Islamic University of Technology (IUT)

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Exercise - 01:

Problem statement: Iccanobif Sequence

This is quite similar to the Fibonacci sequence with a single difference.

- Fib (i) = Fib (i-1) + fib (i-2)
- Icc (i) = reverse (Icc (i-1)) + reverse (Icc (i-2))

Icc = [1,1,2,3,5,8,13,39,124, … …]

Here,

- icc(8) = 39 = rev(icc(7)) + rev(icc(6)) = 31 + 8 =39
- icc(9) = 124 = rev(icc(8)) + rev(icc(7)) = 93 + 31 =124

Your task is to write a function named 'iccanobif' that will provide the n-th number in the iccanobif sequence.

- Plot the points in a figure and see if you can visualize the trend.

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Exercise - 02:

Problem statement: **Amicable Pair**

Amicable numbers are two different numbers related in such a way that the sum of the proper divisors of each is equal to the other number.

For example,

- 220 = 1, 2, 4, 5, 10, 11, 20, 22, 44, 55 and 110
- 284 = 1, 2, 4, 71 and 142

Sum of the proper divisors of 220 is equal to 284.

Sum of the proper divisors of 284 is equal to 220.

Hence, 220 and 284 forms an amicable pair.

Write a function named 'amicable' that takes 2 numbers as in input and returns logical true or false based on whether they are amicable pair or not.

Test Case – 01:

- ➤ Input: a=220, b=374
- ➤ Output: False

Test Case – 02:

- ➤ Input: a= 2620, b = 2924;
- ➤ Output: True

Test Case – 03:

- ➤ Input: a= 66928, b = 66992;
- ➤ Output: True

*Optional exercise:

- Write a function to find all amicable pairs within n (e.g., n=100000)

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Problem statement: Goldbach's marginal Conjecture

Goldbach's conjecture states that every even integer greater than 2 can be expressed as the sum of two primes.

Goldbach's another conjecture states that -

Every integer greater than 5 can be expressed as the sum of three primes.

For example, 7=3+2+2

19=11+5+3

Write a function named 'goldbach_marginal' that takes an integer as in input and provides any of the perfect solutions.

Test Case – 01:

➢ Input: n = 5
➢ Output: "Numbers below 5 don't satisfy the conjecture"

Test Case – 02:

➢ Input: n = 15
➢ Output: [5,5,5] or [3,5,7] or [2,2,11]

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Exercise - 04:

Problem statement: Creating Tables

You've already seen the following dataset. In the previous lectures, we only used the numerical portion since a matrix cannot handle heterogeneous data-type.

- Now create a table named 'Uni_BD' containing the following information.

	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

From the table -

- ➤ Find out the total no of students in CUET
- ➤ Create a new column named 'DU' and add arbitrary values.
- ➤ Delete the management department from the table
- ➤ Convert the department names as categorical type.
- ➤ Summarize the table

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Exercise - 05:

Problem statement: Lunar Addition

Write a function named 'lunar_add' that takes two integers as input and performs lunar addition.

Go to the following link to understand what lunar arithmetic is: https://oeis.org/A087061

Test Case – 01:

➢ Input: a=5, b=9
➢ Output: 9

Test Case – 02:

➢ Input: a=482, b= 24314
➢ Output: 24484

Optional Exercise:

✦ Try Lunar multiplication

✦ Oeis stands for "On-line Encyclopedia of Integer Sequences". It is the largest online database of integer sequences.

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Exercise - 06:

Problem statement: **Extract Middle Name**

Given a cell array of names, perform the following –

    I.   Extract the middle name

   II.   Return only the 1st name

  III.   Return 1st name and last name

  IV.   Append the abbreviate form of the name in the end

Test Case – 01:

➢ Input: {"Harry James Potter", "Eddard Ned Stark", "Charles Francis Xavier"}

➢ Output:

    I.   {"James", "Ned", "Francis"}

   II.   {"Harry", "Eddard", "Charles"}

  III.   {"Harry Potter", "Eddard Stark", "Charles Xavier"}

  IV.   {"Harry James Potter, HJP", "Eddard Ned Stark, ENS", "Charles Francis Xavier, CFX"}

Exercise - 07:

Problem statement:

Refer back to exercise-02 in this week's lecture.

Now, create a function named 'mat_out' that will take a matrix, an integer and a string.

