

TABLE I
PERFORMANCE METRICS FOR QUERIES Q1, Q15, Q86, Q90, AND Q12

	Metric	MySQL	Postgres	Accumulo	Partition 1
Q1	CPU Time (s)	22.10	2.53	43.65	37.70
	Wall Time	4.22m	10.74s	4.85m	4.20m
	Peak Mem. (MB)	638	21.8	90.0	131
	Cum. User Mem. (G)	91.2	6.29	109	123
Q15	CPU Time (s)	3.77	1.79	1.36m	2.04s
	Wall Time	30.33m	35.46s	10.31m	11.11s
	Peak Mem. (MB)	35.1	20.0	133	49.9
	Cum. User Mem. (G)	73.2	20.7	108	15.4
Q86	CPU Time (s)	6.12	3.41	40.54	4.55
	Wall Time	6.77m	24.43s	8.74m	15.46s
	Peak Mem. (MB)	27.1	7.69	44.1	26.3
	Cum. User Mem. (G)	62.8	32.0	85.2	15.3
Q90	CPU Time (s)	1.03	6.97	1.14m	1.39s
	Wall Time	11.05s	25.00ms	10.58m	15.13s
	Peak Mem. (MB)	9.56	0.64	49.6	11.3
	Cum. User Mem. (G)	87.8	0.987	97.8	73.0
Q12	CPU Time (s)	1.62	832.00ms	48.30s	895.00ms
	Wall Time	18.03s	8.20s	7.14m	7.14s
	Peak Mem. (MB)	10.3	9.17	74.6	12.9
	Cum. User Mem. (G)	107	27.6	121	64.0

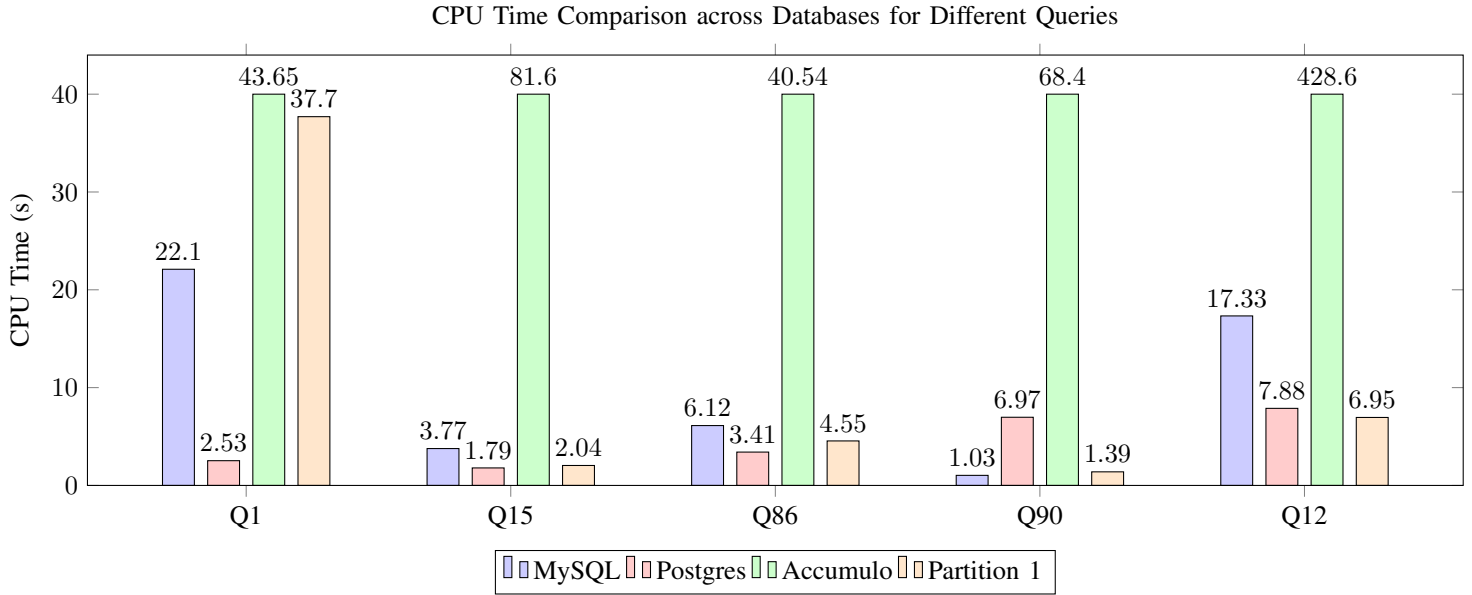


Fig. 1. CPU Time Comparison across Databases for Queries Q1, Q15, Q86, Q90, and Q12

