Ministry of Higher Education and Scientific Research

BADJI MOKHTAR-ANNABA UNIVERSITY, Faculty of Technology, Computer Science department –

Exam- "Programming tools for mathematics" – duration: 1h.30min (2023-2024)

Exercise 1: Consider the following sequence of Matlab instructions:

P1=[7 4 2 ; ones(1, 3) ; 26 5 1] ; P2=[0 :1 ;1 1 ; 4 3] ; P3=[1 1 1 ; 25 3 :-1 :2] ;

P4=[1 1 ; 9 6] ; A=[P1 P2 ; P3 P4] ; T=[3 1 4 1 3]' ; B=[A T] ; C=diag(A, 1) ; V=[ones(6, 1)]' ; B=[B ; V]

- Give the values of variables A, B and C.

Exercise 2: Consider the following A_n matrix:

$$A_n = \begin{pmatrix} 0 & 1 & 0 & 0 & \cdots & 0 & 0 \\ \frac{1}{(n)^2} & 0 & \frac{1}{(2)^2} & 0 & & \vdots & \vdots \\ 0 & \frac{1}{(n-1)^2} & 0 & \frac{1}{(3)^2} & & \vdots & \vdots \\ 0 & 0 & \frac{1}{(n-2)^2} & 0 & \ddots & 0 & 0 \\ \vdots & \vdots & & \ddots & \ddots & \frac{1}{(n-1)^2} & 0 \\ \vdots & \vdots & & & \frac{1}{(2)^2} & 0 & \frac{1}{(n)^2} \\ 0 & 0 & \cdots & 0 & 0 & 1 & 0 \end{pmatrix}$$

Write a Matlab script which allows you to construct the A_n matrix:

- Using a FOR loop

- Without using loop

Exercise 3: Write a Matlab script which allows you to calculate an approximate value of π using the limit of the following series:

$$\frac{1}{1^2 \times 3^2} + \frac{1}{3^2 \times 5^2} + \frac{1}{5^2 \times 7^2} + \ldots + \frac{1}{n^2 \times (n+2)^2} = \frac{\pi^2 - 8}{16}$$

Exercise 4: Using Matlab commands:

1. Define the polynomial P(x)= -x4+ 2x2+3x-1.

2. Calculate P(0), P'(1) and P''(2).

3. Define the vector V which contains 100 values between -2 and 2.

4. Evaluate the polynomial P(x) on the points of V.

5. Given the polynomial S(x)= - x +1, calculate the product and the sum of P and S.

6. Plot in the same figure the two polynomials P and S on the interval $[-10,10]$.

Ministry of Higher Education and Scientific Research

BADJI MOKHTAR-ANNABA UNIVERSITY, Faculty of Technology, Department of Computer Science – "Programming Tools for Mathematics" Exam - Duration: 1 hour 30 minutes (2024/2025)

