

AMS 321: Computer Projects in Applied Mathematics

Project 4

Assignment Date: Wednesday (10/7/2009)

Collection Date: Wednesday (11/11/2009) 5PM

Grade: See Individual Problems

Do any two of the three problems

1. (5 Points) A bullet of mass “m” is fired off the barrel of a gun at an initial speed v_0 to a medium whose resistance follows $\alpha + \beta v^2$ where α and β are constants and v is the bullet’s instantaneous speed. Compute how far the bullet can travel in this medium. You may ignore gravity and assign values (for example, $m = \alpha = \beta = 1$ and $v_0 = 10, v_0 = 20, v_0 = 40$) to the parameters in this problem for numerical experiments. Plot a picture to show the distance vs. the initial speed.

2. (5 Points) Solving the following initial value problem. Please compute the function $x(t) \forall t \in [0, 20]$. You need to get at least 2000 data points for the interval.

$$\begin{cases} e^{-x'} = x' + x + t \\ x(t = 0) = 3 \end{cases}$$

3. (5 Points) In "natural" evolution involving two species such as chicken and fox, we can write the population changes by the following two equations (where "x" and "y" denote the population counts for both species although you don't have to use "integers" for them during your calculation: $x = 1.1234$ chickens is fine!)

$$\begin{cases} x' = ax + bxy \\ y' = cy + exy \\ x(t = 0) = 99 \\ y(t = 0) = 9 \\ a = 0.220, \\ b = -0.009 \\ c = -0.999 \\ e = 0.099 \end{cases}$$

Please use your favorite method to compute the populations at $t = 5$ with step size $\Delta t = h = 0.001$.