- The string should be 'max', 'min' or 'mean'. You should perform similar operation on the matrix. Any other string other than above mentioned should return an error message.
- The integer(a) is the box size that you need to slice.
- There is a catch. If your input matrix size is 10 and a=2; then output matrix size would be 5.
  But if a=3, remainder is no longer 0. In that case, operation should be performed on the remaining slice. Output matrix size would be 4-by-4.

Test Case – 01:

- ➢ Input: mat= randi (400,16), a=3, str='mean'
- ➢ Input: mat= magic (20), a=5, str = 'min'

*Test Case – Optional:

- ➢ Input: mat= randi(400,16,23), a=3, str='max'

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Exercise - 08:

Problem statement:

You're given a matrix. Find and remove the columns that have numbers greater than x or less than y.

Write a function named "mat_prop_256" that'll take x and y as the input as well as the matrix.

If the user doesn't provide the x and y value; by default, consider them as x=0 and y=255.

Test Case – 01:

> **Input:**
> mat= [zeros(50,10),ones(50,30), ones(50,30)*2, ones(50,2)*326, ones(50,30)*255]

Test Case – 02:

> **Input:** mat=randi([-10,20],10, 12), x=-5, y= 14.

Hint:

▪ Remember, you need to provide the 'varargin' option to give user that choice.

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Exercise - 09:

Problem statement:

You're given a sting. Perform the following operations –

    I.   Find the maximum element in the string and its ASCII value.

    II.   Find the minimum element in the string and its ASCII value.

    III.   Find how many punctuation characters are there.

    IV.   Find how many whitespace characters are there.

    V.   Find the total value of the string after removing all occurrences of whitespace characters. [total value = sum of ascii values]

Test Case – 01:

➢ **Input:** x= ' The Chronicles of Narnia!!! – ^Peter Pavensie, @lucy pavensie; '

➢ **Output:**

    I.   8211 , '—'

    II.   32, ' '

    III.   7

    IV.   13

    V.   13351

Hint:

▪ double(str) -- provides the ascii value of a string

▪ char( ) --- provides the character associated with the ascii value

▪ isstrprop -- explore the documentation to understand how to use it

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Exercise - 10:

Problem statement: ZigZag

A matrix is given. Perform the following tasks –

A= [1, 2, 3;

    4, 5, 6;

    7, 8, 9]

   I.   return the elements that are on the Z form of the matrix
       output = [1 2 3 5 7 8 9]

  II.   return the elements that are on the Zigzag form of the matrix
       output = [1 2 3 6 5 4 7 8 9]

 III.   return the elements that are on the alpha form of the matrix
       output= [3,5,7,4,1,5,9]

Test Case:

   ➤ a= magic(4)

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Exercise - 11:

Problem statement: Handling 3D matrix

A 3D matrix is given as input. Perform the following tasks –

   i.   extract all the elements from the 2nd column from the 3rd layer.

   ii.   extract all the elements from the 3rd row from the 1st layer.

   iii.   Change the diagonal elements of the 2nd layer.

   iv.   Change the 18th element of the matrix to nan

   v.   Add another layer to the original matrix with all elements equal to 1000

Test Case:

➢ Input:

- a(:,:,1) =magic(6)
- a(:,:,2)= randi(100,6)
- a(:,:,3)=spiral(6)
- a(:,:,4)= eye(6)

Problem statement:

A 3D matrix of size (2,3,4) is given where each layer represents 3 coordinates of a triangle.

For example, a= randi ([-20,20],2,3,4)

Say, a(:,:,1) = [8   18   -3

            -7 -19   -5]

1st row represents the x-axis and 2nd row represents the y-axis.

   i.   Plot all the triangles in the same window using subplot.
  ii.   Add grid, label, title
 iii.   Use same axis for all figures
  iv.   Each triangle should be of different colors

   ▪   Find out the area and perimeter of each triangle.
       Do this task in two ways.
           i.   Creating polyshape object
          ii.   By mathematical formula

       Then compare the results

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Exercise - 13:

Problem statement:

Import the file named 'worldcities.csv' in your MATLAB and generate a live script.

Further processing should be done in live script.

I.   How many unique country names are there?
II.   How many cities have population greater than 10 million?
III.   Extract the information of all cities with population greater than 5 million.
IV.   Create a geoscatter plot of those cities in ques-03.
V.   Extract the information of all cities with country name Bangladesh.

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