Exercise 1

Let $A = \begin{pmatrix} 1 & 0 \\ -1 & -2 \end{pmatrix}$

1. From A how can I get the following matrix B using MATLAB commands

$$B = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 0 \\ -1 & -2 & -1 & -2 & -1 & -2 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ -1 & -2 & -1 & -2 & -1 & -2 \end{pmatrix}$$

2. What is the value of $>>$ $\mathbf{B(10)}$
3. From B how can I get the following matrix C using MATLAB commands

$$C = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 0 \\ -1 & -2 & 6 & 6 & -1 & -2 \\ 1 & 0 & 6 & 6 & 1 & 0 \\ -1 & -2 & -1 & -2 & -1 & -2 \end{pmatrix}$$

4. From C how can I get the following matrix D using MATLAB commands

$$D = \begin{pmatrix} -1 & -2 & 6 & 6 & -1 & -2 \\ 1 & 0 & 6 & 6 & 1 & 0 \end{pmatrix}$$

5. What is the value of the variable **u** after the following MATLAB command $>>$ $\mathbf{u = D(1, [1\ 3\ 4\ 6])}$
6. What is the value of $>>$ $\mathbf{u(2)}$

Exercise 2

1. Enter the matrix $\mathbf{A} = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 8 \end{pmatrix}$. How can I get the entries $(2,3)$, $(3,1)$, $(1,1)$ of **A**?
2. How can I read the elements 1 and 3 of the second row of **A** and the elements 2 and 3 of the first column of **A**?
3. How can I read the second column of **A** and the third row of **A**?
4. What is the value of $\mathbf{A(5)}$? Type $\mathbf{A}(:)$. What do you observe?
5. Delete the second row of **A**.
6. Add the row vector $\mathbf{u = [25\ 26\ 27]}$.
7. Explain the following command $\mathbf{A}([\mathbf{1:2}, \mathbf{2:3}], :)$.

February 28, 2011 Semester 2, 1431-1432 (2010-20111)

MATH 251 - Introduction to Matlab

Exercise sheet 1

Dr. Samy MZIOU

Part 1

1. Open MATLAB
2. Type `version`. What do you read?
3. Type `ver`. What do you read? what is the difference with the command `version`
4. To quit MATLAB, what do I have to do?
5. Reopen MATLAB.
6. Type `helpwin`. What do you see? Visit some repertories.
7. Type `help`. What do you see?
8. Type `helpdesk`. What do you see?
9. Open a webpage and search for " `Matlab helpdesk` "
10. What is difference between the command `help` and the command `lookfor`. Give some examples of use of the command `lookfor`.
11. Quit MATLAB.

Part 2

1. Open MATLAB.
2. Type the following at prompt (after each command do a return)
   ≫ `clear all`
   ≫ `a=4`
   ≫ `b=5`
   ≫ `c=a*b;`
   What is the role of the character " ; "
3. Type commands `who` and `whos`. Compare them and discuss.
4. How can i know the role of the command `clear` and explain its difference with the command `clear all`

5. Type `clear all; pack`. What is the meaning of the command `pack`.
6. Type `clc` and Type `home`. Explain their difference.
7. May I use the word `2for1` as a variable assignment? Explain why? Give some valid MATLAB variables.
8. May I use a MATLAB word (command, function,...) as a variable assignment? Explain why?
9. Explain the role of the command `isvarname`.
10. For looking general purpose commands, type `help matlab/general`.
11. Quit MATLAB.

Part 3

Which of the following are legitimate variables names in MATLAB

1. `3vars`
2. `global`
3. `help`
4. `My_var`
5. `sin`
6. `X+Y`
7. `_input`
8. `input`
9. `tax-rate`
10. `example1.1`
11. `example1_1`
12. `which`

Part 4

Predict the outcome of the following MATLAB calculations. check your results using the MATLAB command window.

1. $1 + 3/4$
2. $5 * 6 * 4/2$
3. $5/2 * 6 * 4$
4. $5^2 * 3$
5. $1 + 3 + 5/5 + 3 + 1$
6. $(1 + 3 + 5)/(5 + 3 + 1)$

February 28, 2011 Semester 2, 1431-1432 (2010-20111)

MATH 251 - Introduction to Matlab

Exercise sheet 2

Dr. Samy MZIOU

Exercise 1 :

1. What is the role of the symbol %. Give an example.
2. This exercise shows the use of **sqrt** built-in function. Carry out the following commands and redo this exercise by using others built-in function.
   ≫ **sqrt(64)** **% the argument is a number.**
   ≫ **sqrt(50+14*3)** **% the argument is an expression.**
   ≫ **sqrt(sqrt(4)+9*sqrt(100))** **% the argument includes a function.**
   ≫ **(15+600/4)/sqrt(121)** **% the function is included in an expression.**
3. Can I use a built-in function as a variable assignment?
4. Give some examples of non valid variable assignment.
5. Type the following instruction $-\mathbf{10} : \mathbf{15}$ at the prompt and press ENTER. You have defined a default variable **ans** which is a row vector from -10 to 15 with increment 1. With MATLAB how can i know its size ? Can I use the variable **ans** as a variable assignment?
6. Type the following instruction $\mathbf{x} = -\mathbf{10} : \mathbf{3} : \mathbf{15}$ at the prompt. You have defined a line vector called $\mathbf{x}$ from -10 to 15 with increment 3. What is its size?
7. Write the MATLAB command for defining a vector from -1 to -20 with an increment of 4?
8. Write the MATLAB command for defining a vector from -100 to -20 with a number of elements of 40?
9. Try using the command **linspace** to define the row vector x defined in item 6 and assign it to the variable $\mathbf{y}$.
10. What does the following command **isequal**$(\mathbf{x}, \mathbf{y})$ mean? what is the meaning of the command **isvector**$(\mathbf{x})$? Type the command **doc is*** and explain it?
11. Type $\mathbf{x} * \mathbf{y}$. What is wrong here? What is the difference with $\mathbf{x}. * \mathbf{y}$?
12. Type $\mathbf{x}^{\mathbf{T}} * \mathbf{y}$ and assign it to $\mathbf{A}$. What is the size of $\mathbf{A}$. How can I get the size of A via MATLAB?
13. Let $\mathbf{B} = \begin{pmatrix} 1 & 2 \\ 4 & 5 \\ 7 & 8 \end{pmatrix}$. Get the transpose of $\mathbf{B}$. What is its size?