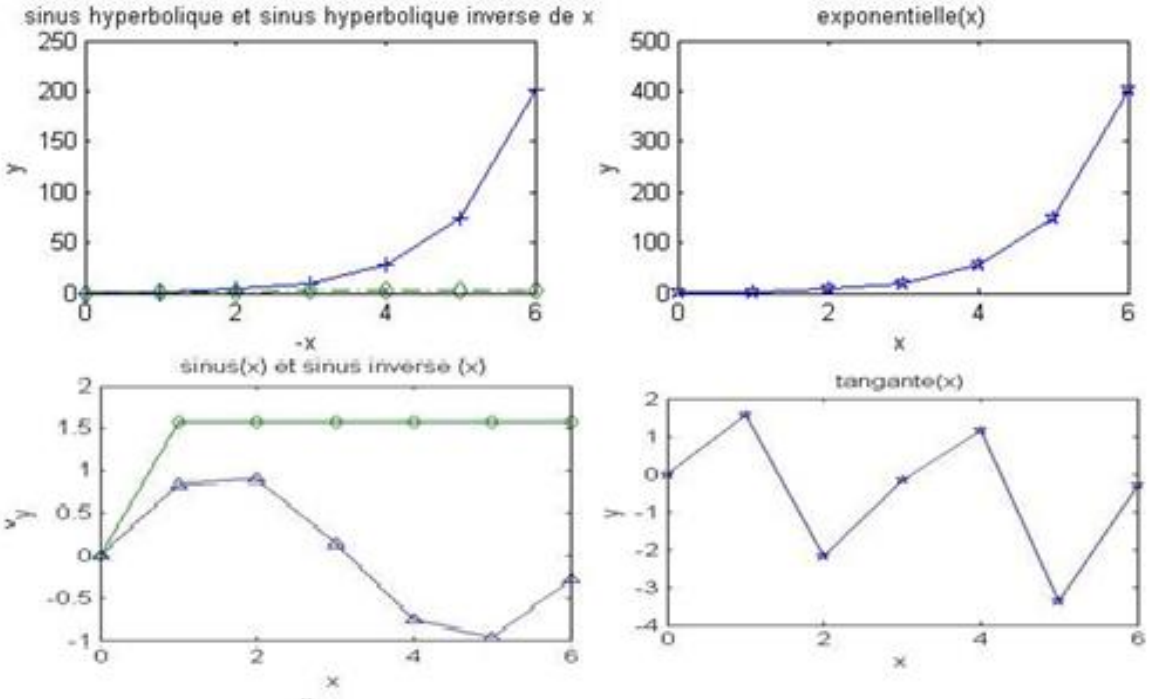
Exercise 1 (4 pts): Give the mathematical expressions equivalent to the following MATLAB instructions: w=−2∗log(5∗x)+sqrt((4∗x ^ 3)+3*i) ; y=abs(2∗n^5−3)/sqrt(4∗n^2+log(6∗n)) ; z=exp (sqrt(x))/(2∗y−1)+abs(x)−1 /(y ^ 2+3) ; t=sum((n:−1:1)./(1:n)).

Exercise 2 (4 pts): Consider the following function with two nested loops:

```
function M=calculate(M)
[n,m]=size(M);
for i=1:n
v=M(i,:);
for j=1:m
M(i,j)=v(m-j+1)
end
end
```

1. Give the value of B after executing the following instructions:
   >> A=[1 2 3 4;5 6 7 8;9 10 11 12];
   >> B=calculate(A)
2. Deduce what this function does.
3. Rewrite the calculate function to obtain the same result (without using loops).

Exercise 3 (8 pts): Write all the MATLAB instructions to plot the following curves:



Exercise 4 (4pts): write a Matlab script that allows you to calculate and display the approximate values of π for each integer n∈ [1 M].

$$\frac{1}{1^2\times 3^2}+\frac{1}{3^2\times 5^2}+\frac{1}{5^2\times 7^2}+\ldots+\frac{1}{n^2\times(n+2)^2}=\frac{\pi^2-8}{16}$$

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Badji Mokhtar Annaba University, Faculty of . Computer Science department

Programming Tools for Mathematics (2023-2024)

Micro-interrogation

Name :……..
First Name :……..
Group :……

Exercise 01 (7 points):

1. Check it or the correct answers:

a. We want to evaluate the function $y=\sqrt{(x+3)} * \text{atan}(x)^2+ 4$ for a value of x=3, what are the correct syntaxes?

y= sqrt(x+3)*atan(x)^2+4 ;
y= sqrt(x+3).*atan(x)^2+4 ;
y= sqrt(x+3).*atan(x).^2+4 ;
y= sqrt(x.+3).*atan(x).^2.+4 ;

b. Let M and N be two matrices (such that n and m are two different positive integers). Indicate which of the four Matlab instructions below gives a result without causing an error.

