Applications of Parallel Computing
Assignment 2:

Do the following three problems using PVM:

- Circular messaging
- Inner product
- Integration to evaluate π

I would like to see a write up of how you did the problems, your PVM programs, and some output from the runs.

Circular Messaging

A vector circulates among the processors
Each processor fills in a part of the vector

figure=circular.ps,height=3.3in,width=3.3in

Solution:

- SPMD
- Uses the following PVM features:
  - spawn
  - group
  - barrier
  - send-recv
  - pack-unpack

Inner Product

Problem: In parallel compute

$$s = \sum_{i=1}^{n} x^T y$$

For the Solution:

- Master - Slave
- Use the following PVM features:
  - spawn
  - group
  - barrier
  - send-recv
  - pack-unpack
- Master sends out data, collects the partial solutions and computes the sum.
- Slaves receive data, compute partial inner product and send the results to master.

Integration to evaluate π

Computer approximations to π by using numerical integration
Know

$$tan(45^0) = 1;$$

same as

$$tan\frac{\pi}{4} = 1;$$

So that;

$$4 * tan^{-1} 1 = \pi$$

From the integral tables we can find

$$tan^{-1} x = \int \frac{1}{1+x^2} dx$$

or

$$tan^{-1} 1 = \int_0^1 \frac{1}{1+x^2} dx$$

Using the mid-point rule with panels of
uniform length $h = 1/n$, for various values of n.
Evaluate the function at the midpoints of
each subinterval (x_{i-1}, x_i) $i * h - h/2$ is the midpoint.
Formula for the integral is

$$x = \sum_{i=1}^{n} f(h * (i - 1/2))$$

$$\pi = h * x$$

where

$$f(x) = \frac{4}{1+x^2}$$

Integration to evaluate π (continued)

Number of ways to divide up the problem.
Each part of the sum is independent.

- Divide the interval into more or less equal parts and give each process a part.
- Let each processor take the p^{th} part.

The example given let's each processor take the p^{th} part.
Use the following PVM features:

- spawn
- group
- barrier
- bcast
- reduce