Numerical Methods for the Solution of Differential Equations (AM 213B)

Homework 3 - Grading rubric

Question 1 (40 points):

(a) (30 points)

- 30 points for correctly setting up the problem and developing the computer code to compute the correct numerical solution of the given BVP using second-order centered finite differences.
- 15 points of partial credits if the code you developed runs but does not produce the correct solution.

(b) (5 points)

- 5 points for producing the correct surface plot of numerical the solution.
- 2 points of partial credit if the plot produced is incorrect.

(c) (5 points)

- 5 points for producing the correct plot of the numerical solution at $y = 0.2$ and $y = 0.5$ versus x
- 2 points of partial credit if the plot produced is incorrect.

Question 2 (60 points):

(a) (15 points)

- 15 points for computing the correct analytical solution to the given problem.

(b) (5 points)

- 5 points for producing the correct surface plot of the analytical solution.
- 2 points of partial credit if the plot produced is incorrect.

(c) (15 points)

- 15 points for correctly setting up the problem and developing the computer code to compute the correct numerical solution using second-order finite differences in space on an evenly-spaced grid and integrate the semi-discrete form of the PDE in time using the Crank-Nicolson method.
- 7 points of partial credit if the code you developed runs but does not produce the correct solution.

(d) (15 points)

- 15 points for correctly setting up the problem and developing the computer code to compute the correct numerical solution using the Gauss-Chebyshev-Lobatto collocation method on a Gauss-Chebyshev-Lobatto grid and integrate the semi-discrete form of the PDE in time using the Crank-Nicolson method.

- 7 points of partial credit if the code you developed runs but does not produce the correct solution.

(e) (10 points)

- 5 points for the correct error plot corresponding to the finite difference method. 2 points of partial credit if the plot produced is incorrect.
- 5 points for the correct error plot corresponding to the collocation method. 2 points of partial credit if the plot produced is incorrect.

Extra-Credit Question (30 points):

(a) (20 points)

- 20 points for correctly setting up the problem and developing the computer code to compute the correct numerical solution of the Kuramoto-Sivashinsky IVP using second-order centered finite-differences in space and the two-step Adams-Bashforth method in time.
- 10 points of partial credit if the code you developed runs but does not produce the correct solution.

(b) (5 points)

- 5 points for producing the correct plot of the numerical solution as a surface on a 200×1001 space-time grid.
- 2 points of partial credit if the plot produced is incorrect.

(c) (5 points)

- 5 points for producing the correct plot of the numerical solution at time $t = 62$ as a function of x.
- 2 points of partial credit if the plot produced is incorrect.