

# ECE 178 Digital Image Processing Discussion Session #1

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## Exercise: 1

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Suppose

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \quad (1)$$

In order to initialize A as stated above type

```
>>A = [ 1 2 3;4 5 6 ]
```

A =

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

The *semicolon* is used for suppressing the output. If you do not want to suppress the output, just ignore the *semicolon* at the end (Be careful when dealing with large arrays i.e. images).

### Warning!

Remember, in Matlab you can not start a variable or a function or even a script name with a number.

1.m → invalid

question1.m → valid

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**Exercise: 2**

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First indices are for accessing rows and the second indices are for accessing columns. In order to access whole row or column, *colon* is used.

```
>>A(2,3)
```

```
ans =
```

```
6
```

```
>>A(:,1)
```

```
ans =
```

```
1  
4
```

```
>>A(1,:)
```

```
ans =
```

```
1    2    3
```

You can access the elements of an array also by specifying a single index  $A(i, j) \equiv A(i+r(j-1))$ . Where  $r$  is the number of rows in  $A$ .

$$A = \begin{bmatrix} A(1,1) & A(1,2) & A(1,3) \\ A(2,1) & A(2,2) & A(2,3) \end{bmatrix} \equiv \begin{bmatrix} A(1) & A(3) & A(5) \\ A(2) & A(4) & A(6) \end{bmatrix} \quad (2)$$

Size of an array can be accessed by:

```
>>size(A)
```

```
ans =
```

```
2    3
```

**Exercise: 3**

Suppose we are trying to create two matrices  $(X, Y)$  where each element in  $X/Y$  contain it's column/row index.

$$X = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 2 & 3 \\ 1 & 2 & 3 \end{bmatrix}, \quad Y = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix} \quad (3)$$

```
X=[1;1;1]*[1,2,3]
```

```
X =
```

```
    1    2    3
    1    2    3
    1    2    3
```

```
Y=[1;2;3]*[1,1,1]
```

```
Y =
```

```
    1    1    1
    2    2    2
    3    3    3
```

Note that  $X = Y^T$ .

The same result can be obtained by

```
[X,Y] = meshgrid(1:3,1:3)
```

```
X =
```

```
    1    2    3
    1    2    3
    1    2    3
```

```
Y =
```

```
    1    1    1
    2    2    2
    3    3    3
```

Suppose, we want to create an array such that each element depends on it's indexes (i.e. image is a function of spatial coordinates ). Then it is useful to use  $X$  and  $Y$  to evaluate the function at each coordinate since  $X$  and  $Y$  contains spatial coordinates.

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**Exercise: 4**

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Drawing a line on  $L$  with equation  $y = x/2$  such that

$$L(y, x) = \begin{cases} 1 & y = x/2 \\ 0 & y \neq x/2 \end{cases} \quad (4)$$

```
L = zeros(3,3)
```

```
L =
```

```
    0    0    0
    0    0    0
    0    0    0
```

```
L(Y==round(X/2)) = 1
```

```
L =
```

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

You can try this exercise with a larger  $L$ .

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**Exercise: 5**

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To read and write and display images:

```
I = imread('filename');
```

**Warning!**

Do not forget to put *semicolon*. Otherwise Matlab will print whole array on the screen.

```
imshow(I);
```

```
imwrite(I, 'another_name', 'fmt');
```

It writes the image  $I$  to the file specified by *another\_name* in the format specified by *fmt*.  
Some common formats:

- 'bmp'
- 'gif'
- 'jpg'
- 'tif'
- ...