14. Add to **B** the vector $\begin{pmatrix} 3 \\ 6 \\ 9 \end{pmatrix}$ and call the new matrix **C**.

15. Put the $(\mathbf{2},\mathbf{3})$**-entry** of **C** to **zero**, then delete the third row of **C** and save it again as **C**. Give the size of the new matrix **C**. What happens when we assign an instruction to a same variable?

16. Find the maximum of **C** entries using the MATLAB command **max**.

17. How can I get the (3×3) null matrix, the (3×3) identity matrix, and the (5×1) ones matrix.

18. Type **whos**.

19. Type **x**.

20. Type **format long**.

21. Retype **x**. What do you observe.

22. Type **format short**.

23. Type **x**.

24. Type **clc;**.

25. A game for us : Type **magic (3)**. Then **magic (4)**

26. Type $\mathbf{A} = [\mathbf{16\ 3\ 2\ 13; 5\ 10\ 11\ 8; 9\ 6\ 7\ 12; 4\ 15\ 14\ 1}]$. Enter at the prompt $\mathbf{sum}(\mathbf{A},\mathbf{1})$. Explain? Type $\mathbf{sum}(\mathbf{A},\mathbf{2})$. Explain? Type $\mathbf{diag}(\mathbf{A})$ then $\mathbf{sum}(\mathbf{diag}(\mathbf{A}))$.
Type $\mathbf{A}(\mathbf{1},\mathbf{4}) + \mathbf{A}(\mathbf{2},\mathbf{4}) + \mathbf{A}(\mathbf{3},\mathbf{4}) + \mathbf{A}(\mathbf{4},\mathbf{4})$.

27. Type **rho = (1+sqrt(5))/2** and $\mathbf{a} = \mathbf{abs}(\mathbf{3} + \mathbf{4i})$.

28. Mohammed went to the souk. he bought 4kg of carrots (3SR/kg), 3kg of apples (7SR/kg), 6 lettuces (2 for 4SR) and 6 pepsi (1SR each). What is the total amount?

29. Imed must buy some eggs and some bread. He has only 100SR. 4 eggs cost 2SR and one bread 5SR. With 6 breads How many eggs Imed can buy?

30. Let $z = -2 + 3j$. What is the conjugate of z, its absolute value? Give the value of $|z^2\ \overline{z}|$

31. Let $A = \tan x + \cot x$ and $B = \frac{1}{\cos x\ \sin x}$. Are these expressions equal for $x = \frac{\pi}{4}$.

32. I want to compare the expression of A and B (previous question) at many points. How can do it?

33. Let the vector w = [1 3 5 7 6 8 0 9 4 2]. Try to sort this vector. What is the sum of its components? How can I do to get square all the terms of w.

34. I want to compute the area and the perimeter of a rectangle, a triangle and a circle. How can I do it in MATLAB?

35. I want to compute the value of the variable $y = x^2 - 3$ for different values of the variable x. How can I do it in MATLAB?

36. I want to enter the name of my four friends in a vector. How can I do it in MATLAB?

Exercise 2 :

Without using MATLAB, explain why using the order of precedence. What are the results with MATLAB.

1. $\gg$ **7 + 8/2**
2. $\gg$ **(7 + 8)/2**
3. $\gg$ **4 + 5/3 + 2**
4. $\gg$ **5^3/2**
5. $\gg$ **27^(1/3) + 32^0.2**
6. $\gg$ **27^1/3 + 32^0.2**

Exercise 3 :

1. Type **format short or format** (it the format default in MATLAB) and type $\gg$ **290/7**.
2. Type **format long** and type $\gg$ **290/7**.
3. Type **format short e** and type $\gg$ **290/7**.
4. Type **format long e** and type $\gg$ **290/7**.
5. Type **format bank** and type $\gg$ **290/7**.
6. Type **format rat** and type $\gg$ **2.75** .

