Worksheet 1

All exercises are on material covered in Lecture 1.

I've written this material up in greater detail as Chapter 1 and the first part of Chapter 2

Questions marked as [$\star$] are particularly recommended and are the questions that will be focussed on in classes. Questions marked as [$\star\star$] are doubly recommended. If you hand in your answers to these questions to the class tutor they will mark them.

There is also a quiz Lecture 1 available on Keats. You can use this as a quick self test.

You can obtain MATLAB from `https://internal.kcl.ac.uk/it/software/matlab.aspx`.

Questions from Chapter 1

Use MATLAB to answer all these questions.

1) What is $\left(\frac{1}{\sqrt{2}}(1+i)\right)^4$?

(Solution: see the file `exercise1.m` in `chapter1.zip`)

2) What is the 95-th percentile of the normal distribution (with mean 0 and standard deviation 1)? Answer this question approximately by creating a large sample of normally distributed random numbers and then finding the 95th percentile.

(Solution: see the file `exercise2.m` in `chapter1.zip`)

3) How would you create a vector containing the first 50 odd integers in MATLAB? What is the sum of the first 50 odd integers?

(Solution: see the file `exercise3.m` in `chapter1.zip`)

4) How would you create a vector of the cubes of the first 50 odd integers in MATLAB?

(Solution: see the file `exercise4.m` in `chapter1.zip`)

5) What is the sum of the cubes of the first 50 odd integers?
(Solution: see the file `exercise5.m` in `chapter1.zip`)

6) [⋆] Use the matrix inverse function `inv` to solve the equations:

$$\begin{aligned} x_1 + 2x_2 + 3x_3 &= 5 \\ -2x_1 + 3x_2 + 4x_3 &= 6 \\ 1x_1 + 3x_2 + 2x_3 &= 7 \end{aligned}$$

Solve the same equations using the \ and / operators. MATLAB will use Gaussian elimination if you use the division operators, but will compute the matrix inverse if you use `inv`. These are two quite different algorithms for solving linear equations. Which is more efficient?
(Solution: see the file `exercise6.m` in `chapter1.zip`)

7) Recall that $\pi = 4(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots)$. Compute π to three decimal places.
(Solution: see the file `exercise7.m` in `chapter1.zip`)

8) [⋆] Create a sample of ten thousand numbers selected from a normal distribution with mean 10 and standard deviation 20. Plot a histogram to make sure it looks right. Also check your answer using the `mean` and `std` functions.
(Solution: see the file `exercise8.m` in `chapter1.zip`)

9) [⋆] Use the documentation to find out how to use the function `randi`. Suppose that 100 dice are thrown and the numbers on the dice are added. Use randi to simulate throwing all 100 dice 10000 times and plot a histogram of the sum. What do you expect the histogram should look like and why?
(Solution: see the file `exercise9.m` in `chapter1.zip`)

Questions from Chapter 2

10) Check that you can create and run the function `polarToCartesian` and test that it works using the code above. (You may notice that it doesn't give precisely the correct answers, this is because MATLAB only stores numbers up to a certain accuracy.)

11) Create and run an inverse function called `cartesianToPolar`
(Solution: see the file `polarToCartesian.m` in `chapter2.zip`)

12) [⋆] Write a function that allows you to solve the quadratic equation $ax^2 + bx + c = 0$. It should take three parameters a, b and c and return two values.
(Solution: see the file `solveQuadratic.m` in `chapter2.zip`)

13) [$\star$] Write a function that computes the price of a call option using the Black–Scholes formula.

It should be invoked as follows: `blackScholesCallPrice( K, T, S, vol, r )`.

(Solution: see the file `blackScholesCallPrice.m` in `chapter2.zip`)