Midterm 1 Review

Past exams are a good indication of the types and difficult of questions on the midterm. The textbook has many other good questions and examples, I've picked out a few good ones so far, but there are more. We will be talking about itineraries and conjugacy in class this week; these two topics will not be on the midterm. If in your studying you find something that you think I may have overlooked in this list, please let me know.

1. Definitions and ideas:
   eventually/asymptotically-periodic, attracting/repelling
   fixed points/periodic orbits, alternatively sink/source/saddle, basin of attraction, sensitivity to initial conditions, dense, chaos, bifurcations, (un)stable manifolds, invariant sets, Lyapunov exponents.
2. Be able to talk about the two types of bifurcations and compute bifurcations. Draw (in)stability of periodic orbit diagrams (i.e. small versions of the logistic pitchfork bifurcation diagram including dashed lines for unstable periodic orbits).
3. Find periodic points and evaluate their stability in one and two-dimensional maps using linearization.
4. The doubling map, logistic map, tent map, and the Hénon map. Logistic model as it relates to population dynamics.
5. Main theorems: evaluate stability, Three Implies Chaos, Lyapunov exponent of asymptotically periodic points.
6. Be able to discuss the long term behavior of maps and the existence and number of periodic points.
7. Calculate the Lyapunov exponent of one-dimensional maps. Comfort with the difference between Lyapunov number and exponent.
8. Practice building examples and counterexamples.
9. Find stable and unstable manifolds for linear maps. Verify that a set is invariant for non-linear maps in order to calculate stable and unstable manifolds for nonliner maps.
10. Give a geometric argument to determine the basin of attraction.
11. The meaning of Jacobian for the case of non-linear two-dimensional maps and why we use it.
12. Some understanding of Poincare's struggle with the 3-body problem (included in the book).