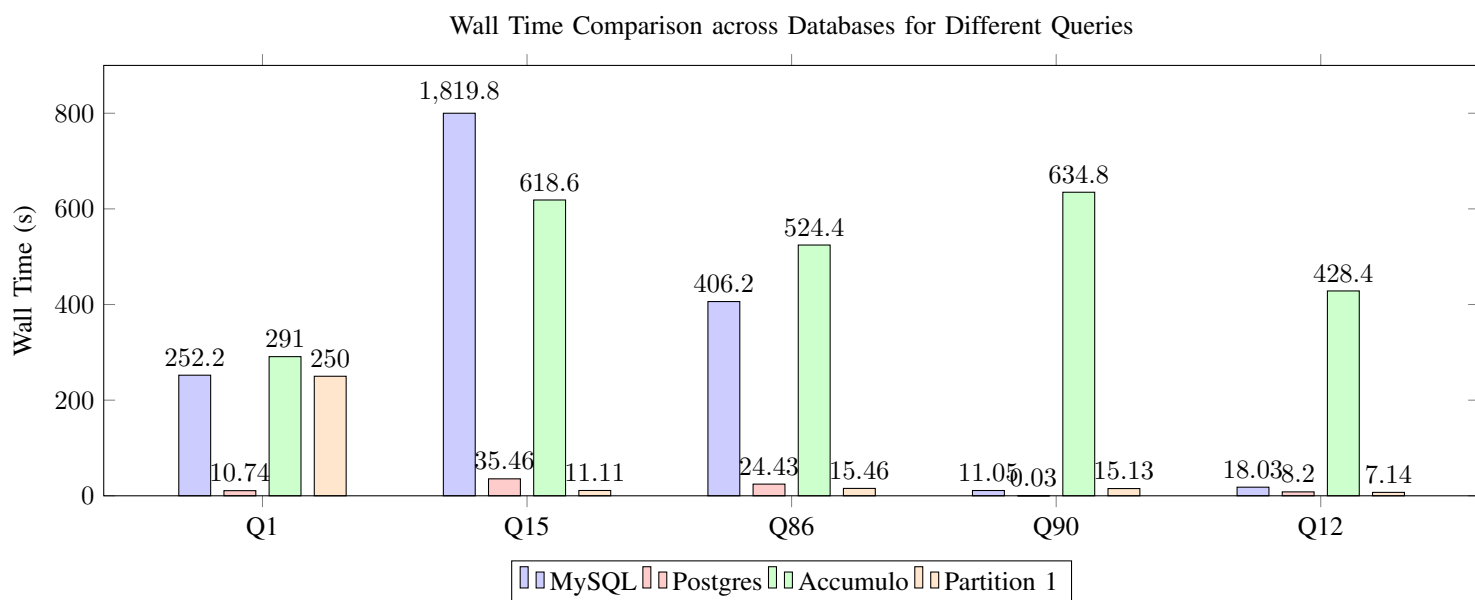


Fig. 2. Wall Time Comparison across Databases for Queries Q1, Q15, Q86, Q90, and Q12

