ME5470 - Introduction to Parallel Scientific Computing

Ishaan Jain
CO21BTECH11006

1.
    a. After execution, we got 2 files with ASCII characters and binary respectively. For *n = 1000,* the sizes were as follows:
        i. ASCII - 20017 kB
        ii. Binary - 7813 kB
    b. Size of Double: 8 Bytes, n = 1000
        i. Size of the file in memory: 8×1000×1000=8000000
           8×1000×1000=8,000,000 bytes ≈ 8 MB
        ii. Size on disk for ASCII format:
            Approximately 22 MB
            Size on disk for binary format:
            Approximately 7 MB

Key Observations:

- Binary format requires less storage on disk than ASCII format because it directly dumps the memory representation. ASCII format takes more space due to text representation, decimal places, line endings, etc.
- Advantages of Binary Format for Large Data Storage:
- Space Efficiency: Binary files use less disk space compared to ASCII files.
- Speed: Binary files are faster to read and write.
- Precision: Binary format retains full numerical precision.

- Accuracy: No risk of floating-point representation errors caused by text conversion.
- Compressibility: Binary files can be easily compressed for storage and transmission.

2.

Here we have used the following algorithm to check whether a given vector is an eigen vector or not.

- We are given a matrix A and a vector $\vec{x}$.
- Multiply the matrix with the vector i.e., $\vec{y} = A\vec{x}$
- To be an eigenvector, the given vector must satisfy the following eigenvector equation

$$A\vec{x} = \lambda\vec{x}$$

- Now the get the value of λ using the following way.

$$\vec{y} = A\vec{x} = \lambda\vec{x}$$
$$\Rightarrow \vec{y} \cdot \vec{x} = \lambda\vec{x} \cdot \vec{x}$$
$$\Rightarrow \lambda = \vec{y} \cdot \vec{x}/\vec{x} \cdot \vec{x}$$

- Now using the obtained value of λ check the difference between each value of $\vec{y}$ and $\lambda\vec{x}$.
- If any one difference the not close to zero (some tolerance), the it is not an eigenvector.