Week 11 Classwork/Homework Assignment

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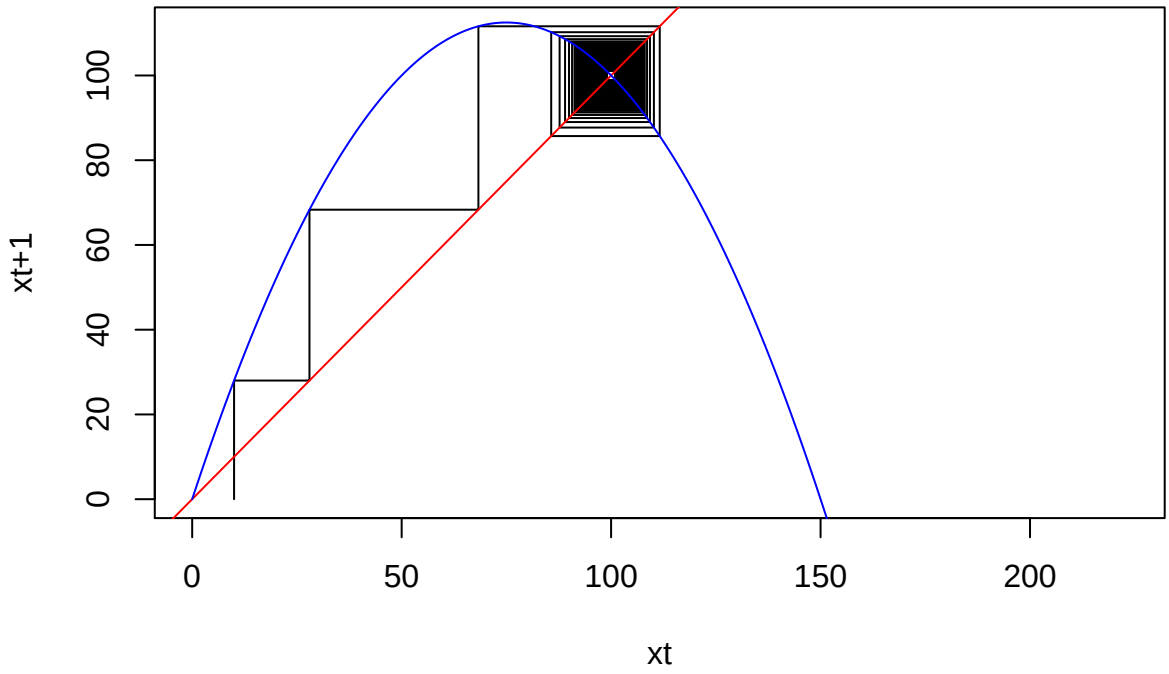
For the assignment, you only need to turn in a completed pdf. You may need to attach a hand written document showing your work for these problems. Make sure that the compiled documents will display all the required code to get your results.

The assignment is due Tuesday October 31 at 3:30 PM.

1. Define and describe the following terms:

- stable
- unstable
- neutrally stable
- asymptotically stable
- cobweb plot
- Jacobian matrix

2. Write a function that creates a cobweb plot for the model $N_{t+1} = N_t(1 + r(1 - \frac{N_t}{K}))$. You should return a figure similar to the one below.



3. For each of the following population models, determine all the possible equilibrium values using a cobweb plot and plot long-term dynamics.

- $N_{t+1} = N_t(1 + r(1 - \frac{N_t}{K}))$ with $r = 0.25$, $K = 100$ and $N_0 = 1$
- $N_{t+1} = N_t(1 + r(1 - \frac{N_t}{K}))$ with $r = 2.2$, $K = 100$ and $N_0 = 40$

4. Robert MacArthur introduced the following model to describe a consumer-resource system in which the supply of resource (R) is at a constant rate (F) from an external source (e.g., allochthonous input to streams), resource capture by consumers (C) occur at a rate a and captured resources are converted to consumer biomass with efficiency K. The death rate of the consumer is d.

$$\frac{dR}{dt} = F - aRC \tag{1}$$

$$\frac{dC}{dt} = C(KaR - d) \tag{2}$$

- Find the equilibrium levels of R and C (R^* and C^*).
- Describe how R^* changes as a function of a.
- Describe how C^* changes as a function of a.
- Find the Jacobian of the model.