Homework 5: Diffusion Equation

Due March 18. This is a hard deadline so I can get grades in on time!

1. Write a program to solve the diffusion problem:

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$

   for $u(x, t)$ over the domain $0 \leq x \leq 1$, $t \geq 0$, with the boundary conditions

$$u(0, t) = 100, \quad u(1, t) = 100, \quad u(x, 0) = 0.$$

   using the explicit forward differencing method with $\Delta x = 0.1$.

2. Plot the results for $u(0.4, t)$ for $0 < t < 0.4$ for two different timesteps: $\Delta t = .01$ and $.002$. How do these two timesteps compare with the stability criterion for the forward difference method?

   Also plot the results for $u(x, .12)$ and $u(x, .4)$.