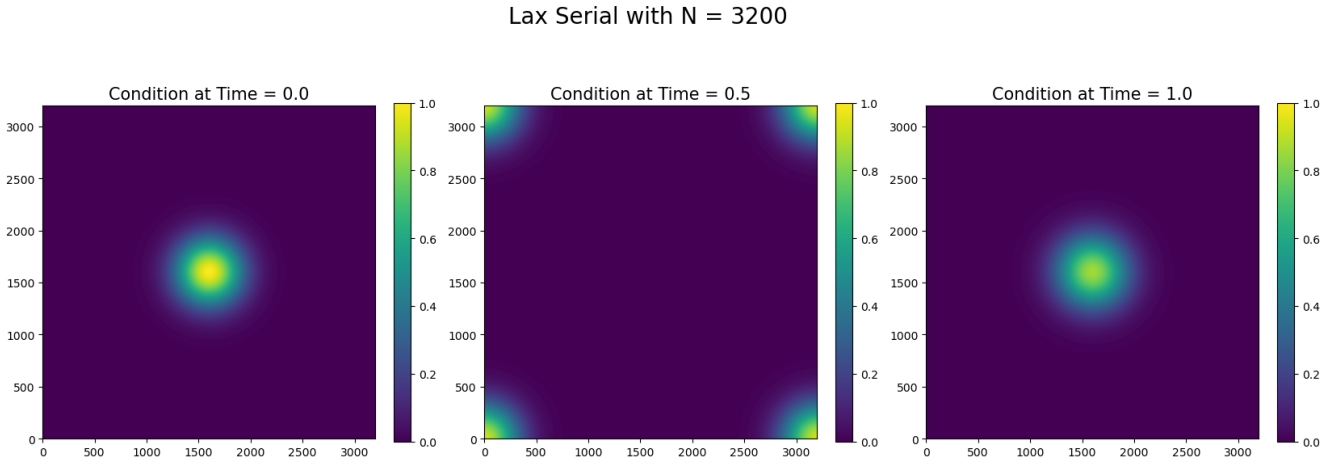
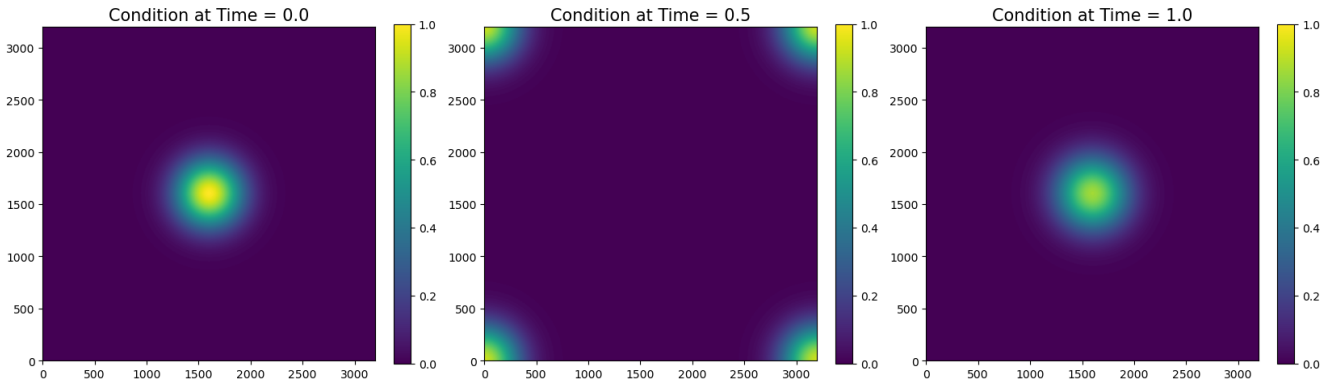
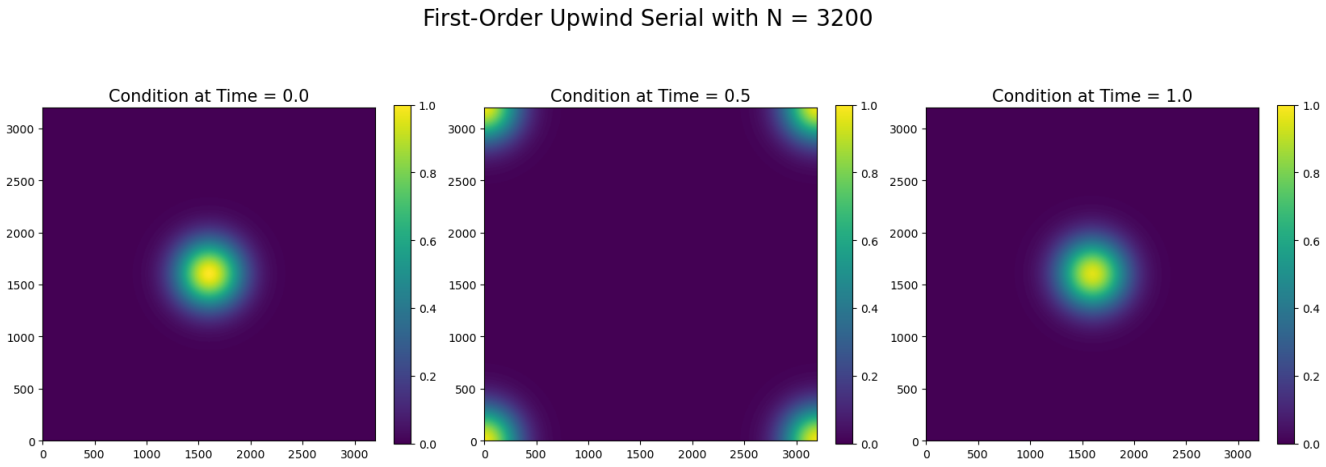
Project 1, Milestone 2 — Multicore Scaling Studies

