Homework 2

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Due:
The reading for this assignment is

2.1 Numbers and errors

1. Perform a computation that causes the MATLAB to overflow. See if you can estimate the largest number it can represent.
2. Perform a computation that causes the MATLAB to underflow. See if you can estimate the smallest number it can represent.

2.2 Functions

In the previous homework you wrote a MATLAB script to evaluate a Fibonnaci sequence. Make a copy of it called `fibonnaci2.m` and make the following changes to it:

1. Make the script a function file by adding a function declaration at the beginning.
2. Add a comment that explains what the function does.
3. Make sure that the last line of the function assigns the result to the return variable.

Now invoke the new method and pass the values 10 and 100 as arguments. You should get the same result as in the previous homework. Also, make sure that the command `help fibonnaci2` works.

```
>> help fibonacci2

  f = fibonacci2 (n)
  takes an integer argument, n, and returns the nth
  element of the Fibonacci sequence that begins (1, 1, ...)
  Allen Downey, Homework 2, part 2
```

2.3 Nested functions

Write a function file called `pdf.m` that takes four arguments, `x`, `theta`, `sigma` and `zeta`, and computes the following function:

$$pdf(x) = \frac{e^{-\frac{1}{2}\frac{[\log(x-\theta)-\zeta]^2}{\sigma^2}}}{(x-\theta)\sqrt{2\pi}\sigma} \tag{1}$$

where θ is `theta`, σ is `sigma`, and ζ is `zeta`.

You should use temporary variables to avoid repeating common subexpressions and make the code as clear as possible.

Here is an example of how to invoke `pdf` and a sample result.

```
>> help pdf

  f = pdf (x, theta, sigma, zeta)
  computes the probability density function of the
  lognormal distribution with parameters theta, sigma and zeta
  Allen Downey, Homework 2, part 3

>> pdf (10, 1, 2, 3)
ans = 0.0204
```

2.4 Quadratic formula

1. Write a function called `quadratic` that takes arguments `a`, `b` and `c` and that uses the quadratic formula,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \tag{2}$$

to compute one of the roots of the polynomial $ax^2 + bx + c$.

2. Add a comment to your function explaining its use. Your comment should follow the style suggested by the previous two examples.

3. Test the function by invoking it with the coefficients $a = 1$, $b = 1000000.000001$, $c = 1$. Use `format long` so you can check all the digits. Also check it with the coefficients $a = 1$, $b = -1000000.000001$, $c = 1$.

4. Read the handout from page 21 of Faires and Burden and make sure you understand the cause of any inaccuracy in the previous answers.

5. Test the function again with the following coefficients: $a = 1, b = 2, c = 3$. If you get a complex number, don't panic. This polynomial is a vagabond; it has no real roots.