This week we will continue to explore programming in Matlab. The practical will start with a short demonstration on creating ‘loops’ which will be presented on the screen at the front of the room – these are Task D1, D2 & D3 below. The code used in the demonstration will be made available on Camtools. Once the demonstration is complete, you should check you have understood the techniques by completing Task 1 on this sheet.

**Task D1 (Note: this task will form the basis of the short demonstration at the start)**

(a) Write a for loop to print out the answers for the three times table from 1 to 12 x 3.

(b) Adapt the for loop so that answers for the three times table are stored in a vector.

(c) Repeat part (a) using a while loop (do not worry about formatting).

(d) Alter the code for (a) and (c) so the three times table is printed “backwards”, i.e. from 12 x 3 down to 1 x 3.

**Task D2 (Note: this task will form the basis of the short demonstration at the start)**

(a) Write a for loop to print out the elements of the sequence $a_n = n^2 + n + 1$ for $1 \leq n \leq 20$.

(b) Adapt the loop to print out $S_n$, the sum of the first $n$ terms of this sequence.

(c) Adapt the code to store the values of $S_n$ in a vector and plot $S_n$ as a function of $n$.

(d) Use a while loop to find the smallest value of $n$ such that $S_n > 500$.

**Task D3 (Note: this task will form the basis of the short demonstration at the start)**

(a) Try the function rand(), which returns a random number between 0 and 1.

(b) Use rand() together with a for loop to simulate tossing a coin 100 times.

(c) Adapt the loop so that the proportion of heads tossed after any given number of tosses (up to 100) is recorded in a vector.

(d) Plot the proportion of heads obtained against the number of tosses of the coin.

(e) Use a for loop to repeat this process 20 times, and put all 20 graphs on the same axes.
Now have a go at writing some loops yourself by completing the task below. If you need more hints, the handout from Practical 3 contains further examples and explanation of how for and while loops can be used.

**Task 1**

(a) Write a for loop that prints the first 10 powers of two, i.e. from $2^1$ up to $2^{10}$.

(b) Adapt your loop to store the values in a vector and plot $2^n$ as a function of $n$, for $1 \leq n \leq 10$.

(c) Repeat parts (a) and (b) but using a while loop instead of a for loop.

**Task 2**

(a) Write a for loop to print out the elements of the sequence $a_n = \frac{1}{2^n}$ for $1 \leq n \leq 20$. Look at your results in the command window: what does Matlab print out as the result when $n \geq 15$? What is wrong with the answer as presented?

(b) Include format long as the first line of the relevant script/cell. What happens now?

(c) Adapt the for loop to print out $S_n$, the sum of the first $n$ terms of the sequence $a_n$.

(d) Adapt the code (if you haven’t already done so) to store the values of $S_n$ in a vector and plot $S_n$ as a function of $n$. What value does $S_n$ tend to?

(e) Use a while loop to find the smallest value of $n$ such that $S_n > 0.999$.

If you have completed **Task 1** and 2, then you are definitely are good enough at Matlab to be able to successfully complete the rest of the practical classes. If you finish early you may wish to spend the extra time having a go at any parts of Practical 3 that you did not attempt last week. It would be advisable to have a go at these during the week if you do not have time to do them today – remember you can access Matlab from the MCS in your college. Hard copies of solutions to both today’s and last week’s tasks are available at the front.