Applications of Parallel Computing
Assignment 6:

Consider the one-dimensional heat equation on a thin wire:

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

and a discretization of the form

$$\frac{A_{i+1,j} - A_{i,j}}{\triangle t} = \frac{A_{i,j+1} - 2A_{i,j} + A_{i,j-1}}{\triangle x^2} \tag{2}$$

giving the explicit formula

$$A_{i+1,j} = A_{i,j} + \frac{\triangle t}{\triangle x^2}(A_{i,j+1} - 2A_{i,j} + A_{i,j-1}). \tag{3}$$

Use PVM with at least 5 processors to solve the differential equation. Map roughly equal portions of a wire to processors. Use the following initial and boundary conditions:

$A(t, 0) = 0$, $A(t, 1) = 0$ for all t
$A(0, x) = sin(\pi x)$ for $0 \leq x \leq 1$.

Take say 100 points ($\triangle x$) and 100 time steps. In different runs, choose $\triangle t$ to be 5x10^{-1}, 5x10^{-3}, 5x10^{-6}, and 5x10^{-9}. Then repeat the computation with 1000 points.

Report the performance of your program with PVM and the numerical behavior of the solution for the different values of $\triangle t$.

(PVM can be found in netlib in the pvm3 directory.)