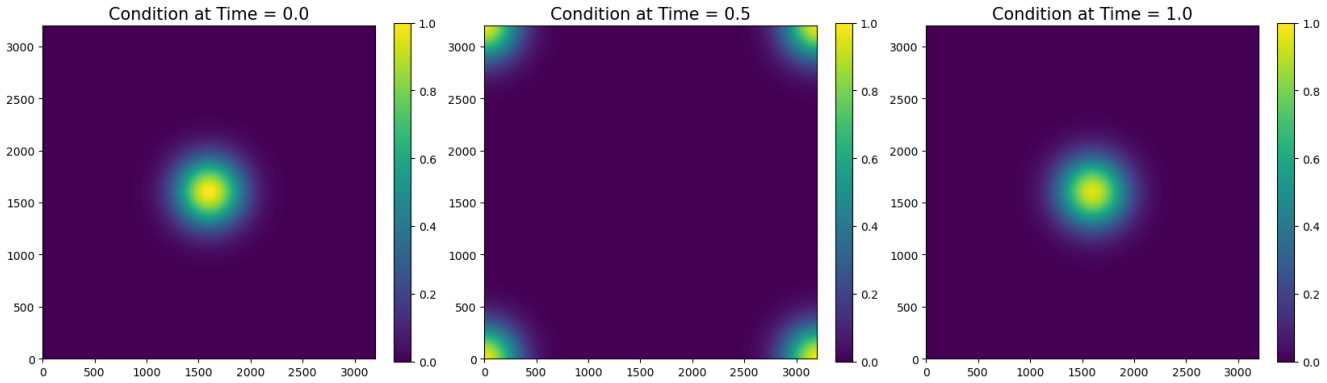
Verification



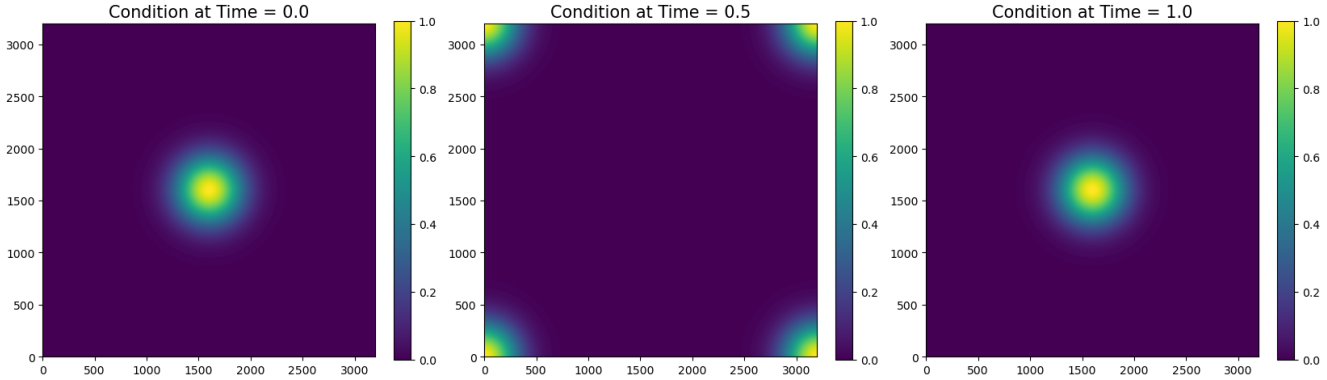




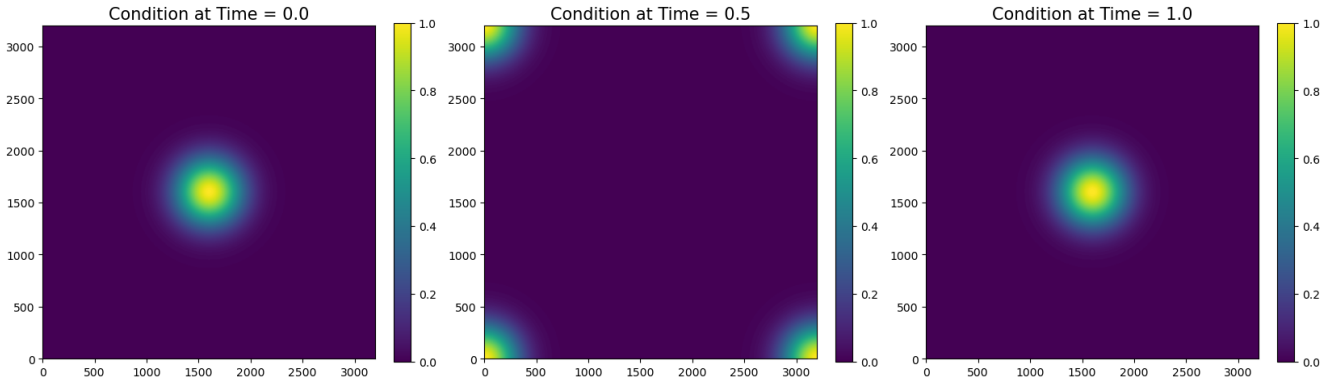
First-Order Upwind Parallel (4 Cores) with N = 3200



