Matrix Multiplication Project Report

2025-03-20

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Submission Date: Mar 20, 2025

System Configuration

Component	Specification
CPU Model	12th Gen Intel(R) Core(TM) i7-12700H
Memory Size	7.6 GiB RAM, 2.0 GiB Swap
OS Version	Linux Priest 5.15.167.4-microsoft-standard-WSL2 (WSL2 on Windows)
Compiler Version	GCC 13.3.0
Python Version	Python 3.12.3

Implementation Details

C Language Implementation

- **Source Code**: “‘c #include <stdio.h>

int main() { int a[2][2] = {{1, 2}, {3, 4}}; int b[2][2] = {{5, 6}, {7, 8}}; int result[2][2];

```
for (int i = 0; i < 2; i++) {
    for (int j = 0; j < 2; j++) {
        result[i][j] = 0;
        for (int k = 0; k < 2; k++) {
            result[i][j] += a[i][k] * b[k][j];
        }
    }
}
```

```
printf("Result matrix:\n");
for (int i = 0; i < 2; i++) {
    for (int j = 0; j < 2; j++) {
        printf("%d ", result[i][j]);
    }
    printf("\n");
}
return 0;
```

}

Compilation Command

gcc matrix.c -o matrix # Execution Command ./matrix

Python Language Implementation

- **Source Code**: "'python a = [[1, 2], [3, 4]] b = [[5, 6], [7, 8]] result = [[0, 0], [0, 0]]

for i in range(2): for j in range(2): for k in range(2): result[i][j] += a[i][k] * b[k][j]

print("Result matrix:") for row in result: print(" ".join(map(str, row))) # Execution Command python3 matrix.py

Algorithm Verification

- Both implementations were tested using 2x2 matrices: A = [[1, 2], B = [[5, 6], [3, 4]] [7, 8]]
- Expected result: [[19, 22], [43, 50]]
- Both the C and Python programs output the correct result, confirming the correctness.

Performance Analysis

- **Execution Times**:

Language	Real time	User	System
C	0m0.011s	0m0.001s	0m0.002s
Python	0m0.106s	0m0.019s	0m0.000s

- **Analysis**:
- C is faster due to compilation and lower-level memory management.
- Python is slower because of its interpreted nature and dynamic typing. ## Conclusion This project strengthened my skills in:

- Using Unix/Linux command line tools effectively.
- Writing and formatting technical documentation in Markdown.
- Implementing and verifying the same algorithm in both compiled and interpreted languages.

References

GCC Documentation: https://gcc.gnu.org Python Docs: https://docs.python.org/3/
WSL Setup Guide: https://learn.microsoft.com/en-us/windows/wsl/

Appendix

- All tests were done in a WSL2 Ubuntu environment running on Windows 11.
- No external libraries were used.