Islamic University of Technology (IUT)

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

EEE 4416 **Lab – 06**

*Exercise - 01

Problem statement: Fibonacci Sequence

The Fibonacci number sequence is following:

0,1,1,2,3,5,8,13,21,34,55, …

Can you see the pattern?

Each number in the sequence is the summation of two numbers before that.

Find the nth entry in the sequence. [e.g. n=20]

- This problem can be solved using recursion. But that is not a good approach. Can you think why? Try to get an intuition what is happening behind the curtain, behind your code.
- For large values of n, see how pre-allocation helps.

Additional Exercise:

Compute the 15th entry in the Tribonacci sequence.

Key Takeaway:

- tic toc*
- pre-allocation*
- time complexity

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Exercise - 02

Problem statement: Write a function named ‘max_out’ that takes a matrix and an integer (a) as an input and performs the following operation on the matrix –

Mat= [244 323 312 113 453 302 43 119

18 190 294 86 490 356 132 230

224 406 104 114 220 111 401 482

154 267 151 218 56 59 15 274

255 176 236 156 130 149 465 261

256 470 116 462 205 160 366 116

409 438 423 216 298 213 245 245

398 276 98 93 132 254 290 313]

a=2;

Since a=2, take 2-by-2 block in your original matrix and pick the maximum element.

Create a new matrix with those maximum elements of each block, maintaining the sequence.

The output matrix should look like the following --

Out= [323 312 490 230

406 218 220 482

470 462 205 465

438 423 298 313]

As you can see, the output matrix size is halved.

- What would happen if the size doesn’t match?

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Exercise - 03

Problem statement 3D matrix

So far, we've worked with 2-Dimensional matrix. We can also create a 3D, 4D or higher dimensional matrix very easily.

Let's try to understand first what is a 3D matrix.

Say, you are taking notes in your diary. The page in which you're writing can have x-axis and y-axis i.e. can be divided as a 20-by-20 matrix. The next page also has the same size and can be divided as the same 20-by-20 matrix.

Now, try to look at your diary from outside. There are say 100 pages stacked on top of one another; each of which (page) is a 20-by-20 matrix.

So, your diary is actually a 3D matrix of size – (20,20,100).

Here, 100 is no. of pages which is the 3rd dimension. Each page is 2D matrix of size (20,20).

Now, Say I want to create a 3D matrix of size (5,5,3).

So, I have 3, 2D matrix of size (5,5). Let's create 3 such matrix first.

- M1= eye (5)
- M2= spiral (5)
- M3= magic (5)

Now we've to stack them on top of one another.

- Mat_3d (:, :, 1) = M1
- Mat_3d (:, :, 2) = M2
- Mat_3d (:, :, 3) = M3

- ➢ Try to create a 3D matrix of size (12,5,4).

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Exercise – 04

Problem statement:

Suppose the following table contains the information of the students of IUT.

ID	Section	CGPA	Year
732	1	3.6	3
813	2	3.4	3
709	1	3.85	2
842	3	3.2	3
987	2	3.9	2

Now, you want to sort the students based on their ID. You're already familiar with the 'sort' function. But there is one catch.

If you sort the ID column of the data, other columns remain the same. But they should also be changed accordingly. Otherwise, there will be mismatch in the information.

So, the question is, how to do that?

Part_02:

Next, say I want to find the information of the 3 students who has the highest CGPA. How can we do that?

Additional Exercise:

- Can you extract the information of the students from 3rd year?
- Can you extract the information of the students from 2rd year, section-1?

Key Takeaway:

- Sortrows*
- Topkrows*

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Exercise – 05

Problem Statement: Insert, Replace, Erase, Extract

Last week you saw how to work with regular expression. It's quite a bit tricky. But compared to MATLAB, Python's regular expression library is quite easy and offers much more flexibility.

MATLAB has some other built-in functions that can make the handling much simpler.

Some of the four functions named above offers 3 operations – after, before and between.

For example, 'insertBefore', 'insertAfter'.

Say, I have a string like this -- "Dhaka, Bangladesh"

Here, 1st I have the capital and 2nd I have the country name. What if I want to extract the country name?

Test Case – 01:

- **Input:** "Dhaka, Bangladesh"
- **Output:** "Bangladesh"

Test Case – 02:

- **Input:** "Beijing, China"
- **Output:** "China"

- Try to extract the capital name by yourself.

Key Takeaway:

- Alternative to regexp

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