Technical computing with Matlab – exercises

Version October 2, 2023

Some of the exercises are based on or from the book *MATLAB: a practical introduction to programming and problem solving* by Stormy Attaway (3rd edition).

Contents

Logbook

Note: more information on your logbook can be found in the lecture notes and the logbook examples on Blackboard.

To help you with your logbook, you can copy-paste the commands entered in Matlab to a Word document. This is the most straightforward way. Copy-paste is done by selecting the command with your mouse, pressing CTRL+C, switch to your Microsoft Word document, and pressing CTRL+V. Note that you can create an online Word document via https://onedrive.lincoln.ac.uk. Don't forget to *logout* at the end of the session.

You can also create screen shots. In windows 10 this is done by pressing WINDOWSKEY+SHIFT+S, then select an area you would like to copy, and subsequently paste it in Word. Make sure the text is large enough to read in the Word document.

Alternatively, you can do this later on, but record the commands using the `diary` command. The diary can be started by executing the following command

```
diary session1.txt
```

Also do this at the start of every new session (but with an appropriately named filename). When you finish your session, use `diary off`. Hint: if you type in the command

```
format compact
```

the resulting output does not take up too much space.

Don't forget to also copy-paste scripts, functions, figures, etc. – they are not included in the diary.

Note that the diary file needs to be modified and annotated – a logbook consisting only of diary files will be marked down considerably.

Remember to save a copy of all your created files (Word file if you didn't do it online, diary file, scripts, etc). This can be achieved in several ways:

- Email it to yourself (e.g., as a draft; safest way)

- Save to your OneDrive (login via onedrive.lincoln.ac.uk, don't forget to logout at the end of the session otherwise other people may see your files).

- One may want to store it on a USB stick, but they are not very reliable. Hence always make an extra backup! To prevent data loss, use the 'eject' button in Windows at the end of your session instead of just pulling out your USB stick.

Best is to do at least two of the previously mentioned options.
Notes:

1. Sometimes errors that you typed in MATLAB can also be included in your logbook, since this may be part of your learning process.

2. Every student should have their own logbook; copying between students is plagiarism and can have serious consequences.

3. Pages of long repeated output (such as an array of a million elements) do not add much to a logbook; please only include the first few and last few lines of them.

1 Exercises session 1

1.1 MATLAB **OnRamp course**

1. Register online for a Matlab account using your university email address, and complete the online Matlab OnRamp course entirely. See https://matlabacademy.mathworks.com/R2023a/portal.html?course=gettingstarted

When you finish the entire MATLAB Onramp course, include your certificate of completion in your logbook (in contrast to the other exercises it is not necessary to include the solution of each task of the OnRamp course in your logbook, but you are free to do so).

More help for accessing the OnRamp course can be found on Blackboard.

1.2 MATLAB **Installation**

1. Install MATLAB on your own laptop/desktop computer. Instructions are on Blackboard.

2 Exercises session 2

2.1 **Calculator**

1. Use MATLAB to determine

    (a) 123/456
    (b) ln(5)
    (c) log(5)
    (d) tan(6)

(e) $7^{1/3}$

(f) e^8

(g) $\sin(2\pi/3)$

(h) $\sin(\cos(9))$

(i) $e^2\sqrt{3\sin(4+\log(5))+6}-7 + 8$

2. The radius r of a circle is 6. Calculate the area A of the circle using MATLAB. Hint: $A = \pi r^2$.

3. Look up the command `acos` using the command `help`, and calculate $\arccos(a)$ for $a = 1/2$. Divide the answer by π to write the result as a fraction of π.

2.2 Variables

1. Set a variable a equal to $7/3$, b equal to $9/6$. Finally, set a variable c equal to $a \cdot b$. What is c?

2. Create a variable `myage` and store your age in it. Subtract two from the value of the variable, and update the variable `myage` with this new value. Add one to the value of the variable, and update the variable again. Observe the Workspace Window and Command History Window as you do this.

3. Set a variable x equal to 10. Increase the content of the variable by 1. Now multiply the content of the variable by a factor 2. What is the value of x?

4. Set a variable r equal to 6. Set another variable A equal to πr^2 (by referring to the variable r), to calculate the area of a circle. Increase the radius by 2 and re-calculate the area. Hint: you can use the up/down arrows on the keyboard to re-use a previously typed command. Afterwards, repeat the calculation for a radius of 1.3×10^{-12}. Does A need to be updated?

2.3 Variable names

1. Test and tell for each of the following names if it is a valid variable name. Hint: see if it appears in your workspace, if you try to assign a value to it.

   (a) `x`

   (b) `x2`

   (c) `2x`

   (d) `xy`

   (e) `x x`

   (f) `exc3.1`

   (g) `tan`

   (h) `if`

   (i) `end`

   (j) `a long variable name`

   (k) `a_long_variable_name2`

   (l) `x$`

   (m) `x%`

   (n) `a_`

   (o) `_a`

2.4 Scripts

1. (a) Create a script with the name `my_script`, by typing in the command line:

   ```
   edit my_script
   ```

   Note that MATLAB will automatically add the extension `.m`, so one does not need to type this.

   (b) In the script set $a = 1$, $b = 2$, $c = 3$, $x = 4$ and then set a variable y to $ax^2 + bx + c$.

   (c) Execute the script by typing in the name of the script on the command line (without the extension `.m`!). What is the value of y?

2.5 Vectors and intrinsic functions

1. Use the colon, `:`, to create a vector of integers starting from 11 to 20. Hint: Use the help function for `:` for more information

2. Use the colon operator to

   (a) create a vector of integers starting from 100 to 110 with step 2

   (b) create a vector starting from 100 to 110 with step 0.1.

3. Use `linspace` to create a vector from 11 to 20 with 50 elements.

4. Create a vector of 10 elements between 0 and 3, set the result in a variable $\mathbf{x}$, and then calculate $\sin(x)$ for all these values at once.

5. Create a vector $\mathbf{x}$ containing the values $0.1, 0.2, 0.3, \ldots, 1.0$ and hence find the following functions of the entries

   (a) The hyperbolic sine. Hint: use `lookfor` hyperbolic

   (b) The natural logarithm.

   (c) The base-10 logarithm.

2.6 Complex numbers

1. Calculate

   (a) $(1 + i)(1 - i)$

   (b) $|2 + 4i|$

   (c) i^i

   (d) $\sqrt{i}$

   (e) $(3 + 4i)(5 - 6i)^{7 + 8i \cos(9 + 10i)/11}$

2. Set x to the imaginary part of $\tan(i)$. What is the value of x? Hint: `imag`.

3. Set $x2$ to the real part of $\sqrt{i}$. What is the value of $x2$? Hint: `real`

4. Determine the argument of $z = 1/i$ using MATLAB.