

Math 411 Hwk 7

Problem 1. Write a Matlab script (or function) that computes the value of π using Monte Carlo integration. Hint compute the area of the unit quarter circle.

Problem 2. Write a Matlab function that integrates a given function $f(x)$ on the interval $[a, b]$ using Monte Carlo integration.

Problem 3. Write a Matlab function that uses the Crank Nicolson method to solve numerically the equation

$$u_t = u_{xx}, \quad 0 \leq x \leq 1, t \geq 0,$$

where $u(0, t) = u(1, t) = 0$ and $u(x, 0) = f(x)$.

Problem 4 (50 point bonus). Prove that the Crank Nicolson method is stable.

Problem 5 (50 point bonus). Code up the implicit backward-time centered-space method for solving the heat equation and compare its performance and accuracy with the Crank Nicolson method. What conclusions can you draw?