Matlab for Psychologists: Exercises

Exercise A: Data Manipulation

Make sure you type `clear all` before starting

1) Enter the following matrices and vectors

$$a = \begin{matrix} 9 & 12 & 13 & 0 \\ 10 & 3 & 6 & 15 \\ 2 & 5 & 10 & 3 \end{matrix}$$

$$b = \begin{matrix} 1 & 4 & 2 & 11 \\ 9 & 8 & 16 & 7 \\ 12 & 5 & 0 & 3 \end{matrix}$$

2) use `a` and `b` to create these matrices

   a) `c` is the element in the 3rd row and 3rd column of `a`

   b) `d` is column 3 of `a`

   c) `e` is rows 1 and 3 of `b`

   d) `f` is `a` and `b` one above each other

   e) `g` is column 1 of `a` next to column 4 of `b`

3) Change some of the entries in this matrices

   a) make element (2,2) of `e` be 20

   b) make row 1 of `a` be all zeros

   c) make column 3 of `f` be the numbers from one to 6

   d) make column 1 of `a` be the number from column 2 of `b`

Exercise B: Maths and functions

Make sure you type `clear all` before starting

1) Enter the following matrices and vectors:

$$A = \begin{matrix} 1 & 5 & 6 \\ 3 & 0 & 8 \end{matrix}$$

$$B = \begin{matrix} 7 & 3 & 5 \\ 2 & 8 & 1 \end{matrix}$$

$$C = 10$$

$$D = 2$$

2) Do these sums:

   `E = A − B`

   `F = D*B`

   `G = A.*B`

   `H = A'`

   `J = B/D`

3) Do some maths on parts of matrices

   a) Put the first column of A into M

b) Put the second column of G into N

c) Add them together

d) Multiple ONLY the third column of A by C and put the result back in the third column of A. You can use several steps if you want, but it is possible do use just one line.

e) Find the Dth row of H (i.e. row 2) and sum all the elements in that row

f) Create a new matrix K made up of A in the first 2 rows and B in the next 2 rows.

4) Look at difference between array multiplication and matrix multiplication

a) Try `A*B` (you will get an error)

b) Try `A*B′` (that is, A matrix multiplied by B transpose), and compare to `A. *B` (that is, array multiplication of A and B)

5) Find the maximum values of each column of J, and find the minimum value of each row of B

Type `help max` and `help min` if you need to

Exercise C: Logicals

Make sure you type `clear all` before starting, and load the dataset ex_C.mat. This data set contains 3 vectors:
`rt` is a vector of reaction times of one subject on a visual attention task.
`cue` is a vector describing if the cue was valid (1), invalid (2) or absent (3).
`side` is a vector describing if the target was on the left (1) or right (2) of the screen.

1) Create a logical vector called `valid` which defines all the trials with valid cues

2) Use this to find the mean and standard deviation of reaction time on valid cues

3) Error trials are ones where the reaction time is less than 100 msec or more than 1000 msec. Create a logical vector called `error` defining which trials are errors

4) Using both `error` and `valid` to find the mean and standard deviation of reaction times for correct valid trials

5) Create a logical vector called `side` which you can use to determine the side of stimulus presentation.

6) Does mean reaction time on all trials vary with side? What about reaction time of valid trials only?

Exercise D: A real data set

Fred is doing a pilot study on the perception of attractiveness, so he asked his flatmates to judge the attractiveness of 20 faces. The gender and symmetry of each face was known in advance. Clear everything and load the data set ex1.mat. This data set has 3 vectors and 1 matrix:

`stimno` (stimulus number)
`gender` (1 = male, 2 = female)
`symm` (symmetry on a 1 to 5 scale)
`data` (each column is the attractiveness judgment on a 1-100 scale for one of his 3 subjects)

1) Fred wrote down the wrong responses for subject 2, stimuli 3, 5 and 17. The values should be 30, 62 and 35. Change them.

2) Find the mean, max and min attractiveness for subject 3, then find the range of responses for each subject.

3) Does subject 1 rate male or female faces as more attractive?

