Copper ring The one-dimensional heat equation gives the time-dependence of temperature as:

$$\frac{\partial T}{\partial t} = \kappa \frac{\partial^2 T}{\partial x^2} \tag{1}$$

where κ is the thermal conductivity of the material. We will examine a copper ring with circumpherence L, where we will define the position x to range from $0 \to L$. (You may prefer to think of x as $R\phi$ in cylindrical coordinates, where R is the radius of the ring.) At $t = 0$, the temperature of the ring (in degrees Celsius) is given by:

$$T(x, 0) = \begin{cases} 0 & x < \frac{L}{2} \\ 100 & x \geq \frac{L}{2} \end{cases} \tag{2}$$

Presumably this is because half the ring is submersed in boiling water, and the other half in ice water. Don't ask me why.

For all later times $t > 0$, the ring obeys the heat equation (which means we removed it from the two water baths at that time).

Write a program to solve for the temperature of the ring for times $t > 0$.

If you have extra time (or it is helpful for debugging), visualize your results.

In your program, please document as comments any assumptions or approximations that you make.