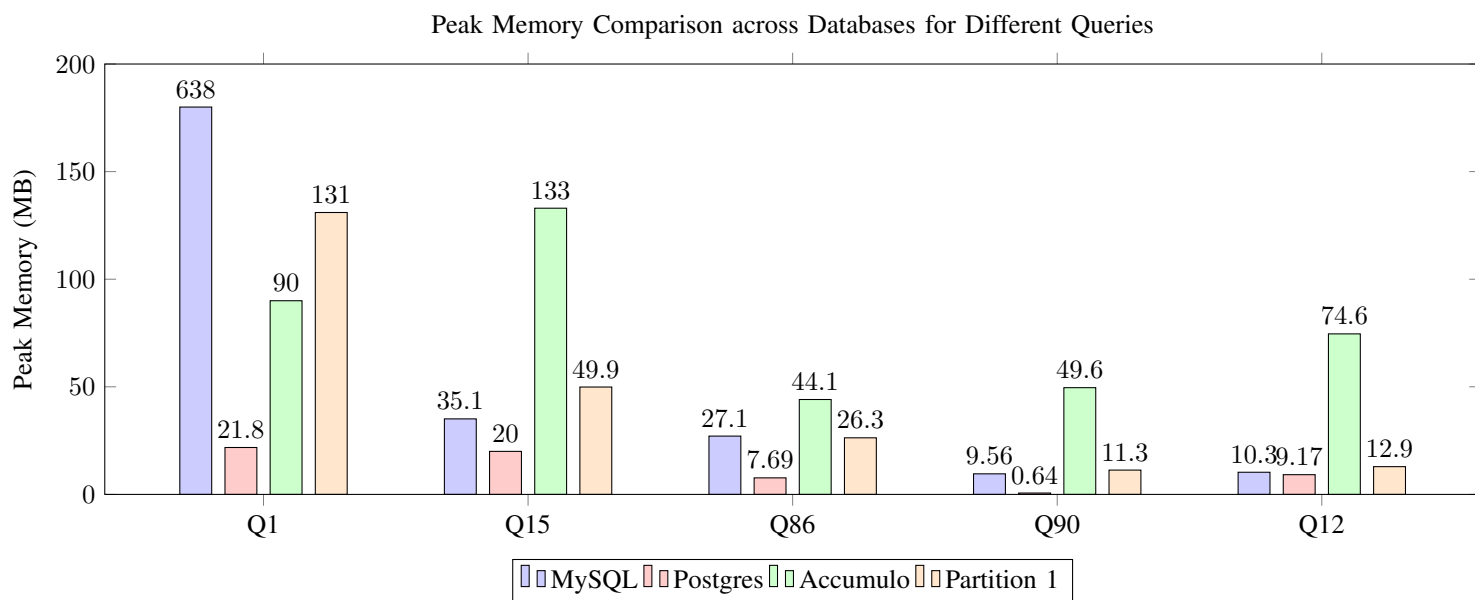


Fig. 3. Peak Memory Comparison across Databases for Queries Q1, Q15, Q86, Q90, and Q12

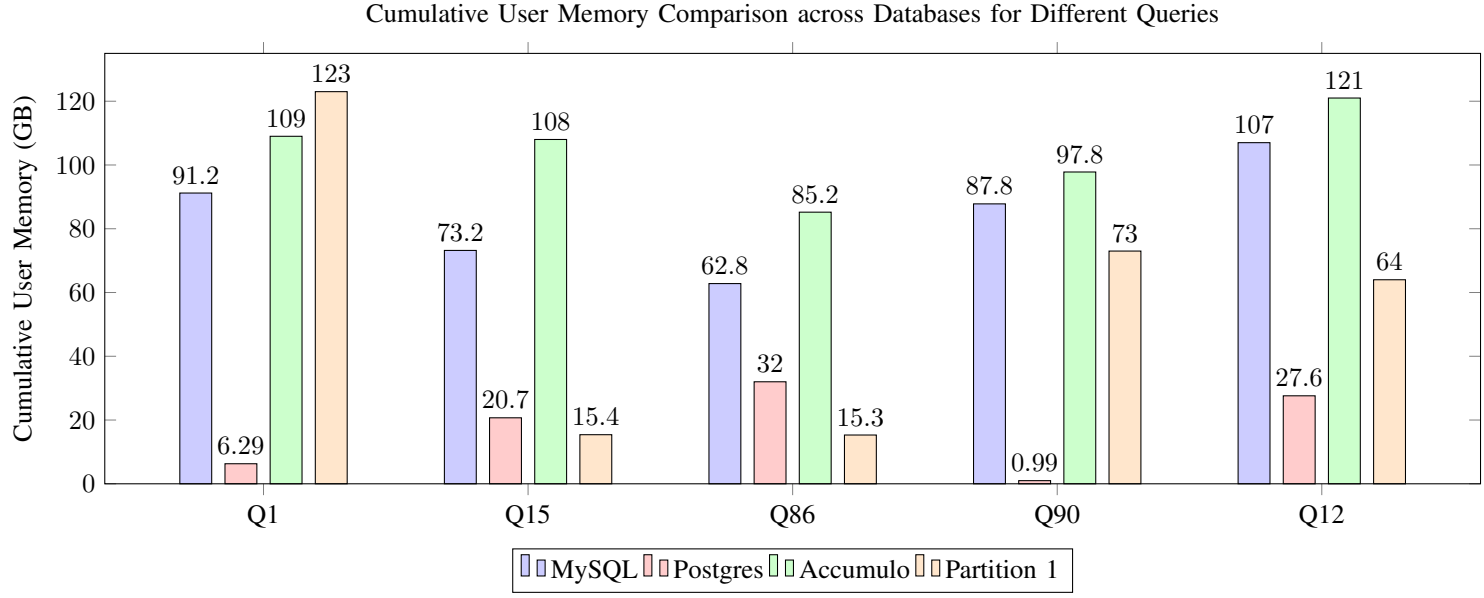


Fig. 4. Cumulative User Memory Comparison across Databases for Queries Q1, Q15, Q86, Q90, and Q12

