1 Textbook exercises

The textbook has many programming exercises that would make good test questions:

Chapter 1 29, 31, 32, 33, 34

Chapter 2 6, 7, 8, 9, 10, 13, 14, 15, 24, 25, 26, 27, 33, 34, 40, 43, 44

Chapter 3 16*, 21*, 23*, 27. 28, 29, 30

Questions marked with a * require you to read in a file using `load`; please see the course web site for example files that you can download for these questions.

2 Sample written questions

1. What is the format for a valid MATLAB variable/script/function name?

2. Explain the difference between the operators `*` and `.*`. Why is there no `.+` operator in MATLAB?

3. Computers use a finite number of bits to represent numbers. Explain why this matters for calculations involving integer numbers (hint: see next question).

4. Explain what is meant by the term saturation arithmetic.

5. Your fellow student has writen the following MATLAB script and they are puzzled as to why their script keeps failing with an error:

   ```
   % size of my matrix
   size = [3 2];

   % my matrix
   A = ones(size(1), size(2));

   % size of my matrix
   size(A)
   ```

   What error has the student made, and how would you fix it?

6. Explain why you cannot safely use `==` to compare two floating point expressions for equality.

7. In the summary at the end of each chapter in the textbook (before the chapter exercises) there is a section titled *Programming Style Guidelines*. Why is good programming style important? Have you been following most or all of these guidelines so far in the course?

3 More sample programming questions

1. The standard normal distribution is the simplest form of the so-called bell curve; its functional form is given by:

$$\phi(x) = \frac{1}{\sqrt{2\pi}} e^{-(x^2/2)}$$

   Plot $\phi(x)$ versus x for 100 values of x evenly spaced between -3 and 3.

2. The general form of the normal distribution is given by:

$$\phi(x, \mu, \sigma) = \frac{1}{\sigma\sqrt{2\pi}} e^{-((x-\mu)^2/(2\sigma^2))}$$

   where the real scalar value σ is called the standard deviation and the real scalar value μ is called the mean. This is a very important distribution in the sciences (for example, experimental measurement noise is often modelled as some kind of normal distribution). Plot $\phi(x, \mu, \sigma)$ versus x using 500 values of x evenly spaced between -10 and 10 for the following pairs of σ and μ:

$$\begin{aligned} \sigma = 1 \quad &, \quad \mu = 0 \\ \sigma = 2 \quad &, \quad \mu = -5 \\ \sigma = 0.5 \quad &, \quad \mu = 7 \end{aligned}$$

3. The Poisson distribution has the following functional form:

$$f(k, \sigma) = \lambda^k e^{-\lambda}/k!$$

   where k is a non-negative integer and the mean λ is a real positive scalar value. The Poisson distribution is used to model the number of discrete occurrences that occur during a time interval (such as counting the number of particles emitted by radioactive decay). Plot $f(k, \sigma)$ versus k for $k = 0, 1, 2, 3, ..., 20$ and $\lambda = 1$, $\lambda = 4$, and $\lambda = 10$.