Matlab Exercises 1

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14 January, 2016

Tasks

1. Create the vectors, `x, y, u` and `v`; and the matrices `A, B` and `C` as they first appear in the lecture notes. Experiment with the basic operators from the lecture notes.

2. Let
$$X = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \text{ and } Y = \begin{pmatrix} -1 & 1 & -1 \\ 1 & -1 & 1 \\ -1 & 1 & -1 \end{pmatrix}$$
   Create the matrices `X` and `Y` above and try to predict what the outcome of the following operations will give before evaluating them in MATLAB.

   (a) `X.*Y`

   (b) `X*Y`

   (c) `X > 3`

   (d) `(X > 3) & (Y == 1)`

   (e) `[(X > 3) ; (Y == 1) ]`

   (f) `X ~= (Y+4)`

   Which of the three operations give the same result: `X*X`, `X^2` and `X.^2`. Why?

3. Execute the command `who`, and `whos`. What do they tell you?

4. Execute the command, `help who`, and read the help page. What about the command `help help`?

5. How would you test if two matrices, `D` and `E`, were identical? Test this on some matrices of your own.

6. Predict what the result will be from the following command before running it.

```
>> min(abs(sin(linspace(0,2*pi,5))),0.0005*logspace(0,4,5))
```

7. Create a numerical approximation of the vector,

$$\vec{v}_1 = (sin(1), 4sin(4), 9sin(9), 16sin(16), 25sin(25), 36sin(36))$$

How would you round each element of this vector up to the nearest integer for positive values, and down to the nearest integer for negative values?

8. (a) Read the help page for the function diag. What is the quickest way to create the matrix:

$$M_1 = \begin{pmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ 10 & 0 & 2 & 0 & 0 & 0 \\ 0 & 9 & 0 & 3 & 0 & 0 \\ 0 & 0 & 8 & 0 & 4 & 0 \\ 0 & 0 & 0 & 7 & 0 & 5 \\ 0 & 0 & 0 & 0 & 6 & 0 \end{pmatrix}$$

   (b) Use the `help` function to read up on the `eig` function. Find the eigenvalues and associated eigenvectors of this matrix.

9. What are the next two numbers in the sequence, 1, 5, 6, 25, 76, ... (hint: the last digits of the squares of these numbers equal the number itself). You will not have to evaluate values above 999.

10. Plot the function $y = sin(x)$ for values of x in the range [0, 5], where ensuring that the curve is drawn with a blue unbroken line. On the same plot, draw the curve of $y = x - \frac{x^3}{3!} + \frac{x^5}{5!}$, using a red dotted line. Decorate the graph with axis labels, a legend and a title. What does the second curve correspond to?

11. Plot the function $y = sinc(x)$ for values of x in the range [-5, 5], where

$$sinc(x) = \begin{cases} \frac{sin\pi x}{\pi x}, & \text{for } x \neq 0 \\ 1, & \text{otherwise} \end{cases}$$

Can you now draw the surface plot that is formed when this plot is rotated 2π radians around the vertical axis, *i.e.*, such that any vertical slice passing through the origin gives the same $sinc(x)$ plot? (hint: it should look a little like a water drop falling into still water)