

1. Implement a revised version of Program 3.2: Trapezoidal rule of calculating the definite integral  $\int_a^b f(x)dx$  such that the users can have their input, note that  $f(x)$  is a function hardcoded in your program.  
**INPUT:**  $b$  – the upper bound of the interval;  
 $a$  – the lower bound of the interval;  
 $n$  – the number of subintervals (trapezoids).  
**OUTPUT:** The value of  $\int_a^b f(x)dx$ .
2. Use MPI\_Reduce to rewrite the collective communication part of Problem 1.
3. Use MPI to implement the histogram program discussed in Chapter 2. Have process 0 read in the input data and distribute it among the processes. Also have process 0 printout the program. Note that the measurements are randomly generated based on *data\_count*,  $a$ , and  $b$  input by the user.

**INPUT:** *data\_count* – the number of measurements;  
 $b$  – the upper bound of measurements;  
 $a$  – the lower bound of measurements;  
 $n$  – the number of bins.

**OUTPUT:** The measurements;  
The range of each bin;  
The number of measurements in each bin.

Note: All programs have to be presented to the instructor on the class of due date.