Assigned: 2-10-20

Due Date: 9-20-19

CS 3200: Scientific Computing

Assignment 2

Note: Please do your programming in Matlab, document thoroughly! The code must compile on one of the lab machines with your instructions.

Instructions

1 .During lecture we discussed Simpson's Rule, for integrating a curve.

$$\int_a^b f(x)dx \approx \sum_{i=1}^{N} w_i f(x_i)$$

Implement the quadratic interpolant (composite Simpson formula) for $N = 17,33,65,129,257,513$. Test your code on the interval $[0,1]$ with the functions x^p $p = 2,3,4,5,6$ and 8 and show and explain the results.

Calculate the integral for the function below.

$$\int_0^{2\pi} 1 + \sin(x) \cdot \cos\left(\frac{2x}{3}\right) \cdot \sin(4x)\, dx$$

- **Report** the results and **create** a convergence plot for Simpson's Rule t for $N = 217,33,65,129,257,513$ that shows how quickly the methods go to a common final value.

2. Using the supplied QuadTX functions from the book calculate the integral defined by $\int_0^3 (\cos(x^3))^{200} dx$ use tolerances 1.0e-7, 1.0e-8, ….. 1.0e-14 and compare the time spent and the number of functions calls of f(x) used.

Modify the code so that the accuracy test is changed from the error on every step being less than tol to the error being less than tol h/(b-a). What difference does this make to the number of function evaluation used to reach a given tolerance? Illustrate your answer with experimental results.

3. Change your fixed gris code to estimate the overall error by repeating the calculation and compare the performance of Quadtx with your fixed grid Simpson's code by showing how many steps quadtx takes to achieve a number of fixed grid cases. Note you may need many intervals for this difficult function

What to turn in

For these assignments, we expect both *SOURCE CODE* and a written *REPORT* be uploaded as a zip or tarball file to Canvas.

- Source code for all programs that you write, thoroughly documented.
  - Include a README file describing how to compile and run your code.
- Your report should be in PDF format and should stand on its own.
  - It should describe the methods used.
  - It should explain your results and contain figures.
  - It should also answer any questions asked above.
  - It should cite any sources used for information, including source code.
  - It should list all of your collaborators.

This homework is due on Wednesday February 26th by 11:59 pm. If you don't understand these directions, please send questions to me or to the TAs or come see one of the TAs or the instructor during office hours well in advance of the due date.