Exercise 4 :

Try to use some built in functions (*sqrt, exp, abs, factorial, sin, cos, tan, cot, round, fix, ceil, floor, rem, sign*)

Exercise 5 : Calculate

1. $$\frac{35.7 \cdot 64 - 7^3}{45 + 5^2}$$
2. $$\frac{5}{7} \cdot 7 \cdot 6^2 + \frac{3^7}{9^3 - 652}$$
3. $$(2+7)^3 + \frac{273^{2/3}}{2} + \frac{55^2}{3}$$
4. $$2^3 + 7^3 + \frac{273^3}{2} + 55^{3/2}$$
5. $$\frac{3^7 \log 76}{7^3 + 546} + \sqrt[3]{910}$$

6.

$$\cos^2(\frac{5\pi}{6})\sin(\frac{7\pi}{8})^2 + \frac{\tan(\frac{\pi}{6}\ln 8)}{\sqrt{7}}$$

Exercise 6 :

Define the variables a, b, c and d as:
$a = 15$, $b = -7$, $c = a - b$, $d = 2 * ab - c$.

Evaluate:

1. $a + \frac{ab}{c}\frac{(a+d)^2}{\sqrt{|ab|}}$
2. $d\mathrm{e}^{(\frac{d}{a})} + \frac{\frac{ad+cd}{\frac{20}{a}+\frac{30}{b}}}{(a+b+c+d)}$

Exercise 7 :

a) Do the two following commands give the same result? Explain why?

i) >> $\mathbf{1+3 \quad * \quad 2-1 \quad / \quad 2*4}$ ii) >> $\mathbf{1 \quad +3*2 \quad - \quad 1/2 \quad *4}$

b) What is the result of the following command? >> $\mathbf{4 + (6/3) - 5/(2+3) * 2}$

c) Are the variable assignments correct? if no, explain why?

1. >> $\mathbf{\_mutiple3 = 3 * (x.\hat{}2 + 1)}$;
2. >> $\mathbf{3multiple = 3 * (x.\hat{}2 + 1)}$;
3. >> $\mathbf{three\ multiple = 3 * (x.\hat{}2 + 1)}$;
4. >> $\mathbf{threemultiple = 3 * (x.\hat{}2 + 1)}$;
5. >> $\mathbf{multiple3 = 3 * (x.\hat{}2 + 1)}$;

Exercise 8 :

Two trigonometric identities are given by:

a) $\sin 2x = 2\sin x \cos x$

b) $\cos\frac{x}{2} = \sqrt{\frac{1+\cos x}{2}}$

For each part, verify that the identity is correct by calculating each side of the equation, substituting

1. $x = \frac{5}{24}\pi$
2. $x = linspace(0, 2, 50) * \pi$

Exercise 9 :

In the right triangle (a,b,c) with $a = 11\ cm$ and $c = 21\ cm$(hypothenuse), and α the angle between b and c.

a) Using the Pythagorean theorem, calculate b by typing one line in the command window.

b) Using the value of b and the $\arccos(x)$, calculate the angle α in degrees typing one line in the command window.

Exercise 10 : This exercise contains three parts

1. Answer the following questions

A. MATLAB is a ..... language

1. compiled 2. interpreted 3. object oriented

B. How can I type several commands in the same line?

C. Can I go back to a previous line in the command window?

D. If a command is too long to fit one line what do I have to do?

2. Find all the mistakes in the following program and correct them.

$>>\ A = random(3, 2);$

$>>\ A[2, 1] = 2;$

$>>\ u = zeros[1; 3];$

$>>\ x = linspace(6, 1);$

$>>\ 1y = x\text{^}2 + 1;$

3. What is the MATLAB command for carrying out the following instruction.

$$2^3 - 4 \cdot 5^{-2} + \frac{5^{\frac{1}{3}}}{\frac{1}{5^3}}$$

Exercise 11 :

Let $A = \begin{pmatrix} 1 & 0 \\ -1 & -2 \end{pmatrix}$

1. From A how can I get the following matrix B using MATLAB commands

$$B = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 0 \\ -1 & -2 & -1 & -2 & -1 & -2 \\ 1 & 0 & 1 & 0 & 1 & 0 \\ -1 & -2 & -1 & -2 & -1 & -2 \end{pmatrix}$$

2. What is the value of $>>$ **B(10)**

3. From B how can I get the following matrix C using MATLAB commands

$$C = \begin{pmatrix} 1 & 0 & 1 & 0 & 1 & 0 \\ -1 & -2 & 6 & 6 & -1 & -2 \\ 1 & 0 & 6 & 6 & 1 & 0 \\ -1 & -2 & -1 & -2 & -1 & -2 \end{pmatrix}$$

4. From C how can I get the following matrix D using MATLAB commands

$$D = \begin{pmatrix} -1 & -2 & 6 & 6 & -1 & -2 \\ 1 & 0 & 6 & 6 & 1 & 0 \end{pmatrix}$$

5. What is the value of the variable **u** after the following MATLAB command >> $\mathbf{u} = \mathbf{D}(\mathbf{1}, [\mathbf{1\ 3\ 4\ 6}])$
6. What is the value of >> $\mathbf{u}(\mathbf{2})$

Exercise 12 :