TABLE II
PERFORMANCE METRICS FOR QUERIES Q1, Q15, Q86, Q90, AND Q12

	Metric	MySQL	Postgres	Accumulo	Partition 1	Prt.2-N:2
Q1	CPU Time (s)	22.10	2.53	43.65	37.70	38.87s
	Wall Time	4.22m	10.74s	4.85m	4.20m	4.14m
	Peak Mem. (MB)	638	21.8	90.0	131	100
	Cum. User Mem. (G)	91.2	6.29	109	123	45.2
Q15	CPU Time (s)	3.77	1.79	1.36m	2.04s	3.01s
	Wall Time	30.33m	35.46s	10.31m	11.11s	23.03s
	Peak Mem. (MB)	35.1	20.0	133	49.9	49.5
	Cum. User Mem. (G)	73.2	20.7	108	15.4	1.65
Q86	CPU Time (s)	6.12	3.41	40.54	4.55	5.58s
	Wall Time	6.77m	24.43s	8.74m	15.46s	10.43s
	Peak Mem. (MB)	27.1	7.69	44.1	26.3	17.7
	Cum. User Mem. (G)	62.8	32.0	85.2	15.3	30.5
Q90	CPU Time (s)	1.03	6.97	1.14m	1.39s	1.20s
	Wall Time	11.05s	25.00ms	10.58m	15.13s	9.57s
	Peak Mem. (MB)	9.56	0.64	49.6	11.3	10.1
	Cum. User Mem. (G)	87.8	0.987	97.8	73.0	13.1
Q12	CPU Time (s)	1.62	832.00ms	48.30s	895.00ms	784.00ms
	Wall Time	18.03s	8.20s	7.14m	7.14s	2.18m
	Peak Mem. (MB)	10.3	9.17	74.6	12.9	12.5
	Cum. User Mem. (G)	107	27.6	121	64.0	23.1

TABLE III
PERFORMANCE METRICS FOR QUERIES Q1, Q15, Q86, Q90, AND Q12 (PARTITION 1 VS. PARTITION 2)

	Metric	Partition 1 - N:3	Partition 2 - N:2
Q1	CPU Time (s)	37.70	38.87s
	Wall Time	4.20m	4.14m
	Peak Mem. (MB)	131	100
	Cum. User Mem. (G)	123	45.2
Q15	CPU Time (s)	2.04s	3.01s
	Wall Time	11.11s	23.03s
	Peak Mem. (MB)	49.9	49.5
	Cum. User Mem. (G)	15.4	1.65
Q86	CPU Time (s)	4.55	5.58s
	Wall Time	15.46s	10.43s
	Peak Mem. (MB)	26.3	17.7
	Cum. User Mem. (G)	15.3	30.5
Q90	CPU Time (s)	1.39s	1.20s
	Wall Time	15.13s	9.57s
	Peak Mem. (MB)	11.3	10.1
	Cum. User Mem. (G)	73.0	13.1
Q12	CPU Time (s)	895.00ms	784.00ms
	Wall Time	7.14s	2.18m
	Peak Mem. (MB)	12.9	12.5
	Cum. User Mem. (G)	64.0	23.1

TABLE IV
PERFORMANCE METRICS FOR QUERIES ACROSS DIFFERENT PARTITIONS AND NODE CONFIGURATIONS

	Metric	Prt.1 - N:3	Prt.2 - N:1	Prt.2 - N:2	Prt.2 - N:3
Q1	CPU Time (s)	37.70	2.08s	38.87s	4.01s
	Wall Time	4.20m	9.39s	4.14m	14.02s
	Peak Mem. (MB)	131	14.5	100	19.5
	Cum. User Mem. (G)	123	73.2M	45.2	3.98G
Q15	CPU Time (s)	2.04s	2.93s	3.01s	4.10s
	Wall Time	11.11s	26.74m	23.03s	1.94m
	Peak Mem. (MB)	49.9	31.2	49.5	32.3
	Cum. User Mem. (G)	15.4	47.9G	1.65	7.10G
Q86	CPU Time (s)	4.55	2.97s	5.58s	4.07s
	Wall Time	15.46s	7.44s	10.43s	8.29s
	Peak Mem. (MB)	26.3	6.58	17.7	6.62
	Cum. User Mem. (G)	15.3	50.6M	30.5	2.83G
Q90	CPU Time (s)	1.39s	766.00ms	1.20s	412.00ms
	Wall Time	15.13s	14.18s	9.57s	4.84s
	Peak Mem. (MB)	11.3	2.94	10.1	5.95
	Cum. User Mem. (G)	73.0	88.7M	13.1	24.9G
Q12	CPU Time (s)	895.00ms	983.00ms	784.00ms	1.49s
	Wall Time	7.14s	5.07s	2.18m	3.48s
	Peak Mem. (MB)	12.9	9.17	12.5	9.22
	Cum. User Mem. (G)	64.0	330M	23.1	36.0G

TABLE V
OPTIMIZER METRICS IN RELATION TO PARTITIONING: NUMBER OF SPLITS AND ROWS TRANSFERRED

		q86	q15	q12	q1	q90
Prt.2	splits	4	5	4	6	12
	rows	102K	750K	54.1K	218K	12.7K
Prt.1	splits	6	6	6	12	14
	rows	105.5K	854.2K	80.4K	2.1M	1.3M

