Introduction to Parallel Scientific Computing [ME5470]

Assignment 1

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January 20, 2025

Question 1: Part A

Table 1: Comparison of size of Files

format flag	File Type	Size (MB)
0	ASCII	320
1	Binary	123

Comment: Size of ASCII file is **larger** than Binary file.

Question 1: Part B

Size of the array in memory: For n = 4000

$$\text{sizeof(double)} \times n^2 = 8 \times (4000)^2 = 128{,}000{,}000 \text{ bytes}$$

$$\approx 122 \text{ MB}$$

Comment: The size of binary file is close to the in-memory size, while the size of ASCII file is significantly larger. This is because ASCII file stores data in human readable format having adding overhead for character representation, space, commas, newlines.

- **Binary format** is preferred for **large dataset** due its compactness and **memory efficiency**.
- **ASCII format** can be used for ease of inspection and **debugging** but at the cost of **increased file size** and slower execution times

Question 2

Methodology: An eigenvector must satisfy the following relation:

$$\mathbf{Ax} = \lambda \mathbf{x}$$

To compute λ, let:

$$\mathbf{y} = \mathbf{Ax}$$

$$\lambda_i = \frac{y_i}{x_i}$$

Results:

Input File	Is Eigenvector?	Eigenvalue
vec 000003 000001.in	Yes	-6.000000e+00
vec 000003 000002.in	Yes	-6.000000e+00
vec 000003 000003.in	Yes	-1.000000e+00
vec 000003 000004.in	Not an eigenvector	-

Table 2: Eigenvector Results, for n = 3

Input File	Is Eigenvector?	Eigenvalue
vec 000005000001.in	Yes	2.680981e-01
vec 000005000002.in	Not an eigenvector	-
vec 000005000003.in	Yes	9.868750e-01
vec 000005000004.in	Yes	1.399039e+00

Table 3: Eigenvector Results, for n = 5

Input File	Is Eigenvector?	Eigenvalue
vec 000050000001.in	Not an eigenvector	-
vec 000050000002.in	Yes	4.796282e-01
vec 000050000003.in	Yes	1.337887e+00
vec 000050000004.in	Not an eigenvector	-

Table 4: Eigenvector Results, for n = 50

Input File	Is Eigenvector?	Eigenvalue
vec 000080000001.in	Yes	3.330178e-01
vec 000080000002.in	Yes	4.931420e-01
vec 000080000003.in	Yes	9.392745e-01
vec 000080000004.in	Not an eigenvector	-

Table 5: Eigenvector Results, for n = 80