Project #2

In class, we looked at some of the details of the `fnInt` algorithm on the TI-8X calculators. The algorithm uses an *iterative* method based on a *stopping criterion* to (generally) acheive a specified tolerance. The algorithm is also *adaptive* so that smaller subintervals are used in some parts of the full interval and larger subintervals are used in other parts.

The *stopping criterion* uses the following quick "rule of thumb": Start by computing an approximation A_1. Double the number of subintervals to 2 and compute A_2. If A_1 and A_2 differ by less than the desired tolerance, stop and use A_2. If the difference is bigger than the desired tolerance, double the number of subintervals again. Repeat (that is, *iterate*) until the difference is less than the desired tolerance. Use the last approximation you compute. This approximation often has an error less than the desired tolerance but there is no guarantee.

The *adaptive* feature of the algorithm often saves computational time. Compute A_1 and A_2 as before. If the difference is less than the tolerance, stop and use A_2. If the difference is bigger than the tolerance, treat each of the two subintervals separately. Allot half of the original tolerance to each subinterval. For each subinterval, compute approximations using one and two "subsubintervals" and compare the difference to the allotted tolerance. If the difference is less than the allotted tolerance, stop. If not, treat each of the "subsubintervals" separately, dividing the allotted tolerance in half again. Repeat until the allotted tolerance is achieved for each piece. Sum the A_2 approximations for each piece to get a total approximation.

In class, we started implementing this algorithm (using the midpoint approximation) to approximate $\displaystyle\int_0^2 e^{-x^2}\,dx$ to within ± 0.01. **For this project, you should finish that calculation and then write a paper using this as an example to present the key ideas of the `fnInt` algorithm.** Your paper should be aimed at peers in a calculus class who have not seen any details on the algorithm.

One of the challenges in this paper will be finding a way to organize the details and results of the calculations. Think carefully about how you want to present those details and results.

The project is due on Tuesday, November 17.