Good coding style is like correct punctuation: you can manage without it, butitsuremakesthingseasiertoread.

1. R has an in built function called uniroot(). It finds a root in a specified interval. The function uniroot.all in package rootSolve finds all the zeros in a specified interval. Consider the following functions:

   (a) $f(x) = x^{\frac{1}{3}} \sin(5x) - \frac{1}{2}\sqrt{x}$

   (b) $g(x) = 1 + \sin(x)$

   Execute the following commands and explain the output that R will produce.

```
> f = function(x) x^(1/3)*sin(5*x) - (1/2)*x^(1/2)
> uniroot(f,c(.1,1))
> uniroot(f,c(.1,.5))
> require(rootSolve)
> uniroot.all(f, c(0,5))
```

```
> g = function(x) 1+sin(x)
> uniroot(g,c(-pi,0))
> uniroot(g,c(-pi,-pi/2))
> require(rootSolve)
> uniroot.all(g, c(0,5))
```

2. Write a function Bisection(a) which takes in a real number a and finds an approximation to $\sqrt[3]{a}$ to within 10^{-4} using the bisection algorithm. What is the result for $a = 125$ and $a = 8$?

3. Find the root of the equation $x - x^{\frac{1}{3}} - 2 = 0$ using the three methods discussed in class, namely Bisection, Newton, and Secant with an initial guess $x_0 = 3$. Wherever applicable use the x-tolerance and f-tolerance to be within 5×10^{-16}. Note down the number of iterations required for convergence in each method and the value of the root obtained.