Math 172 **Quiz 8 Solutions** **Fall 2006**

1. Suppose that a population of deer grows logistically with an intrinsic growth rate of 25% and a carrying capacity of 1600.

   (a) Determine a discrete dynamical system with initial value to model this deer population.

   $u(n) = u(n-1) + 0.25u(n-1)\left(1 - \frac{u(n-1)}{1600}\right)$

   (b) Determine the maximum interval of stability for this deer population.

   $(0, 8000)$

2. Suppose we have the following discrete dynamical system.

   $u(n) = 0.1u^2(n-1) + 0.3u(n-1) + 1$

   (a) Find each equilibrium value for this discrete dynamical system and state whether it appears to be stable or unstable.

   $E = 5$ (unstable), $E = 2$ (stable)

   (b) For each stable equilibrium value, determine the maximum interval of stability.

   For $E = 2$, the maximum interval of stability is $(-8, 5)$ (Note: for population models it may make more sense to say $(0, 5)$)

   (c) For each stable equilibrium value, suppose that $u(0)$ is within the maximum interval of stability. Approximate the rate at which $u(n)$ goes toward the equilibrium value.

   For $E = 2$ and an appropriate choice for $u(0)$ we obtain $\lim_{n\to\infty} \frac{u(n) - E}{u(n-1) - E} = 0.7$. Thus for large enough n, $u(n)$ is about 30% closer to equilibrium than $u(n-1)$.