1. Enter the matrix $\mathbf{A} = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 8 \end{pmatrix}$. How can I get the entries $(2,3)$, $(3,1)$, $(1,1)$ of **A**?
2. How can I read the elements 1 and 3 of the second row of **A** and the elements 2 and 3 of the first column of **A**?
3. How can I read the second column of **A** and the third row of **A**?
4. What is the value of $\mathbf{A}(\mathbf{5})$? Type $\mathbf{A}(:)$. What do you observe?
5. Delete the second row of **A**.
6. Add the row vector $\mathbf{u} = [\mathbf{25\ 26\ 27}]$.
7. Explain the following command $\mathbf{A}([\mathbf{1:2}, \mathbf{2:3}], :)$.
8. Explain some following particular functions : **triu**, **tril**, **diag**, **rot90**, **flipud**, **fliplr**. Try to use them in some examples.
9. Let $\mathbf{u} = \mathbf{ones}(\mathbf{1}, \mathbf{3})$, $\mathbf{A} = [\mathbf{u}; \mathbf{2} * \mathbf{u}; \mathbf{3} * \mathbf{u}]$ and $\mathbf{B} = \mathbf{ones}(\mathbf{3})$. Execute $\mathbf{A} + \mathbf{B}$, $\mathbf{A} - \mathbf{B}$, $\mathbf{A} * \mathbf{B}$, $\mathbf{A} + \mathbf{10}$.
10. Type $\mathbf{A}.*\mathbf{B}$,then $\mathbf{A}./\mathbf{B}$,then $\mathbf{A} * \mathbf{3}$ and then $\mathbf{A}/\mathbf{3}$.
11. Start with the 4-by-4 magic square, **A**, and form $\mathbf{B} = [\mathbf{A}\ \mathbf{A} + \mathbf{32};\ \mathbf{A} + \mathbf{48}\ \mathbf{A} + \mathbf{16}]$. How can I delete the 2^{nd} row of B. How can I delete the 7^{th} row of B. How can I replace the $(5,6)$-entry of B by 0. How can I replace all the 5^{th} column of B by 0.
12. Type $\mathbf{A} = \mathbf{rand}(\mathbf{300}, \mathbf{41})$. We obtain a $(300, 41)$ random matrix. How can I extract the element of the row 200 and column 33? How can I extract all the elements of the row 134 from column 15 to 38?
13. Type $\mathbf{A} = \mathbf{rand}(\mathbf{3}, \mathbf{4})$.How can I seek for entries greater than 0.2 and less than 0.8 .
14. Type **help matlab/ops**. This lists the operators and special characters.
15. Type **help matlab/elmat** for listing the elementary matrices and matrix manipulations.
16. Type **help matlab/elfun** for listing the elementary math functions.
17. Type **help matlab/matfun** for listing matrix functions for numerical algebra.

Exercise 13 :

Let $A = \begin{pmatrix} 1 & 1 & -1 & 2 \\ -1 & 0 & 2 & 1 \\ -3 & -5 & 4 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & -1 \\ 2 & -2 \\ 3 & 0 \\ 0 & 1 \end{pmatrix}$

1. What are the size of A and B. Write the MATLAB command for getting the size.
2. Calculate the matrix product AB if it exists. Write the MATLAB command for this.
3. Give A^T (Transpose matrix of A). Write the MATLAB command for this.

March 20, 2011 Semester 2, 1431-1432 (2010-20111)

MATH 251 - Introduction to MATLAB

Exercise sheet 3

Dr. Samy MZIOU

Exercise 1 :

1. Type the following at the prompt.

   $\gg$ **x = 0 : .1 : 2 * pi;**
   $\gg$ **y = cos(x);**
   $\gg$ **plot(x, y);**

2. Try to plot in red the function $y = x^2$ between -5 and 5 with an increment of 1.
3. Close the figure.
4. Sketch the function $1/y - \log(y) + log(-1 + y) + x - 1$.
5. Type **grid**. What do you see?
6. Type **grid off**. What do you see in the figure?
7. Give a title to the graph.
8. Label the axis.
9. Put a legend.
10. Add to the graph the function defined in item 2.
11. Zoom to see the intersection points. Read their coordinates.
12. Add a text to specify one of these intersection points.
13. Change the axis limits to [0 2] for x-axis and [0 5] for y-axis.
14. Close the figure.
15. What is the meaning of the command axis square.
16. Open a empty figure.
17. Type **subplot(3,1,2)**. What do you see?
18. Try to plot a circle on this subfigure.

19. Type **subplot(3,1,1)** and plot the graph of a line.
20. Type **subplot(3,1,3)** and plot the graph of a quadratic function.
21. Close the figures.
22. Try to use the command **plotyy** and the other commands that you have been seen in the course.

Exercise 2 :

The following table contains sales data of a company from 1988 t0 1994. Plot data as a function of time. The data must be plotted in dashed red line and asterisk marker with a line width of 2 points and a marker size of 12 points.

YEAR	1988	1989	1990	1991	1992	1993	1994
SALES (millions)	8	12	20	22	18	24	27

Exercise 3 :

a) Plot the function $y = 3.5^{-0.5x} cos(6x)$ for $-2 \leq x \leq 4$.

b) Try to use the **fplot** command.

Exercise 4 :

Let the function $y = 3x^3 - 26x + 10$. Plot on the same figure this function and its first and second derivatives for $-2 \leq x \leq 4$. Add a legend an a title to this figure.

Exercise 5 :

From the previous exercise, try to use the **line** command and explain the difference with **plot** command.

Exercise 6 :

The table below shows the grades that were assigned to a class. Try to use a pie chart to visualize the grades ratio.

Grade	A	B	C	D	E
Number of Students	11	18	26	9	5

Exercise 7 :

The following data points are the daily maximum temperature (in ^oF) in Riyadh during the month of April 2002: 50, 73, 73, 53, 50, 48, 56, 73, 73, 66, 69, 63, 74, 82, 84, 91, 93, 89, 91, 80, 59, 69, 56, 64, 63, 66, 64, 74, 63, 69.

