

Homework ¹

Instructor: Prof. Hector D. Ceniceros

General Instructions: Please write your homework papers neatly. You need to turn in both full printouts of your codes and the appropriate runs you made. Write your own code, individually. **Do not copy codes!**

1. Consider the linear system of the boundary value problem of homework # 4, i.e.

$$\frac{-v_{j-1} + 2v_j - v_{j+1}}{h^2} + \pi^2 v_j = 2\pi^2 \sin(\pi x_j) \quad \text{for } j = 1, 2, \dots, N - 1. \quad (1)$$

- (a) Implement Jacobi's iteration method to find an approximation of the solution of (1) using a stopping criterium of $\|b - Ax^{(k)}\|_2 / \|b\|_2 < 0.1h$, with $h = 1/N$. Do this for $N = 50$ and $N = 100$ and comment on the required number of iterations.
- (b) Repeat (a) for the Gauss-Seidel iteration.
- (c) Repeat (b) for the Conjugate Gradient Method and compare the performance with that of the Jacobi and Gauss-Seidel iterations.

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