Islamic University of Technology (IUT)

Organization of Islamic Cooperation (OIC)

Department of Electrical and Electronic Engineering (EEE)

EEE 4416 **Lab – 05**

Exercise - 01:

Problem statement: "Zero Padding"

Given a matrix of size (m, n), pad zeros on its outer layer.

Test Case – 01:

- Input: x= [2,4;
  5,8]
- Output: y = [0,0,0,0;

  0,2,4,0;

  0,5,8,0;

  0,0,0,0]

Here the size of the output matrix = (m+2, n+2)

We've added 1 extra layer of zeros around the input matrix. So, p=1.

Additional Exercise:

- Try to add 2 extra layers around x. so, p=2.
- Write a function called 'zero_padding' that will take p as an input and will provide the matrix y as output.
- Try it for different values of p as well as different size of input matrix (e.g., m=3, n=7).

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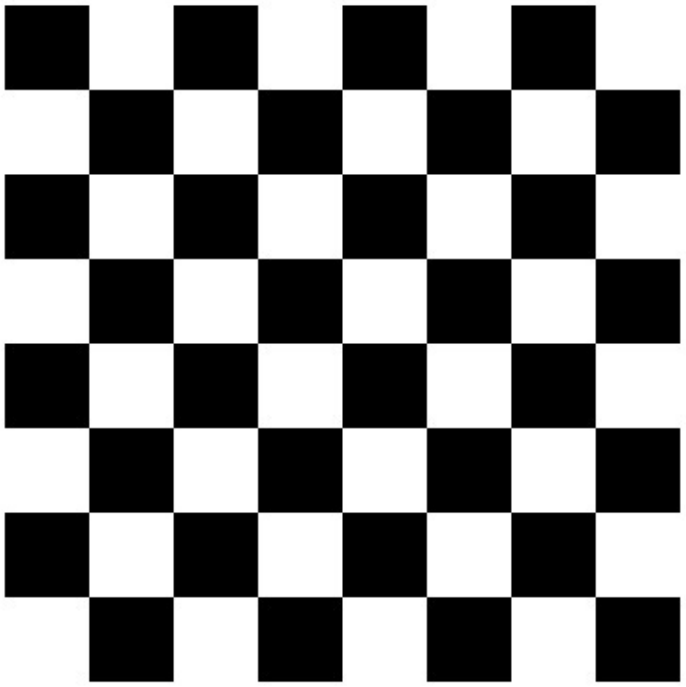
Exercise - 02:

Problem statement: I believe all of you have seen a chess board. It kind of looks like this – one white square, then one black square and so on.



Suppose that the white square represents 1 and black square represents 0.

Create a checkerboard matrix like this –

```
             [0 1 0 1 0
              1 0 1 0 1
              0 1 0 1 0
              1 0 1 0 1]

The matrix should be of size n [n is an integer – function input]
```

Key Takeaway:

- repmat, repelem, ceil, floor, imshow
- Introduction to binary Image**

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**Exercise - 03:

***Problem statement** Refer back to exercise – 04, where we created the 'lcm_array' function of our own.

Now if you remember from earlier lectures, a function, say, max(x),

- provides the maximum of the array x.
- But if x is a matrix, the same function by default performs column-wise max operation.
- Moreover, it also takes addition input like max(x,2) to perform row-wise max operation. It performs column-wise if max(x,1) is provided – which is set to default.
- It takes an additional 3rd argument and performs max operation on the whole matrix if max(x, [ ], 'all') is given as input.

- As you can see, MATLAB functions can handle different types of inputs like vectors, matrices, char arrays [without having to be defined by the user what kind of input is fed to the function].
  This particular feature that MATLAB offers is called 'Polymorphism' (not available in many other programming languages)

In this programming exercise, we want our 'lcm_array' function to perform similar task. You'll have to take necessary steps so that it can take an array as well as a matrix as the input and perform in the same fashion presented above.

Key Takeaway:

- Varargin*
- Varargout*
- Nargin*

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Exercise – 04:

Problem statement: **"One-hot encoding"**

Given an array x, say x = [3,1,0,2] – perform one hot encoding. The output looks like this:

Y= [0 0 1 0;

0 1 0 0;

0 0 0 1;

1 0 0 0]

Here, no of rows in y = (maximum element in x) + 1

No of columns in y = no. of elements in x

The mapping is done in the following way:

Since the 1st element of x is 3 – the (3+1)th element in the 1st column is 1. Others are 0.

Again the 2nd element of x is 1 – the (1+1)th element in the 2nd column is 1. Others are 0.

And so on.

You should write a function named "one_hot_encoding" that takes x as an input and outputs y.

Test case – 02:

- x= [0,0,1,0,3]
- y= [1 1 0 1 0;

  0 0 1 0 0;

  0 0 0 0 0;

  0 0 0 0 1]

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Exercise – 05:

Problem Statement: Write a script that takes a string as an input and returns –

I. the count of #vowels.
II. Find the index of ‘o’
III. The string removing all the vowels.
IV. The string removing all the letters from a to j.
V. The string removing all the consonants.
VI. The string replacing all the vowels with asterisk (*)
VII. The string removing all the digits.

Test Case – 01:

- Input: A= ‘david attenborogh’
- Output:
  I. 6
  II. [13,15]
  III. 'dvd ttnbrgh'
  IV. 'v ttnoro'
  V. 'ai aeoo'
  VI. 'd*v*d *tt*nb*r*gh'
  VII. ‘david attenborogh’

Key Takeaway:

- Regular Expression (regexp, regexprep)**
- ismember*
- strfind, contains

- ‘regular expression’ is a very powerful technique for string manipulation. It is widely used for text data processing and cleaning. It can be quite a bit tricky and is like a complex web. So, this portion is only for introductory purpose. Don’t sweat it.

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