Homework assigned Wednesday, April 11.

Problem 1. Due to poaching, a population of bears in a national forest grows at a discrete exponential rate with a per-capita growth rate of -.3 (bears/year)/bear. To keep a stable population size of 75 bears how many bears per year should be stocked into the park each year? *Answer:* Stock at a rate of $S = .3 \cdot 75 = 22.5$ bears/year.

Problem 2. A population of bass in a pond grows logistically with an intrinsic growth rate of $r = .2$ (fish/year)/fish and a carrying capacity of 2000 fish.

(a) If fish are harvested at a rate of 15% of the population per year what is the long term effect on the population? *Answer:* The new rate equation is

$$\frac{dN}{dt} = .2N\left(1 - \frac{N}{2000}\right) - .15N$$

Solving this equal to zero gives equilibrium points $N = 0$ and $N = 500$. The point $N = 500$ is stable, so in the long run the population stabilizes at $N = 500$ fish.

(b) If the fish are harvested at a rate of 50 fish/year what is the long term effect on the population? *Answer:* This time the new rate equation is

$$\frac{dN}{dt} = .2N\left(1 - \frac{N}{2000}\right) - 50.$$

Solving this equal to zero gives that there are equilibrium points at $N = 292.9$ and $N = 1707.1$ The second of these is stable so the long term effect on the population is that it stablizes at about $N = 1701$ fish.

(c) What is the maximum rate the fish can be harvested without the population dying out? *Answer:* This is the maximum of right side of

$$\frac{dN}{dt} = .2N\left(1 - \frac{N}{2000}\right)$$

which we can compute to be 100 fish/year.