

Islamic University of Technology (IUT)
Organization of Islamic Cooperation (OIC)
Department of Electrical and Electronic Engineering (EEE)

EEE 4416: Simulation Lab
Lab – 05 (Part B)

Exercise - 01

Problem statement: The following table contains the no. of students in different departments in different universities in Bangladesh.

	BUET	RUET	KUET	CUET	IUT
CSE	120	120	100	80	40
EEE	180	120	150	80	80
ME	150	80	150	80	55
CIVIL	195	80	150	80	45
CE	40	nan	30	80	nan
Architecture	100	50	80	80	nan
Management	50	50	nan	80	30

✓ **nan** stands for ‘not a number’ [that department is not there].

You can represent the table exactly the same way in MATLAB using the ‘table’ datatype which will be discussed later. For now, consider the numeric portion and take the matrix as the input. It contains only numeric values. The size of the matrix is (7,5) i.e. 7 rows and 5 columns.

Find out –

- i. What is the total no. of students in each university?
- ii. What is the total no. of students in all the 5 universities combined?
- iii. What is the total no. of CSE students in all 5 universities?
- iv. How many students are there in the civil department of KUET?
- v. Which department/departments of each university has the highest no. of students? [Mark them by index for now i.e. index – (3,2) represents (ME, RUET)]
- vi. Which department of which university has the highest #students?
- vii. Try to visualize the data.

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Key Takeaway:

- Learn how to use the built-in functions of MATLAB in different ways. Understand the concept of variable-length input/output arguments.
- Learn how to use *MATLAB's plotting app* to quickly create visualization.
- NaN is necessary to represent the original data. But while processing the data, we can ignore it and replace it with 0 for convenience.
- Useful functions: *isnan()*, *ismissing()*

Exercise – 02

Problem statement: In continuation to the previous exercise, solve the following problems –

Add a new varsity to the list.

SUST = [40,60,30,100,20,30,20]

- ✚ Here the given array is a row vector of size (7,1). To add it to our original matrix, we need to convert it to a column vector [size = (1,7)].
- ✚ To add something to an array or matrix, you can use –

$$a = [a, SUST]$$

Class Task:

Now answer the following –

- Which department of which university has the minimum #students?
 - How many departments are there in IUT?
 - What are the indices that contain 120 students?
 - Which varsity has the lowest #students?
 - What is the average no of students in universities in Bangladesh?
 - Try to visualize your data and compare it with your previous problem.
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- ✓ So far, we've used 'numeric data type' or you can simply call them matrix. A matrix can only contain numeric values. It is called 'homogeneous data type'.
 - ✓ Later we'll introduce you to 'table data type'. They can contain heterogeneous data, i.e., numeric data as well as string data.

Exercise – 03

Problem Statement: Character array handling

Given a character array, find out –

- I. How many times did 'a' appear?
- II. How many characters are there?
- III. Convert all the characters to lowercase.
- IV. Bring out the 1st and the last element.
- V. Change the 2nd element to 'x'.

Test Case – 01:

- Input: x= 'Asif Newaz'
- Output:
 - I. 1
 - II. 10
 - III. 'asif newaz'
 - IV. ['A', 'z']
 - V. 'Axif Newaz'

Test Case - 02:

- Input: x= 'Can a man still be brave if he is afraid? That is the only time a man can be brave.'
- Output:
 - I. 11
 - II. 83
 - III. 'can a man still be brave if he is afraid? That is the only time a man can be brave.'
 - IV. ['C', 'e']
 - V. 'Cxn a man still be brave if he is afraid? That is the only time a man can be brave.'

Exercise – 04

Problem Statement: A character array is given. Find out its abbreviated form i.e. take the 1st element from each word and compile them together. The output should be in capital letters.

Test Case – 01:

- Input: ‘convolutional neural network’
- Output: ‘CNN’

Test Case – 02:

- Input: ‘Long Term Evolution’
- Output: ‘LTE’

Key Takeaway:

- *Split()* function
- *Strsplit()* function
- Learn how to use the *cellfun()* function*

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a= 'Long Term Evolution'
```

```
b= strsplit(a)
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out = cellfun(@(x) x(1), b)
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Exercise – 05

Problem Statement: Write a function 'prime_out' that takes as input - a number or a vector or a matrix of integer values. It returns the following –

- I. if the input is a number – return either of the following strings based on whether the number is prime or not –
 - “Input is a prime number”
 - “Input is not a prime number”
- II. if the input is a matrix, return a list containing only the prime numbers.
- III. if the input is a string, return – “Input must be a number or a numerical array”

Test Case – 01:

- Input: 7
- output: “Input is a prime number”

Test Case – 02:

- Input: [2,1,77,4,79]
- output: [2,79]

Test Case – 03:

- Input: 'prime'
- output: “Input must be a number or a numerical array”

Test Case – 04:

- Input: magic (4)
- output: [5 2 11 7 3 13]

Key Takeaway:

- *isprime()* , *isrow()* , *iscolumn()* , *isnumeric()* , *islogical()* , *ischar()* , *isscalar()* , *isequal()*
- There are many of these types of inquiry functions. When you try to solve different problems, they'll come in handy in many scenarios.
- Some other functions related to prime numbers - *nthprime()* , *nextprime()* , *prevprime()*
- If you search MATLAB documentation, you'll find these functions belong to the 'symbolic math toolbox'.