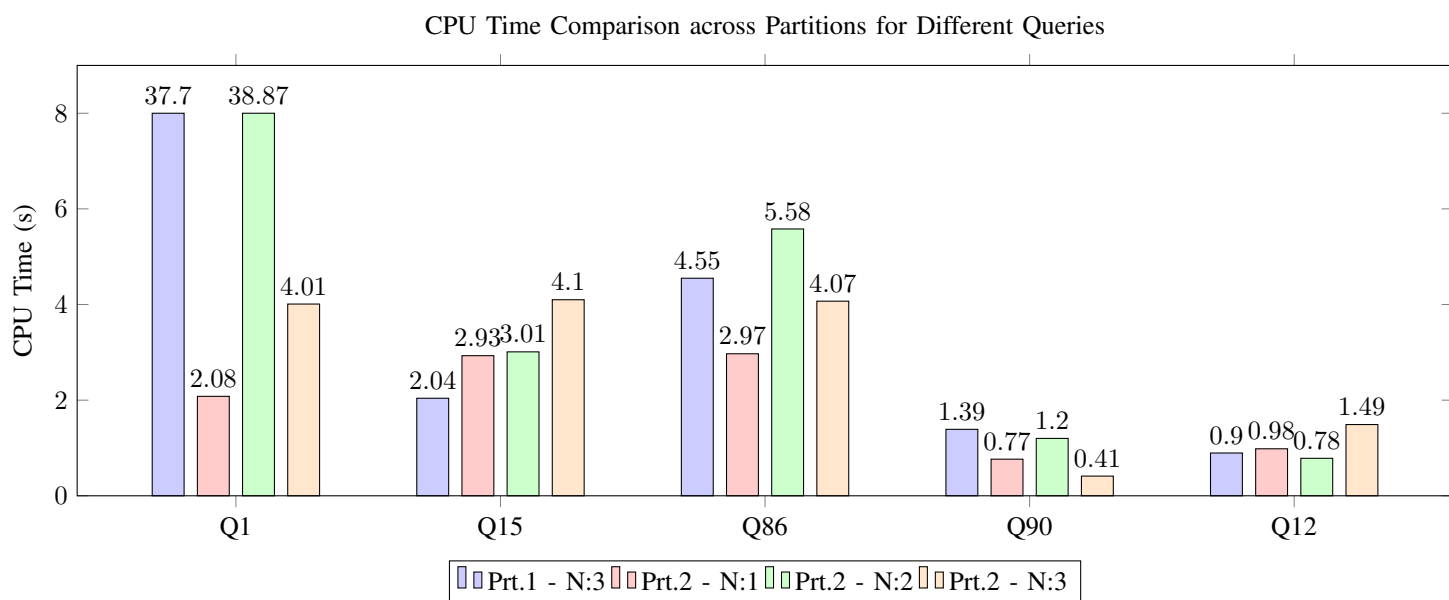


Fig. 5. CPU Time Comparison across Partitions for Queries Q1, Q15, Q86, Q90, and Q12