Use a histogram of this data to visualize the number of days that have a certain temperature.

Exercise 8 :

Read about MATLAB graphics from the textbook "Getting started"

Exercise 9 :

Explain the following command

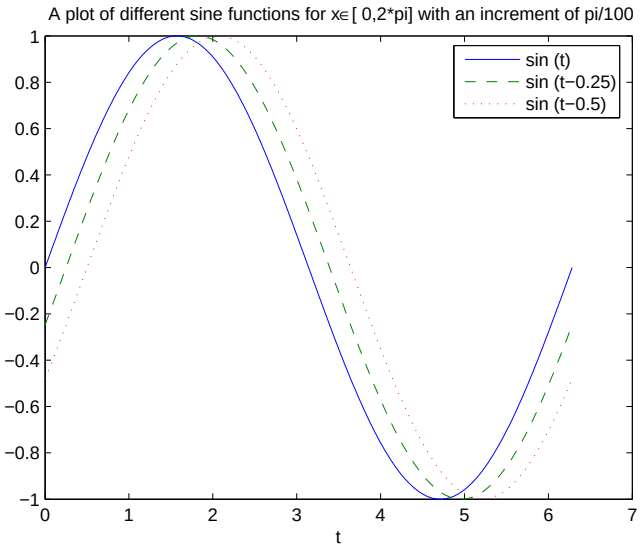
$\gg$ **yr** = [**1988** : **1994**];

$\gg$ **sle** = [**8 12 20 22 18 24 27**];

$\gg$ **plot**(**yr**, **sle**,′ − − **r**∗′,′ **linewidth**′, **2**,′ **markersize**′, **12**);

Exercise 10 :

Given the following figure. Explain all steps for plotting the three graphs.



Exercise 11 :

Plot the parametric function given by

$$x = \sqrt{t}\sin 2t; \quad y = \sqrt{t}\cos 2t; \quad z = 0.5t \qquad \text{for } 0 \le t \le 6\pi.$$

Exercise 12 :

Execute the following commands and try to understand what they do.

1. This example evaluates and graphs the two dimensional *sinc* function, $\sin(R)/R$, between the x and y directions. R is the distance from the origin. Adding *eps* (a MATLAB command that returns a small floating-point number) avoids the indeterminate 0/0 at the origin.

   $\gg$ [**X**, **Y**] = **meshgrid**(−**8** : .**5** : **8**);
   $\gg$ **R** = **sqrt**(**X**.^**2** + **Y**.^**2**) + **eps**;

$\gg$ **Z** = sin (**R**)./**R**;
$\gg$ **mesh**(**X**, **Y**, **Z**,′ **edgecolor**′,′ **k**′);

2. A surface plot is similar to a mesh plot except that MATLAB colors the rectangular faces of the surface. The color of each faces is determined by the values of Z and the colormap (a colormap is an ordered list of color). These statements graphs the *sinc* function as a surface plot, specify a colormap, and add a color bar to show the mapping of data to color.

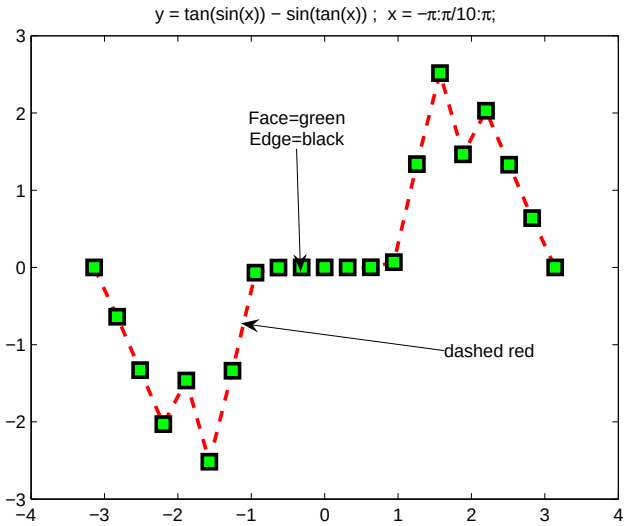
$\gg$ **surf**(**X**, **Y**, **Z**);
$\gg$ **colormap hsv**;
$\gg$ **colorbar**;

3. You can make the faces of a surface transparent to a varying degree. Transparency (referred to as the *alpha* value) can be specified for the whole object or can be based on an alphamap, which behaves in a way analogous to colormap. *Alpha* values range from 0 (completely transparent) to 1 (not tranparent). Here a surface with a face *alpha* value of 0.4.

$\gg$ **surf**(**X**, **Y**, **Z**);
$\gg$ **colormap hsv**;
$\gg$ **alpha**(**0.4**);

Exercise 13 :

Given the following figure. Explain all steps for plotting the three graphs.



Exercise 14 :

Write the commands for drawing the curve $f(x, y) = y+x+10\cos(xy)$ for $x \in [-5,\ 5]$ and $y \in [-5,\ 5]$ using the **surf** function. Label the axis and give a title. color the curve in gray.

Exercise 15 :

Write the commands for drawing the curve $f(x, y) = y+x+10\cos(xy)$ for $x \in [-5,\ 5]$ and $y \in [-5,\ 5]$ using the **mesh** function. Label the axis and give a title. color the curve in red.

Exercise 16 :

We wish to draw the curve $f(x, y) = -x^2 + y^2$ over the square interval $[-10\ 10] \times [-10\ 10]$.

