AE454/777: Dynamics and Bifurcations
Tutorial 3

1. Construct the orbit diagram for (a) logistic map and (b) sine map. Also plot the variation of Liapunov exponent for various values of r.

2. Solve the Lorenz equations numerically for $\sigma = 10$, $b = \dfrac{8}{3}$, and r near 166.
   (a) Show that if $r = 166$, all trajectories are attracted to a stable limit cycle. Plot both the xz projection of the cycle, and the time series $x(t)$.
   (b) Show that if $r = 166.2$, the trajectory looks like the old limit cycle for much of the time, but occasionally it is interrupted by chaotic bursts. This is the signature of intermittency. (c) Show that as r increases, the bursts become more frequent and last longer.

3. Compute the correlation dimension of the logistic map at the parameter value $r = r_\infty = 3.5699456...$, corresponding to the onset of chaos.