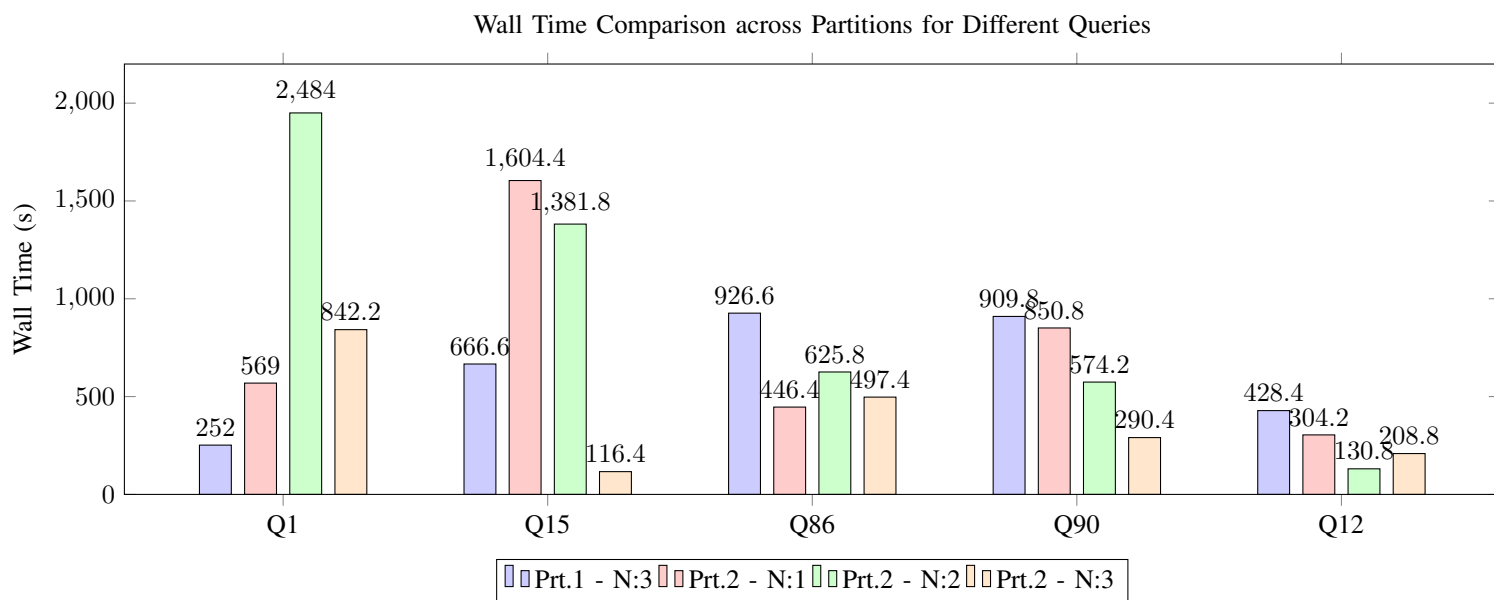


Fig. 6. Wall Time Comparison across Partitions for Queries Q1, Q15, Q86, Q90, and Q12

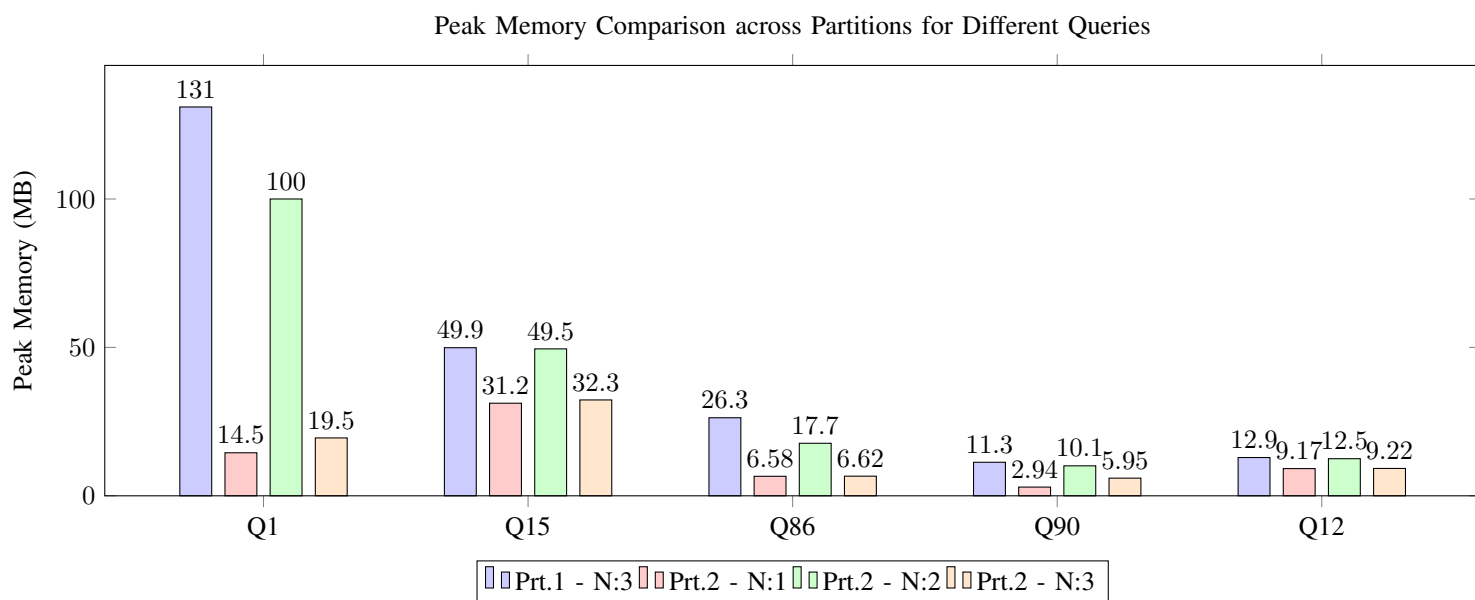


Fig. 7. Peak Memory Comparison across Partitions for Queries Q1, Q15, Q86, Q90, and Q12