Second-Order Upwind Serial with N = 3200

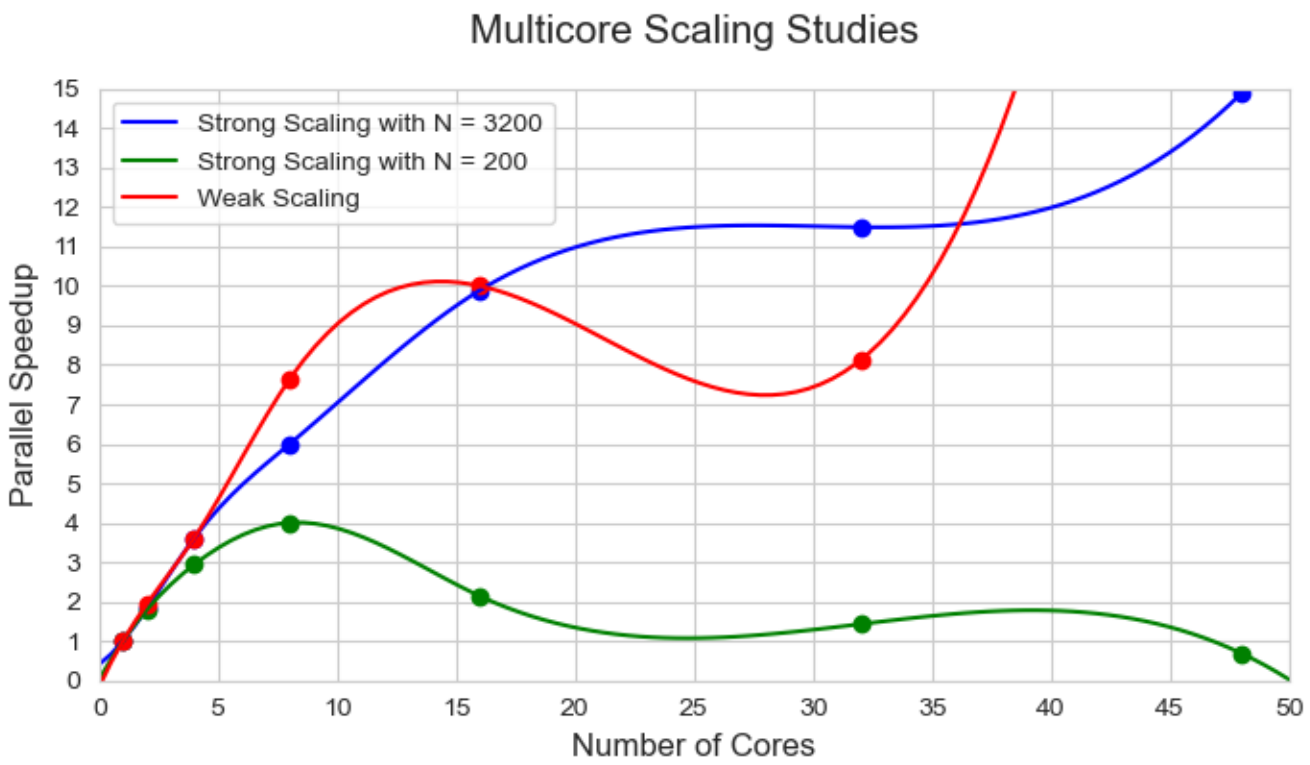


Second-Order Upwind Parallel (4 Cores) with N = 3200



Performance

Fill out the tables below with the requested information. To keep things manageable, performance data is only required for the Lax solver as it is a reasonable representative of the general approach.



Cores	Problem Size (NXN)	Grind Rate ($\frac{cells}{sec}$)	Parallel Speedup
1	3200×3200	741,306,889	1.00
2	3200×3200	1,352,994,222	1.82
4	3200×3200	2,678,539,218	3.61
8	3200×3200	4,447,640,204	5.99
16	3200×3200	7,333,957,492	9.89
32	3200×3200	8,522,448,450	11.49
48	3200×3200	11,034,588,528	14.88

Table 1: Performance of Lax Method for specified core counts and problem size. All experiments should use $L = 1.0m$, $u = 1.0\frac{m}{s}$, $v = 1.0\frac{m}{s}$, and $T = 1.0s$ with $\delta x = \frac{L}{N-1}$, $\delta t = 0.25\frac{\delta x}{\sqrt{u^2+v^2}}$. You are free to fill in the empty core count cell with any value greater than 32 that you are able to access.

Cores	Problem Size (NXN)	Grind Rate ($\frac{cells}{sec}$)	Parallel Speedup
1	200×200	871,151,921	1.00
2	200×200	1,563,710,895	1.79
4	200×200	2,567,619,316	2.94
8	200×200	3,485,156,866	4.00
16	200×200	1,867,905,224	2.14
32	200×200	1,246,233,372	1.43
48	200×200	607,903,458	0.69