1. Write the commands for plotting this 3D curve.
2. Label the x-axis by 'abscises' and the y-axis by 'ordinates'
3. Put in title : 'an example of 3D curve'
4. What is the command for Interactively rotating the view of a 3-D plot.
5. What is the command for adding a text on the graph without a mouse.
6. What is the command for coloring the map of the curve in hsv

Exercise 17 :

Type **help graph2d** or **help graph3d** for some help in 2d or 3D graphs.

Exercise 18 :

Type **help scribe** for annotation and plot editing.

Exercise 19 :

Type **help specgraph** for specialized graphs.

Exercise 20 :

Type **help graphics** for handle graphics.

April 4, 2011 Semester 2, 1431-1432 (2010-20111)

MATH 251 - Introduction to MATLAB

Exercise sheet 4

Dr. Samy MZIOU

Exercise 1 :

Explain the following commands and give the results.

1. $\gg$ $\mathbf{5 > 8}$
2. $\gg$ $\mathbf{a = 5 > 8}$
3. $\gg$ $\mathbf{y = (6 < 10) + (7 > 8) + (5 * 3 == 60/4)}$
4. $\gg$ $\mathbf{b = [15\ 6\ 9\ 4\ 11\ 7\ 14];\ c = [8\ 20\ 9\ 2\ 19\ 7\ 10]}$
   a) $\gg$ $\mathbf{d = c >= b}$
   b) $\gg$ $\mathbf{c == b}$
   c) $\gg$ $\mathbf{b = c}$
   d) $\gg$ $\mathbf{f = b - c > 0}$
5. $\gg$ $\mathbf{A = [2\ 9\ 4; -3\ 5\ 2; 6\ 7\ -1]}$
   $\gg$ $\mathbf{B = A <= 2}$
6. $\gg$ $\mathbf{r = [8\ 12\ 9\ 4\ 23\ 19\ 10]}$
   $\gg$ $\mathbf{s = r <= 10}$
   $\gg$ $\mathbf{t = r(s)}$
   $\gg$ $\mathbf{w = r(r <= 10)}$

Exercise 2 :

Explain the difference between

$\gg$ $\mathbf{3 + 4 > 16/2}$ and $\gg$ $\mathbf{3 + (4 > 16)/2}$

Exercise 3 :

Explain the following command and give the results.

1. $\gg$ $\mathbf{3\&7}$
2. $\gg$ $\mathbf{a = 5|0}$
3. $\gg \sim \mathbf{25}$
4. $\gg$ $\mathbf{t = 25 * ((12\&0) + (\sim 0) + (0|5))}$
5. $\gg$ $\mathbf{x = [9\ 3\ 0\ 11\ 0\ 15];\ y = [2\ 0\ 13\ -11\ 0\ 4];}$
   $\gg$ $\mathbf{x\&y}$
   $\gg$ $\mathbf{z = x|y}$
   $\gg \sim \mathbf{(x + y)}$

Exercise 4 :

Explain the following commands and give the results.

1. $\gg$ $\mathbf{x = -2; y = 5;}$
2. $\gg$ $\mathbf{-5 < x < -1}$
3. $\gg$ $\mathbf{-5 < x\ \&\ x < -1}$
4. $\gg \sim \mathbf{(y < 7)}$
5. $\gg \sim \mathbf{y < 7}$
6. $\gg \sim \mathbf{((y >= 8)|(x < -1))}$
7. $\gg \sim \mathbf{(y >= 8|x < -1)}$

Exercise 5 :

Explain the following commands and give the results.

1. $\gg$ $\mathbf{xor(7, 0)}$
2. $\gg$ $\mathbf{xor(7, -5)}$
3. $\gg$ $\mathbf{A = [6\ 4\ 5\ 7\ 11\ 9]; B = [6\ 2\ 15\ 9\ 0\ 11];}$
   $\gg$ $\mathbf{all(A)}$
   $\gg$ $\mathbf{all(B)}$
   $\gg$ $\mathbf{any(A)}$
   $\gg$ $\mathbf{any(B)}$

Exercise 6 :

Explain the following commands and give the results.

$\gg$ $\mathbf{A = [8\ 0\ 5\ 4\ 0\ 9\ 3\ 6\ 0\ 0\ 6];}$
$\gg$ $\mathbf{find(A)}$

$\gg$ **find(A > 4)**

Exercise 7 :

Explain the following commands and give the results.

$\gg$ **A = magic(4)**
$\gg$ **i = find(A > 8)**
$\gg$ **A(i) = 100**

Exercise 8 :

Carry out the following commands

$\gg$ **[x,y,z]=peaks;**
$\gg$ **surfl(x,y,z)**
$\gg$ **axis tight**
$\gg$ **colormap(gray(64))**

Using the `find` command, try to extract the part of this surface for which the z values lie between 2 and 4 and plot these elements over the surface. See the plot in a plane view.

Exercise 9 :

let **temp** be the vector that contains the following data :100, 98, 94, 101, 93 . How can I know which values are less than 95^o:

1. using logical operator
2. using **find** command

Exercise 10 :

Let the following matrix $A = \begin{pmatrix} 1 & 2 & 3 \\ 10 & 5 & 1 \\ 8 & 3 & 1 \end{pmatrix}$.
Using help function, find the location of the elements that are greater than 9.

