ME964: Assignment 7
Using MPI to Evaluate an Integral on a Cluster

March 26, 2011

Drawing on the integral calculation example presented in class, write a program that uses the MPI parallel programing paradigm to evaluate the integral

$$I = \int_0^{100} e^{\sin x} \cos(\frac{x}{40})\, dx \quad .$$

Note that the value provided by MATLAB for this integral is $I = 32.121040688226245$. To approximate the value of I use the following "alternative extended Simpson's rule":

$$\int_0^{100} f(x)\, dx \approx \frac{h}{48}\left[17f(x_0)+59f(x_1)+43f(x_2)+49f(x_3)+48\sum_{i=4}^{n-4} f(x_i)+49f(x_{n-3})+43f(x_{n-2})+59f(x_{n-1})+17f(x_n)\right] .$$

In the equation above, $x_0 = 0$, $x_n = 100$, $h = 10^{-4}$, and $n = \frac{100-0}{h} = 10^6$. This value of n goes to say that you divide the interval $[0, 100]$ in 10^6 subintervals when evaluating I.

After implementing the code, you will have to:

- Run the code on Newton using only one node and one core
- Run the code on Newton using only one node and four cores
- Run the code on Newton using only one node and eight cores (note that Newton has on each compute node two quad-core Intel Xeon 5520)
- Run the code on Newton using two nodes and four cores on each node
- Run the code on Newton using four nodes and two cores on each node

For each scenario above report in a "results table" as well as on the class forum the value that you obtained for I along with the amount of time required to carry out the computation.

In your report also include

- An explanation of the results you obtained for the five scenarios above
- An execution configuration; i.e., number of compute nodes and number of cores per node, that produces the value of I in the shortest amount of time

Please zip your directory containing your MPI code and report and use the Learn@UW drop-box to submit your work by April 07, 11:59 PM.