Task 1E: Confusion hi confusion hai !!

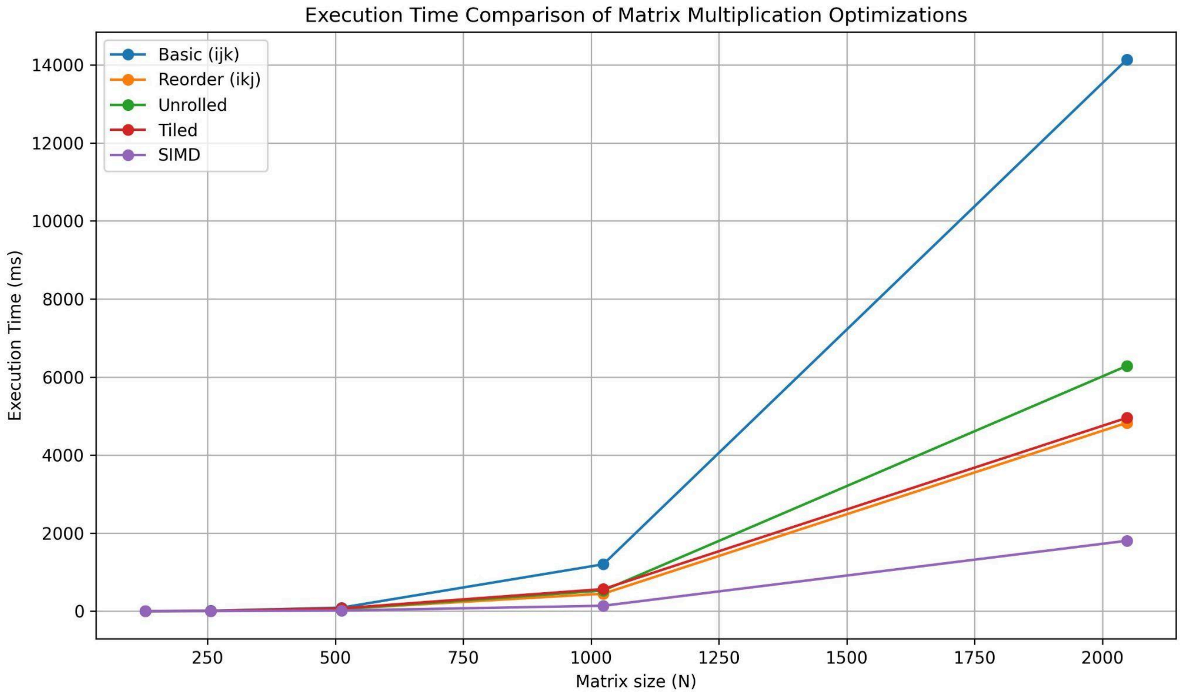
1.Execution time in ms:

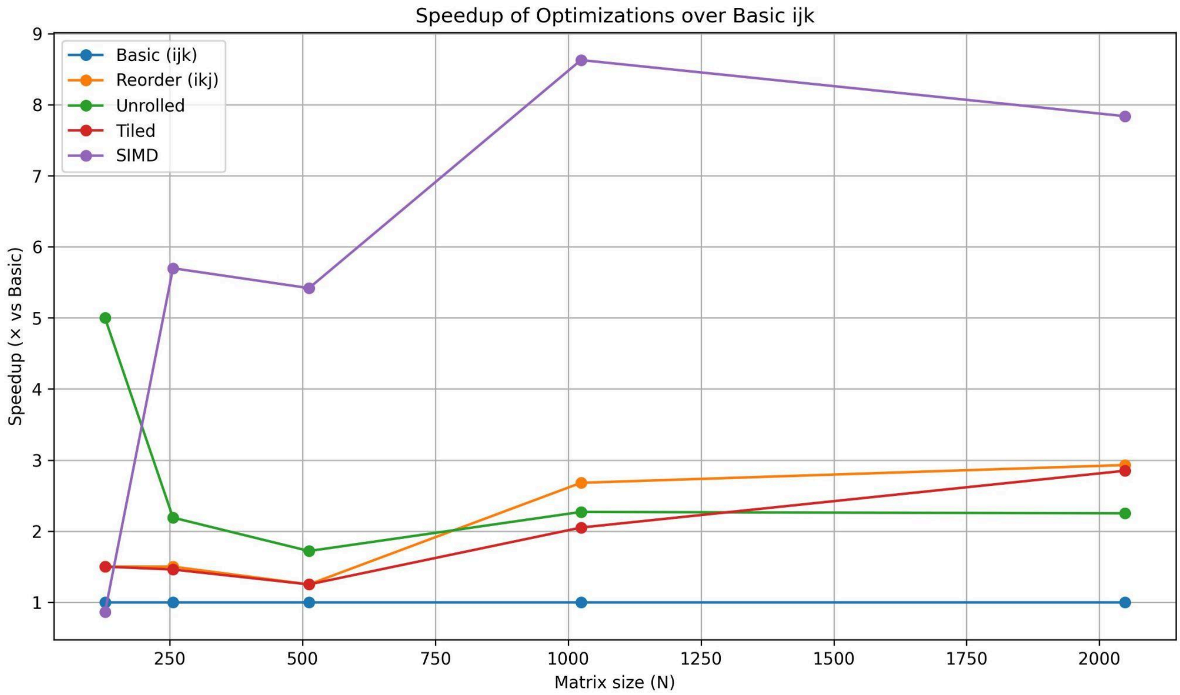
Matrix size(N)	Basic(ijk)	Reorder(ikj)	Unrolled	Tiled	SIMD
128	1.2	0.8	0.0–0.2	0.8	~1.41.00
256	11.4	7.6	5.2	7.8	2.0
512	91	58	53	73	16.8
1024	1202	448	530	567	139
2048	14138	4828	6286	4955	1805

2.SpeedUp:

Matrix size(N)	Basic(ijk)	Reorder(ikj)	Unrolled	Tiled	SIMD
128	1.00	1.50	>>1(unstable)	1.50	0.86× (slower)
256	1.00	1.50	2.19	1.46	5.70x
512	1.00	1.25	1.72	1.25	5.42
1024	1.00	2.68	2.27	2.05	8.63
2048	1.00	2.93	2.25	2.85	7.83

3. Plot for comparison for execution time and speedup comparison:





4. Reasoning:

1. Loop Reordering (ikj) improves cache locality.
2. For smaller matrices, reorder gives ~1.5×, but for larger sizes (1024, 2048), it gives 2.7–2.9x speedup because more cache lines are reused efficiently.

3. Loop Unrolling reduces loop overhead by performing multiple computations per iteration.

4. At N=128, performance is unstable (too small workload), but for N≥256, it consistently outperforms reorder, reaching ~2.2x speedup.

5. Tiling attempts to exploit spatial/temporal locality, but overhead of block management is visible.

6. For small/medium matrices, tiling doesn't help much (~1.2–1.5x).

7. At larger sizes (2048), it reaches ~2.85x, showing benefits of cache blocking.
8. SIMD achieves the highest performance.

9. At N=256, SIMD already gives 5.7x speedup, and at 1024 it reaches 8.63x.

10. Vectorized instructions allow multiple multiplications per cycle, significantly reducing runtime.

11. However, for N=128, setup overhead makes it slightly slower than basic.