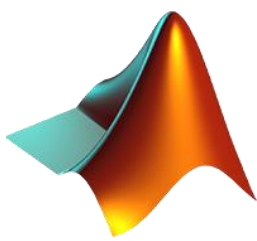




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# El Matrico

IIT Hyderabad Presents  
 **ηVISION**  
2015

Submission Date – 26<sup>th</sup> August, 2015 (Wednesday), 11:59 PM

**P.S** – \* implies multiplication.

## Problems

1. Given two sequences of a & b of length n & m ( $n > m$ ) respectively, polynomial functions -

$$f(x) = \sum (a(t) * x^{n-t}) \quad \text{where } t \in [1, n]$$

$$g(x) = \sum (b(k) * x^{m-k}) \quad \text{where } k \in [1, m]$$

Get the partial fractions of the function

$$F(x) = \frac{f(x)}{g(x)} = \sum \frac{c(k)}{x - d(k)} + \sum e(k) * x^{(k-1)}$$

Plot all the  $s(k) = c(k) * x + d(k)$  for  $x \in (0, 45)$  in one graph.

**Example** : Let  $f(x) = x - 2$  and  $g(x) = x^2 + 6x + 8$  then

$$F(x) = \frac{x-2}{x^2+6x+8} = \frac{3}{(x+4)} - \frac{2}{(x+2)}$$

then plot  $s(1) = 3x - 4$  and  $s(2) = -2x - 2$  in one graph for  $x \in (0, 45)$ .

2. In this question take  $\sin(\pi/6)$  and its taylor series expansion until n terms and let the difference between them is k. Find the minimum number of terms 'n' you will use for approximation so that the error caused k is less than

- a) 0.005
- b) 0.0005

c) 0.00005

3. For a given 'n' generate two random numbers  $r_1$  &  $r_2$  and a matrix with  $n * n$  dimension in which all the entries are some random numbers (all numbers are between 0 and 1. For  $0 < r_1 < r_2 < 1$ , return a matrix such that if the element is in range

Range	Get replaced by
$(0, r_1]$	-1
$(r_1, r_2]$	0
$(r_2, 1)$	1

4. For a given  $p$  ( $0 < p < 1$ ) and  $n$  generate one  $n * n$  matrix as output having  $p$  as one of its elements & it satisfies the following conditions –

- a) Each element  $x$  is such that  $0 \leq x \leq 1$
- b) Sum of any row or column is between 0 and 1
- c) Sum of all the elements is 1.

5. Write a function to generate a matrix of order 'n' where 'n' should be taken as input. Also each element of the matrix should belong to the integer and lies between 0 to  $n-1$ . The matrix should have the following format -

$$\begin{pmatrix} 0 & 1 & 2 & 3 & \dots & n-1 \\ 1 & 0 & 1 & 2 & \dots & n-2 \\ 2 & 1 & 0 & 1 & \dots & n-3 \\ \dots & \dots & \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots & \dots & \dots \\ n-1 & n-2 & \dots & \dots & \dots & 0 \end{pmatrix}$$

6. Implement a simple function which takes an array of numbers as input and gives all different types of repeated sequence and the number of times it gets

repeated in the array as an output. Every sequence that appears at least two times should be recorded and be given as output.

**Example –**

**Sample input**

12341212356

**Sample input**

121212

**Sample output**

12 – 3

123 – 2

**Sample output**

12 – 3

121 – 2

212 – 2

7. Given a value of  $n$  and  $k$ , where ' $n$ ' denotes the total number of bits of a string containing 0's & 1's only and ' $k$ ' denotes the total of number of 1's in the string, write a function that returns all the possible strings.

**Example -**

**Sample input**

$n = 3, k = 2$

**Sample output**

110

101

011