4) Are the faces with a high symmetry (4 or 5) rated as more attractive than faces with low symmetry (1 or 2) by subject 3?

5) Do subjects 2 and 3 agree on any of their ratings? How many?

6) Find the mean disagreement between subjects 1 and 2 (use abs)

7) Faces 4, 10, 12 and 18 were much older than the other faces. Were they ranked as less attractive?

8) Sort the data according to the stimulus number (use `sortrows`)

Exercise E: Basic Graphs

Make sure you type `clear all` and `close all` before starting

1) Try plotting some graphs

   a) Generate a vector X with values from 1 to 10

   b) Generate a vector Y containing X squared.

   c) Generate a vector Z containing X*9

   d) In Figure 2, plot Y against X, using a red line with stars at each data point. (type `help plot` if you need to)

   e) Keep that plot, and on the same graph plot Z against X using a green line with squares at each point

   f) Give your figure a title and legend

2) Load Exercise2.mat. This file contains three vectors – `iq`, `scoreA` and `scoreB`, which represent the results test scores obtained by some (fictional) subjects

   a) Plot iq against scoreA using blue circles

   b) On the same plot, plot iq against scoreB using red squares

   c) Label your axes

   d) If you have the statistics toolbox, type `lsline` to fit a least squares line to this data

   e) In a new plot, compare the mean of scoreA and scoreB using a bar graph. You may find it easiest to create a new vector containing both mean values.

   f) Add errorbars to your bar graph

   g) Start a new figure with two subplots. Plot the distribution of scoreA in subplot 1 (use `hist`) and the distribution of scoreB in subplot 2.

Exercise F: Scripts and Functions

1) Look back at exercise C and write a script to perform this exercise. Your script should also plot the mean reaction time in the cue-valid, cue-invalid and no-cue conditions.

2) Try writing loops

   a. Write a for loop to find the mean of 3 random numbers 20 times and place the result in a vector A

   b. Write a second loop to find the mean of 30 random numbers 20 times and place the result in vector B

   c. find the standard deviations of A and B

   d. Clear figure 2 and plot A and B in different subplots so you can compare their distributions (try a histogram!)

3) Test out the switch loop given as an example in the main text

   a) Run the loop for several different values of A

   b) Modify the loop to tell you if A if 0 or 1 or 2

c) Modify the switch statement to give you the remainder of A divided by 3 (use the `rem` command)

d) Put the whole `switch` loop within a `for` loop that counts though A from 50 to 70. Your program should print what remainder of A/3 in words for each value of A.

4) Write a function which will find the standard error of a vector, and test that it works.

Exercise G: Structures and cells

You can use a script to do this exercise if you like.

1) Enter the following words into a cell array, making sure they all go in one column: hat coat gloves shoes socks vest jacket gown.

2) In the second column of your cell array, enter the word frequency class of each word. Hat is high frequency, coat, shoes and jacket are medium frequency and the others are low frequency.

3) load ex_F.mat. This contains a matrix ld which represents the lexical decision times for 30 subjects responding to these 8 words. Write a script to plot the mean and standard error of lexical decision time for each word. Put the words (from your cell array) on the x axis.

4) Sort your data into responses to high, medium and low frequency words. Use a for loop and a switch statement to work through your cell array and classify each word

5) Plot the mean lexical decision time for high, medium and low frequency words with a bar plot and nice heading and axis labels.

6) Put all the useful results of your analysis into a structure and save it. You should save the word lists and the mean and standard error for each word.

Exercise H: More real data

ex2.mat contains data from a single subject performing a stroop task.

Cong - 1=congruent, 2=neutral, 3=incongruent
Stim - 1=words, 2=colours
data - reaction time
err - error rate, 1=error

1) Plot the raw data for responses to congruent colors

2) Exclude all errors and reaction times below 200 msec or above 1000 msec

3) Does the exclusion rate differ between conditions?

4) Use a histogram to see if the data is normally distributed

5) Write a for loop to find the mean and standard error of reaction time in each condition and put them in a structure

6) Plot the results of 5 with error bars

7) Load the data from a second subject (ex2b.mat) and use your script to analyse it.