M(m,n)*N(n,1) ;
N(m,n)*M(n,m) ;
M(m,n).*N(m, 1) ;
M(m,1)+N(1,m) ;

d. Let two vectors be u= [-5 : 3 : 3, linspace(1,10,4)], v= [u(end :-2 :1), u(1 :2 :4), 2, 4],the v(end:-4:1) instruction gives the result:

-5 4
1 4
4 -5
error

e. So that the matrix B=[rand(4, 5);rand(2,2) A; ones(5)] is computable; what should be the size of matrix A:

2 rows and 3 columns;
3 rows and 3 columns;
1 row and 3 columns;
whatever the size;

2. Answers the following questions:

a. For k=11:-3:1, y=[3 2 1 0], x=y-[1 3 -1 5], what is the expression s=[k(3) (k(1)-2)) (k(end)+ 4) x]

……..

b. z=ones(1, 4)+x

…… ;

c. Donnez l'instruction Matlab pour tracer une courbe de points contenus respectivement dans deux matrices x et y de même taille. Les points doivent être matérialisés sur le graphe par des marqueurs sous forme de cercle rouge et reliés par une courbe en tirets.

……..

d. Quelle est la fonction Matlab utilisée pour donner un titre différent à chacun des courbes contenues dansla même figure.

……..

Exercise 02 (8 pts):

A. Give the result of each of the following MATLAB instructions:

≫ $k = 20 : -3 : 1$ …….
≫ $b = [1 - 3\ 2\ 10] * (5 * eye(4))$ …….
≫ $a = b - [4\ 5\ 9 - 1]$ …….
≫ $S = [k(5)\ k(1)\ (k(5) - 1)\ (k(5) + 3)\ ;\ a\ ;\ b\ ]$ ……

B. Translate the following mathematical expressions into MATLAB statements:

– $w \leftarrow -2\,ln(5x) + \sqrt{4x^3 + 1},\ \text{pour } x = -3i$ …….
– $y \leftarrow \frac{|2n^5-3|}{\sqrt{4n^2+\ln(6n)}}$; ……
– $z \leftarrow \frac{e^{\sqrt{x}}}{2y-1} + |x| - \frac{1}{y^2+3}$ ……..

C. Let n be a natural number defined in advance. Give the MATLAB commands to calculate the following expressions in the simplest way (without using a loop):

$f = n!$: ……

$z = n + \frac{n-1}{2} + \frac{n-2}{3} + \cdots + \frac{1}{n}$ …….

– "Programming tools for mathematics" exam – 1h
Unauthorized handwritten documents and course notes -2023-2024-

Name : .....

First name :.....

Group :.....

Exercise 1: Give the MATLAB/SCILAB result for each of the following commands:

$$\mathbf{M} = \begin{pmatrix} \begin{bmatrix} 1 & 2 \\ 7 & 2 \end{bmatrix} & \begin{bmatrix} -1 & 3 \\ 0 & 1 \end{bmatrix} \\ \begin{bmatrix} 3 & -2 \\ 0 & 1 \end{bmatrix} & \begin{bmatrix} -1 & -1 \\ 4 & 8 \end{bmatrix} \end{pmatrix}$$

`M(1:3,[2 4])'`	
`M(2,:) = M(2,:)-7*M(1,:)`	
`M([1 3],[1 3]) = 10*ones(2,2)`	
`M = [[M(2:3,[1,3]);M(2:3,[2,4])] ones(4,2)]`	
`size(M)*M([2,4],[2: end ])`	
`M(end :-1:1,end :-2:1)`	

Exercise 2: Give the results of the following expressions:

`[-1 2 ; 4 6 ; 3 -7] >= [2 2 ; -1 8 ; 4 -2]`	
`isequal(2*ones(3,3),2+zeros(3,3))`	
`isempty([4:1;-3:-1:-1;[]])`	

– "Programming tools for mathematics" exam – 1h
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Name : .....

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Exercise 3: Consider the following function:

$$f(x) = \begin{cases} -x^2 - 4x - 2 , & x < -1 \\ |x| , & |x| \leq 1 \\ 2 - e^{\sqrt{x-1}} , & x > 1 \end{cases}$$

Draw the curve of the function f in the interval [-4, 4]?	
Draw the curves of these three sub functions in the same figure in the interval [-4, 4]?	