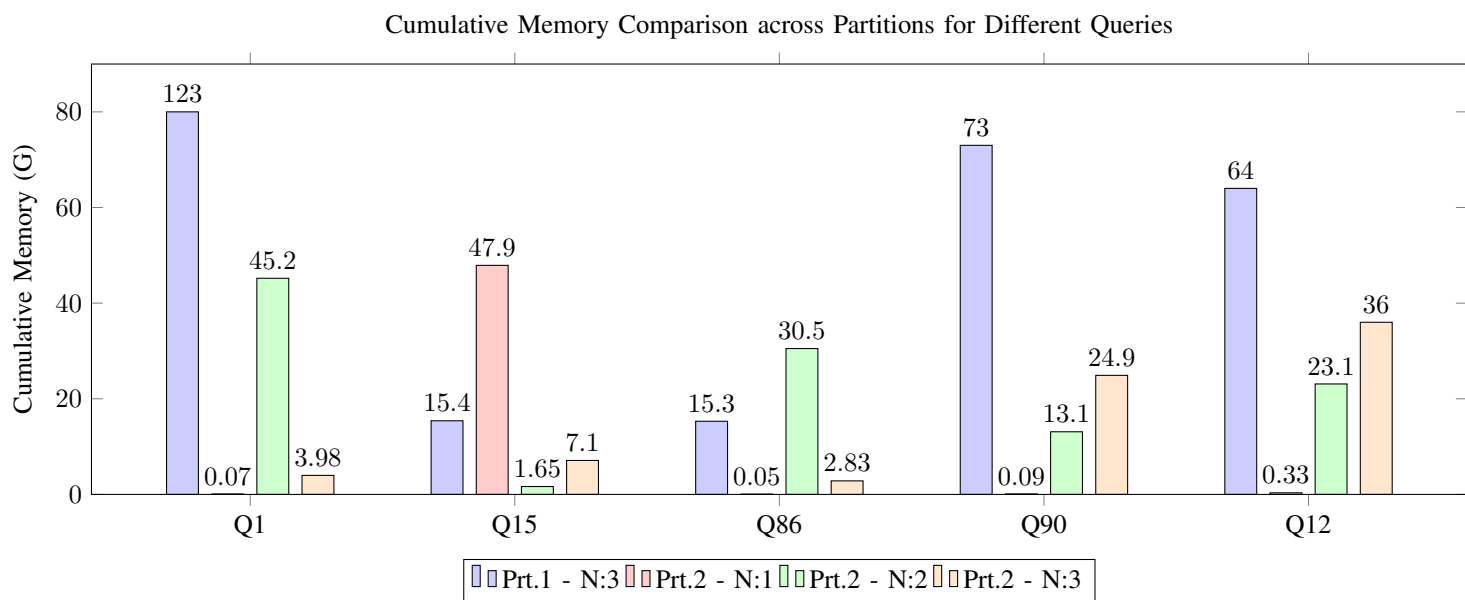


Fig. 8. Cumulative Memory Comparison across Partitions for Queries Q1, Q15, Q86, Q90, and Q12

TABLE VI
PERFORMANCE METRICS FOR QUERIES FOR PARTITIONED AND BROADCASTED JOINS

	Metric	Partitioned	Broadcasted
Q12	CPU Time (s)	2.70	2.62
	Wall Time (s)	14.70	9.77
	Peak Memory (MB)	9.84	8.15
	Cumulative Memory (G)	3.81	0.703
Q15	CPU Time (s)	7.24	5.33
	Wall Time (m)	4.08	3.72
	Peak Memory (MB)	57.9	36.4
	Cumulative Memory (G)	52.1	10.0
Q1	CPU Time (s)	5.35	3.60
	Wall Time (s)	12.62	7.50
	Peak Memory (MB)	30.2	16.1
	Cumulative Memory (G)	32.0	2.37
Q86	CPU Time (s)	4.94	7.29
	Wall Time (s)	5.83	3.45
	Peak Memory (MB)	13.8	7.15
	Cumulative Memory (G)	31.3	21.4
Q90	CPU Time (s)	1.26	0.470
	Wall Time (s)	4.49	6.20
	Peak Memory (MB)	11.0	2.13
	Cumulative Memory (G)	46.4	2.74

