Homework 1

Introductory Programming **Allen B. Downey**
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Some of these problems are adapted from Faires and Burden, *Numerical Methods*.

1.1 MATLAB expressions

The sequence F_n described by $F_0 = 1$, $F_1 = 1$, and for $n \geq 0$, $F_{n+2} = F_n + F_{n+1}$, is called a Fibonacci sequence. Its terms occur naturally in many botanical species, particularly those with petals or scales arranged in the form of a logarithmic spiral (see `http://maven.smith.edu/~phyllo/`) .

The Fibonacci sequence can be approximated by the following expression:

$$F_n \approx \frac{1}{\sqrt{5}} \left[\left(\frac{1+\sqrt{5}}{2} \right)^{n+1} - \left(\frac{1-\sqrt{5}}{2} \right)^{n+1} \right] \tag{1}$$

1. Use MATLAB to evaluate this expression for $n = 10$ and $n = 100$.

2. Write a script called `fibonacci1.m` that evaluates this expression for whatever the current value of `n` is. You should be able to invoke your script like this:

```
>> n = 10
>> fibonacci1
        89
```

1.2 MATLAB math functions

1. To see the list of MATLAB's elementary math functions, type `help elfun`. To read the documentation of `abs`, type `help abs`. Then try to evaluate the following expressions:

```
abs(pi)
abs (pi)
abs ( pi )
a b s ( p i )
abs[pi]
abs{pi}
abs(pi
abs()
abs(1, 2)
abs pi
abs('pi')
abs(1 + i)
exp(i*pi)
```

2. Use MATLAB to check if the following equations hold. You can check the equations two ways: first, compute the value of both sides and see if they are the same (use the `format long` command to see all the digits); alternatively, compute the difference between the right and left sides and see if the difference is zero. You should check 1 or 2 values of x for each equation.

   (a) $\tan x = \sin x / \cos x$

   (b) $\sin^2 x + \cos^2 x = 1$

   (c) $\sinh \frac{x}{2} = \pm\sqrt{\frac{1}{2}(\cosh x - 1)}$

   (d) $\log_{10} x = \frac{log_e x}{log_e 10}$

   Can you find values of x for which these equations are not exactly true in floating-point arithmetic?