Islamic University of Technology (IUT)

Organization of Islamic Cooperation (OIC)

Department of Electrical and Electronic Engineering (EEE)

COURSE NO	:	EEE 4416
LAB NO	:	02 (Part B)
TOPIC	:	STRING, CHARACTER ARRAY

In the previous lab, you were introduced to the *Numerical Array.* In today's session, you will learn about some of the other commonly used data structures. More advanced data structures will be introduced in later labs.

This part contains the following data structures:

i. Character array
ii. String
iii. Cell array
iv. Logical

Character Array

To represent numbers, we use a numerical array where the items are enclosed within third brackets [ ], separated by a comma or a space. Now, to represent a text, the basic datatype provided by MATLAB is 'char'. It's one of the ways to handle text data in MATLAB (the other being strings introduced in newer versions).

A character array is a sequence of characters stored as a 1D or 2D array of type char. Each character is stored as an element in a matrix. A single quote is used to enclose the characters.

```
T1= 'Hello'      % t1 is a 1x5 char array
```

```
T2= ['gandalf', 'aragorn']                % output will be 'gandalfaragorn'
```

Placing texts separated by a comma within square brackets does not work the same way as numbers (separate elements). All the texts inside the brackets constitute a single array.

To set them apart, you need to include a comma and a space during variable declaration.

```
T3 = ['gandalf', ',', ' ', 'aragorn']          % output = 'gandalf, aragorn'
```

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Now, to create a 2D character array, all the elements need to be of the same size and should be separated by a colon.

```
T3= ['gandalf'; 'aragorn']                    % output will be a 2×7 char array
```

```
T4 = ['gandalf'; 'aragorn'; 'Frodo']          % this is going to throw an error.
        % Dimenstions being concatenated are not consistent.
```

As you can see, a character array offers less flexibility while working with texts. To offer better flexibility, MATLAB introduced an advanced data structure called 'Strings'. It makes working with texts easier and offers many useful built-in functions for processing.

Indexing in character array

Indexing in a character array is similar to numeric arrays. Both linear and subscript indexing can be used to locate, extract, or modify items.

- You can use both empty '' or empty [] to remove a character from the array.

```
T5 = 'Charles, old friend!'
                    T5(1) => 'C'
                    T5(end) => '!'
T5(1)= 'S'              % output=  'Sharles, old friend!'
T5(1:6) ='Xavier'       % output = 'Xaviers, old friend!'
T5(7) = ''              % output = 'Xavier, old friend!'
T5(7) = []              % output = 'Xavier old friend!'
```

Regular Expression

Processing a corpus (a collection of written texts) is a complex task that often requires advanced tools and libraries to handle a wide range of operations. Regular expressions (regex) are among the most powerful tools for text processing and pattern matching. While most modern programming languages, including MATLAB, support regular expressions, the syntax and implementation can vary across languages.

MATLAB offers built-in functions like regexp, regexpi, and regexprep for text processing. We will discuss these in a later lab.

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Strings

Introduced in newer versions of MATLAB, string arrays are objects specifically designed for more intuitive handling of text data. Strings are enclosed in double quotes (e.g., "Hello"), and MATLAB offers a wide range of functions that make working with text simpler and more efficient compared to traditional character arrays.

```
A1= 'phoenix'          % a character array

A2 = "phoenix"         % a string array


length(A1) => 7

length (A2) => 1
```

- Unlike character arrays, strings are atomic, i.e., you cannot separate the inside characters. Think of them as numbers. For instance, 427 is a unique number. Here, 4 2 7 are not separate items. Rather, all three of them together constitute number 427. Similarly, in the string "phoenix", all the letters together form the word. They cannot be separated.

```
S = "Malfoy"

S(1)          %Output: "Malfoy" ("Malfoy" is the only string in the variable S. You cannot extract the single letter)
```

- To get 'M', you need to covert string str1 to character first.
  Example: char1 = char(S) → char1(1) = 'M'

```
x= ["Charles", "Xavier"]

x =

  1×2 string array

    "Charles"    "Xavier"
```

```
x(3)= "Professor"

x =

  1×3 string array

    "Charles"    "Xavier"    "Professor"
```

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```
x= ["Charles", "Xavier"]

x(1) = []          % output = “Xavier”

x(1) = “”          % output = ["" , "Xavier"]
```

Basic operations

- string() – Convert character array or numeric values to a string.
- char() – Convert string to character array.
- char() – Convert numeric values to corresponding ASCII characters.
- str2double() – Convert string to numeric value.
- num2str() – Convert number to character array.

```
>> string('thor')

ans =

    "thor"

>> string(66)

ans =

    "66"

>> char("thor")

ans =

    'thor'

>> char(66)

ans =

    'B'
```

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- upper(str) – Convert to uppercase.
- lower(str) – Convert to lowercase.

- Replacing parts of the string – use the 'replace ( )' function.
  - replace(str, old, new)

```
>> str1 = "My name is Walter"

str1 =

    "My name is Walter"

>> str2 = replace(str1, "Walter", "Heisenberg")

str2 =

    "My name is Heisenberg"
```

- logical function to compare strings for equality – 'strcmp ( )'

name1 = 'Alice'

name2 = 'alice'

strcmp(name1, name2)

Output: false {case-sensitive}

⇨ Try: *strcmpi(name1, name2)*

- To prompt the user to input a string value –

input('Please enter your full name: ', 's')

% 's' tells MATLAB to treat the input as a string of characters instead of evaluating it as a number or function.

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