MATH 5364 Final Exam

This assignment is your final exam for this course; it must be completed without any outside assistance, except that you may consult a Calculus textbook for a refresher on Riemann sums, if necessary. You may also use anything on the Blackboard page for this course, including previous assignments and solutions, previous discussion board posts, supplied presentations, and the Python cheat-sheet. You may *not* post any comments or questions about this assignment on Blackboard or anywhere else. If you think there is a problem or ambiguity with the assignment, please email me directly.

In this assignment, you will write code to approximate the definite integral

$$\int_a^b f(x)\mathrm{d}x,$$

using Riemann sums. Recall that a partition of $[a, b]$ into N subintervals is a list

$$a = x_0 < x_1 < x_2 < \cdots < x_{N-1} < x_N = b.$$

The subintervals corresponding to this partition are $[a, x_1], [x_1, x_2], \ldots, [x_{N-1}, b]$. A Riemann sum over such a partition is a sum of the form

$$\sum_{j=1}^{N} f(t_j)(x_j - x_{j-1}), \qquad \text{with } t_j \in [x_{j-1}, x_j].$$

In this assignment, we will consider only partitions whose subintervals all have equal length (e.g., $x_1 - x_0 = x_2 - x_1 = ... = x_N - x_{N-1}$), and the integral we will approximate is

$$\int_a^b e^{-x^2}\mathrm{d}x.$$

Write a program which approximates the definite integral of $f(x) = e^{-x^2}$ over $[a, b]$ using Riemann sums, as specified below; your program should not have any output except what is specified below.

1. (5 points) Prompt the user to input values of a, b, and N (prompt seperately for each of these).

2. (10 points) Compute the Riemann sum over the interval $[a, b]$ using a partition into N subintervals and $t_j = x_{j-1}$ and print:

`using left-endpoints :`   (value to 10 decimal places),

3. (10 points) Compute the Riemann sum over the interval $[a, b]$ using a partition into N subintervals and $t_j = x_j$ and print:

`using right-endpoints :` (value to 10 decimal places),

4. (10 points) Compute the Riemann sum over the interval $[a, b]$ using a partition into N subintervals and $t_j = (1/2)(x_j + x_{j-1})$ and print:

`using midpoints :` (value to 10 decimal places),