

CE5310 Numerical Methods**Homework #05**

1. Write a program to solve a banded linear system of equations using the Relaxation method.

Your program should perform the following tasks:

- a. Prompt the user for the file paths for the file containing the coef. matrix and constants
- b. Load the provided banded coef. matrix and constants.
- c. Solve the linear system of equations using the relaxation Method for banded matrices.
- d. Write the unknowns to a user specified output file.

The banded relaxation Method code must be in a standalone function, called by your main program.

2. Compare the difference in the error of the unknowns and time required to complete between your banded Relaxation Method and the MATLAB “\” operator (using an expanded matrix).

Deliverables:

- 1) A pdf including a title page, the problem statement, all m-file listings and example input and output. Preferably bookmarked.
- 2) All m-files, loaded separately, required for your solution to run.

Grading:

Your solution will be graded based on completion of the above requirements, correct performance, neatness and professionalism of pdf submittal.

| | | |
|---|-------|-------|
| Prompt user for banded coefficient matrix file path for input | 5pnts | _____ |
| Open and load the banded coefficient matrix | 5pnts | _____ |
| Prompt user for constants vector file path for input | 5pnts | _____ |
| Open and load the constants vector | 5pnts | _____ |
| Solve the linear system of equations using Relaxation method for banded matrices | 5pnts | _____ |
| Prompt user for the unknown vector path for output | 5pnts | _____ |
| Save the unknown vector to a csv file | 5pnts | _____ |
| Expand the banded matrix to a full matrix | 5pnts | _____ |
| Solve the full matrix with the constant vector using the “\” operator | 5pnts | _____ |
| Compare the time required for each method to run | 5pnts | _____ |
| Compare the residuals of your banded Relaxation method and the MATLAB “\” operator. | 5pnts | _____ |

Required Functions:

| | | |
|---------------------------------------|--------|-------|
| Banded Relaxation Function | 50pnts | _____ |
| Banded Matrix to Full Matrix Function | 20pnts | _____ |

Deductions:

| | | |
|--|---------|-------|
| <u>Properly formatted PDF</u> | | |
| Title Page | -2pnts | _____ |
| Table of Contents/pdf Bookmarks | -2pnts | _____ |
| Problem Statement | -2pnts | _____ |
| m-file listings | | |
| Main program | -5pnts | _____ |
| Banded Relaxation Function | -5pnts | _____ |
| Banded Matrix to Full Matrix Function | -5pnts | _____ |
| Command line Input/Output Example | -5pnts | _____ |
| Comparison of required times between the banded Relaxation and the “\” | -5pnts | _____ |
| Comparison of residuals between the banded Relaxation and the “\” | -5pnts | _____ |
| <u>m-files</u> | | |
| Main program | -5pnts | _____ |
| Banded Relaxation Function | -5pnts | _____ |
| Banded Matrix to Full Matrix Function | -5pnts | _____ |
| Program Runs and completes required tasks: | -10pnts | _____ |
| Overall Presentation: | -10pnts | _____ |

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|---------------------|---------|-------|
| Total Grade: | 100pnts | _____ |
|---------------------|---------|-------|