Table 2: Performance of Lax Method for specified core counts and problem size. All experiments should use $L = 1.0m$, $u = 1.0\frac{m}{s}$, $v = 1.0\frac{m}{s}$, and $T = 1.0s$ with $\delta x = \frac{L}{N-1}$, $\delta t = 0.25\frac{\delta x}{\sqrt{u^2+v^2}}$. You are free to fill in the empty core count cell with any value greater than 32 that you are able to access.

Cores	Problem Size (NXN)	Grind Rate ($\frac{cells}{sec}$)	Parallel Speedup
1	800×800	903,762,684	1.00
2	1600×1600	1,609,120,840	1.93
4	3200×3200	2,678,539,218	3.61
8	6400×6400	4,937,210,879	7.63
16	12800×12800	6,528,736,139	10.00
32	25600×25600	5,277,052,863	8.12

Table 3: Performance of Lax Method for specified core counts and problem size. All experiments should use $L = 1.0m$, $u = 1.0\frac{m}{s}$, $v = 1.0\frac{m}{s}$, and $T = 1.0s$ with $\delta x = \frac{L}{N-1}$, $\delta t = 0.25\frac{\delta x}{\sqrt{u^2+v^2}}$.

Problem Size (NXN)	Method	Grind Rate ($\frac{cells}{sec}$)	Execution Time
3200×3200	Lax	741,306,889	249.96
3200×3200	First-Order Upwind	595,099,525	311.38
3200×3200	Second-Order Upwind	454,444,628	1274.24

Table 4: Performance comparison of the three methods. All experiments should use $L = 1.0m$, $u = 1.0\frac{m}{s}$, $v = 1.0\frac{m}{s}$, and $T = 1.0s$ with $\delta x = \frac{L}{N-1}$, $\delta t = 0.25\frac{\delta x}{\sqrt{u^2+v^2}}$.