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Exercise sheet 5

Dr. Samy MZIOU

Exercise 1 :

The function **disp** is used to display data without printing the variable 's name. Try to use it in various example.

example:

≫ X= [1:5]; disp('The values in the matrix X are'); disp(x)

Exercise 2 :

The **fprintf** built-in function displays formatted output. it gives you more control over the output than you have using the built-in function **disp**.

1. Try to use this function to display : "the temperature is 98.6 degrees F".
2. Try to use this function to display : "the temperature is 98.6 degrees F" with a total of 8 digits with 2 after the decimal point.
3. Try to use this function to display : "the temperature is x degrees F" with a total of 8 digits with 2 after the decimal point for x=10, 40, 52.

Exercise 3 :

Write a function file (name it chap6one) for the function $f(x) = \frac{x^4\sqrt{3x+5}}{(x^2+1)^2}$. The input to the function is x and the output is $f(x)$. write the function such that x can be a vector. Use the function to calculate

1. $f(x)$ for $x = 6$,
2. $f(x)$ for $x = 1, 3, 5, 7, 9, 11$

Exercise 4 :

Use **inline** function and redo steps 1. and 2. of exercise 3

Exercise 5 :

1. Write a function file for $f(x, y) = 2x^2 - 4xy + y^2$
2. Use **inline** function for $f(x, y) = 2x^2 - 4xy + y^2$

Exercise 6 :

1. Write a M-file for the function
$$f_1(x) = \frac{x^5 - 3}{\sqrt{x^2 + 1}}$$
2. In the Matlab command, test the function for some values of x.
3. Generate a vector x from -5 to 5 with increment 0.1.
4. Draw the function in the points defined by the previous vector x (you can modify the M-file for this).

Exercise 7 :

1. Use **feval** function to evaluate $\sqrt{64}$
2. Use **feval** function to evaluate the function in exercise 3
3. Use **feval** function to evaluate the function in exercise 6

Exercise 8 :

1. Write a program that show if the series $S_n = \sum_{i=1}^{n} \frac{1}{i}$ converge or not.
2. Write a program that calculate the maximum and the minimum of a matrix.
3. Write a program that compute and visualize the motion of a projectile.
4. Write a program that compute the integral of the function **cosine** between 0 and $\frac{\pi}{2}$ using the method of rectangles.

Exercise 9 :

Write a function that find the greatest integer n whose the sum from 1 to n^2 is less that 1000

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Exercise sheet 6

Dr. Samy MZIOU

Exercise 1 :

1. Write a function file $\mathbf{R} = \mathbf{RECTANGLE}(\mathbf{a}, \mathbf{b})$ which compute the area of a rectangle with length a and width b.
2. Write a function file which compute the area of a trapezoid.
3. Write a function that compute the maximum of a vector $VECT$

Exercise 2 :

6.10 EXAMPLES OF MATLAB APPLICATIONS

Sample Problem 6-4: Exponential growth and decay

A model for exponential growth, or decay, of a quantity is given by:

$$A(t) = A_0 e^{kt}$$

where $A(t)$ and A_0 are the quantity at time t and time 0, respectively, and k is a constant unique to the specific application.

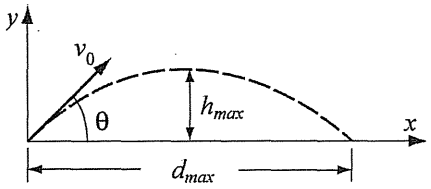
Write a user-defined function that uses this model to predict the quantity $A(t)$ at time t from knowing A_0 and $A(t_1)$ at some other time t_1. For function name and arguments use `At = expGD(A0,At1,t1,t)`, where the output argument `At` corresponds to $A(t)$, and the input arguments `A0,At1,t1,t` corresponds to A_0, $A(t_1)$, t_1, and t, respectively.

a) The population of Mexico was 67 millions in the year 1980 and 79 million in 1986. Estimate the population in 2000.

b) The half-life of a radioactive material is 5.8 years. How much of a 7-gram sample will be left after 30 years.

Sample Problem 6-5: Motion of a Projectile

Create a function file that calculates the trajectory of a projectile. The inputs to the function are the initial velocity and the angle at which the projectile is fired. The outputs from the function are the maximum height and distance. In addition, the function generates a plot of the trajectory. Use the function to calculate the trajectory of a projectile that is fired at a velocity of 230 m/s at an angle of 39^o.



Solution

The motion of a projectile can be analyzed by considering the horizontal and vertical components. The initial velocity v_0 can be resolved into horizontal and vertical components:

$$v_{0x} = v_0\cos(\theta) \quad \text{and} \quad v_{0y} = v_0\sin(\theta)$$

In the vertical direction the velocity and position of the projectile are given by:

$$v_y = v_{0y} - gt \text{ and } y = v_{0y}t - \frac{1}{2}gt^2$$

The time it takes the projectile to reach the highest point ($v_y = 0$) and the corresponding height are given by:

$$t_{hmax} = \frac{v_{0y}}{g} \text{ and } h_{max} = \frac{v_{0y}^2}{2g}$$

The total flying time is twice the time it takes the projectile to reach the highest point, $t_{tot} = 2t_{hmax}$. In the horizontal direction the velocity is constant, and the position of the projectile is given by:

$$x = v_{0x}t$$

In MATLAB notation the function name and arguments are taken as: `[hmax,dmax] = trajectory(v0,theta)`. The function file is:

Exercise 3 : — Problem 7-2: Calculating worker's pay —
A worker is paid according to his hourly wage up to 40 hours, and 50 % more for overtime. Write a program in a script file that calculates the pay to a worker. The program asks the user to enter the number of hours and the hourly wage. The program then displays the pay.

