

Introductory computation session

Linux basics

- vi To edit files on the terminal
- gedit To edit files in a separate window
- cd Folder_name/ To navigate through folders in terminal
- cd .. To return back to the previous folder in the terminal
- g++ file_name.cpp To compile the code
- ./a.out To run the code

Computation run time:

- Syntax:

```
#include <time.h>    /* clock_t */
-----
clock_t t;
t = clock();
Operations;
t = clock()-t;
printf("Operations took %ld clicks (%f seconds).\n",t,((float)t)/CLOCKS_PER_SEC);
```

Assignment 1

General Instructions

- Put down your roll number and name on your solution
- Write the code with comments for readability
- Upload both the hand calculation and programming part in the shared Google form.
- Deadline is 10 Feb 2026.

Problems

1. Consider random matrices A and B of size $N \times N$ (user input). Convince yourself computationally that matrix product is not commutative: *i.e.* $AB \neq BA$. (10 points)
2. Consider a random matrix A of size $N \times N$ (user input). Convince yourself computationally that $(A + A^T)$ is symmetric. (10 points)
3. Adapt the function to *multiply two matrices* to perform a *matrix* ($N \times N$) *vector* ($N \times 1$) *product*. Plot the time taken as a function of N for $N = 256$, $N = 512$, $N = 1024$, $N = 2048$, and $N = 4096$. (40 points)
4. Let X and Y be thin matrices (size $m \times n$, such that $m > n$) and z be a vector of size $m \times 1$. Compute $XY^T z$ as (a) $X(Y^T z)$ and (b) $(XY^T)z$. Compare the time it takes between the two for $(m, n) = (256, 8)$, $(m, n) = (512, 8)$, $(m, n) = (1024, 8)$, $(m, n) = (2048, 8)$, $(m, n) = (4096, 8)$. Plot the time taken as a function of m . (40 points)