Homework #8a

Due: December 9

1. Construct numerically, by iterating initial conditions and leaving out the transients (i.e. do not plot the first N iterations for some large number N), the bifurcation diagram for:

   (a) The quadratic map: $x_{n+1} = rx_n(1-x_n) \qquad x_n \in [0,1]$ for $r \in [0,4]$

   (b) The sine map: $x_{n+1} = r\sin\pi x_n \qquad x_n \in [0,1]$ for $r \in [0,1]$

   (c) Let r_n denote the nth period doubling bifurcation in the doubling bifurcation sequence. For both maps, find numerically, for as large an n as you can, the ratio: $\delta_n = \frac{r_n - r_{n-1}}{r_{n+1} - r_n}$. Can you see convergence to the Universal Feigenbaum constant $\delta = 4.669201..$? (bonus: derive more sophisticated ways to find δ_n, read about it).

2. Bonus: find a paper in your field of interest in which period doubling bifurcation plays a role. Write the equations leading to the bifurcation, and describe the implications to the specific problem.