Exercise 4 : — Problem 7-4: Converting units of energy —

Write a program in a script file that converts a quantity of energy (work) given in units of either Joule, ft-lb, cal, or eV to the equivalent quantity in different units specified by the user. The program asks the user to enter the quantity of energy, its current units, and the new desired units. The output is the quantity of energy in the new units. The conversion factors are: 1 J = 0.738 ft-lb = 0.239 cal = 6.24×10^{18} eV. Use the program to:

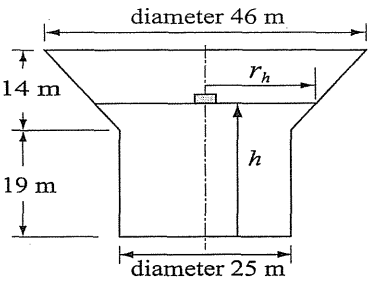
a) Convert 150 J to ft-lb.

b) 2800 cal to Joules.

c) 2.7 eV to cal.

Sample Problem 7-3: Water level in water tower

The tank in a water tower has the geometry shown in the figure (the lower part is a cylinder and the upper part is an inverted frustum cone). Inside the tank there is a float that indicates the level of the water. Write a user-defined function file that determines the volume of the water in the tank from the position (height h) of the float. The input to the function is the value of h in m, and the output is the volume of the water in m^3.



Sample Problem 7-5: Sum of series

a) Use a `for-end` loop in a script file to calculate the sum of the first n terms of the series: $\sum_{k=1}^{n} \frac{(-1)^k k}{2^k}$. Execute the script file for $n = 4$ and $n = 20$.

b) The function sin(x) can be written as a Taylor series by:

$$\sin x = \sum_{k=0}^{\infty} \frac{(-1)^k x^{2k+1}}{(2k+1)!}$$

Write a user-defined function file that calculates sin(x) by using the Taylor's series. For the function name and arguments use `y = Tsin(x,n)`. The input arguments are the angle `x` in degrees, and `n` the number of terms in the series. Use the function to calculate sin(150°) using 3 and 7 terms.

Sample Problem 7-6: Modify vector elements

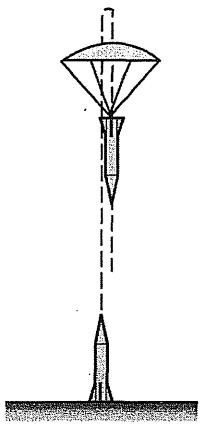
A vector is given by: V = [5, 17, –3, 8, 0, –1, 12, 15, 20, –6, 6, 4, –7, 16]. Write a program as a script file that doubles the elements that are positive and are divisible by 3 and/or 5, and raise to the power of 3 the elements that are negative but greater than –5.

Sample Problem 7-8: Creating a matrix with a loop

Write a program in a script file that creates a $n \times m$ matrix with elements that have the following values. The value of the elements in the first row is the number of the column. The value of the element in the first column is the number of the row. The rest of the elements are equal to the sum of the element above them and the element to the left. When executed, the program asks the user to enter values for n and m.

Sample Problem 7-11: Flight of a model rocket

The flight of a model rocket can be modeled as follows. During the first 0.15s the rocket is propelled up by the rocket engine with a force of 16N. The rocket then flies up while slowing down under the force of gravity. After it reaches the apex, the rocket starts to fall back down. When its down velocity reaches 20 m/s a parachute opens (assumed to open instantly) and the rocket continues to move down at a constant speed of 20 m/s until it hits the ground. Write a program that calculates and plots the speed and altitude of the rocket as a function of time during the flight.



Solution

Exercise 5 : — linear algebra—

let $A = [2, 5, 1; 0, 3, -1]$; $B = [1, 0, 2; -1, 4, -2; 5, 2, 1]$

1. Compute AB
2. Compute BA. explain what happens.
3. Compute the transpose of A

Exercise 6 : — linear algebra—

Consider the following linear system

$$\begin{array}{rcrcrcr} 3x & + & 2y & - & z & = & 10 \\ -x & + & 3y & + & 2z & = & 5 \\ x & - & y & - & z & = & -1 \end{array}$$

1. Write the system using matrix notation
2. Solve the system using **inv** MATLAB command
3. Solve the system using the MATLAB operator \

Exercise 7 : — Interpolation—

Let the following table of points

1	2	3	4	5	6
0	20	55	65	100	120

Find the interpolating polynomial using the MATLAB function **interp1**

Exercise 8 : — Polynomials evaluation—

let the polynomial $p(x) = x^5 - 12.1x^4 + 40.59x^3 - 17.01x^2 - 71.95x + 35.88$,

1. Calculate p(9) using the MATLAB function **polyval**
2. Plot the polynomial for $-1.5 \leq x \leq 6.7$
3. Compute the roots of p using the MATLAB function **roots**

Exercise 9 : — Integration and differentiation—

1. Using MATLAB function **quad** compute the integral of $f(x) = \frac{1}{1+x^2}$ over $[0, 1]$. Compare with the analytical solution.
2. Compute the integral of $f(x) = \frac{1}{1+x^5}$ over $[0, 2]$.