(6)                    % Create a magic square in which sum(A,1) =
sum(A,2) = trace(A) = trace(rot90(A))
```

Matrix operations

```
A = [1 2; 3 4]                  % Create a 2-by-2 matrix
B = A'                          % Transpose A
C = [A; A]                      % Concatenate a matrix
A(1,2)                          % Extract the element in row 1, column 2
A(1,:)                          % Extract the element in row 1
A(end,:)                        % Extract the row of the last index
A(A>2)                          % Extract all the elements of A that are
greater than 2
```

Matrix assignment and deletion

```
A = rand(10,10)
A(1,2) = 100                    % Assign 100 to the element in row 1, column
2
A = rand(10,10)
A(:,1:3:end) = 100              % Assign 100 to the elements of columns from
1 to the last index with an interval of 3
A(1,:) = []                     % Delete the first row
```

Array and matrix sorting

```
A = [9 0 -7 5 3 8 -10 4 2]      % Sort an array
B = sort(A)
A = [3 6 5; 7 -2 4; 1 0 -9]     % Sort a matrix along its rows
B = sort(A,2)
A = [9 0 -7 5 3 8 -10 4 2]      % Sort an array and also obtain the indices
[B, idx] = sort(A)
```

Matrix manipulation

```
A = [1 2; 3 4]
B = [2 4; 6 8]
C = A*B                          % Matirx multiplication
Cdot = A.*B                      % Matirx elememt-wise multiplication
```

MATLAB function example

```
function value = CosineFunction(x)
 value = cos(x);
end
```

Plot example

```
%% Construct a sphere model
k = 5;
n = 2^k-1;
[x,y,z] = sphere(n);

%% Plot 3D lines
plot3(x,y,z);
axis equal

%% Plot 3D mesh plot
figure(2)
mesh(x,y,z);
axis equal

%% Plot contour
figure(3)
contourf(x,y,z);
```

Exercises

1.1 Create a 3-by-3 matrix with all ones. Create an 8-by-1 matrix with all zeros. Create a 5-by-2 matrix with all elements equal to 0.37.

1.2 Given matrix m = [1, 2, 3; 2, 1, 5; 4, 6, 4; 2, 3, 2], create its submatrix n containing first two rows and the first and the third column.

1.3 Given the same matrix A = [1, 2, 3; 2, 1, 5; 4, 6, 4; 2, 3, 2], create matrix B with rows sorted in a descending order of elements in the second column, e.g., B = [4 6 4; 2 3 2; 1 2 3; 2 1 5]

1.4 Write a Matlab function of two variables x and y: z = y + x*x. Evaluate the function over the range x = −1 : 0.1 : 1, y = −1 : 0.1 : 1. Plot a 3-D mesh surface and a contour plot of this function.

1.5 Learn how to use for-loop by typing “help for”, or by googling “for loop matlab”. Write a function using for-loop to do matrix multiplication. Compare the this for-loop version with matrix multiplication using *