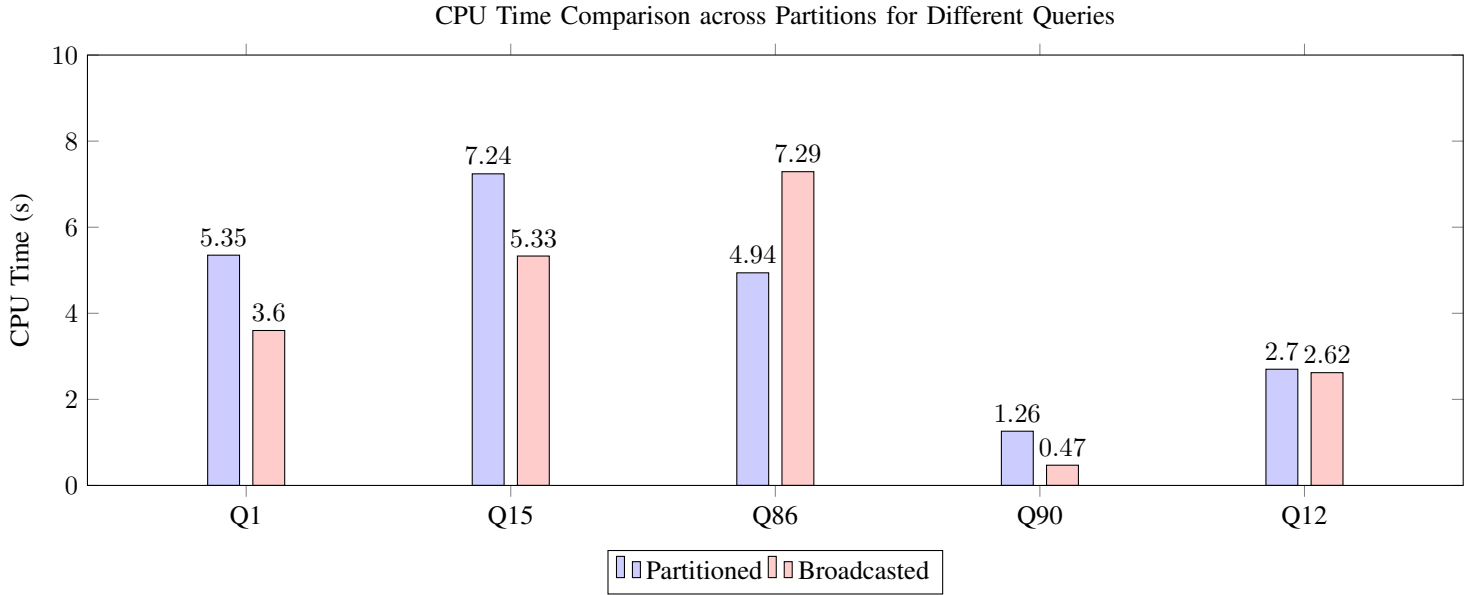


Fig. 9. CPU Time Comparison across Partitions for Queries Q1, Q15, Q86, Q90, and Q12

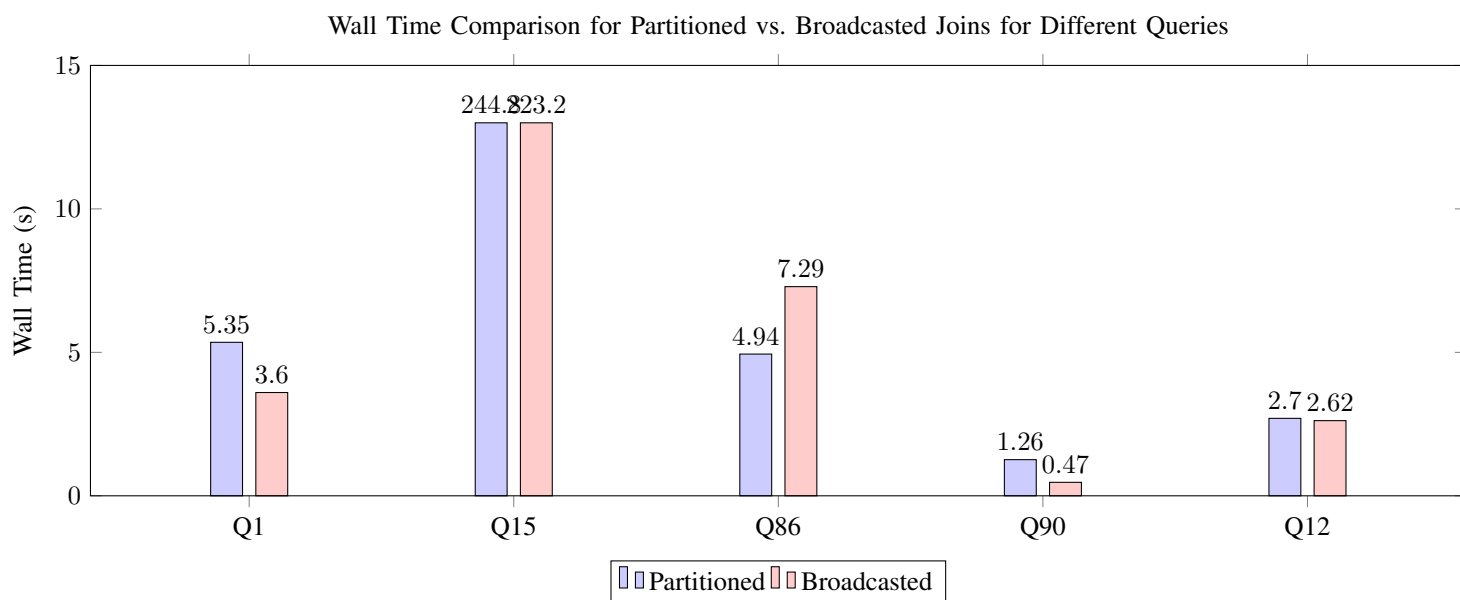


Fig. 10. Wall Time Comparison for Partitioned vs. Broadcasted Joins for Queries Q1, Q15, Q86, Q90, and Q12

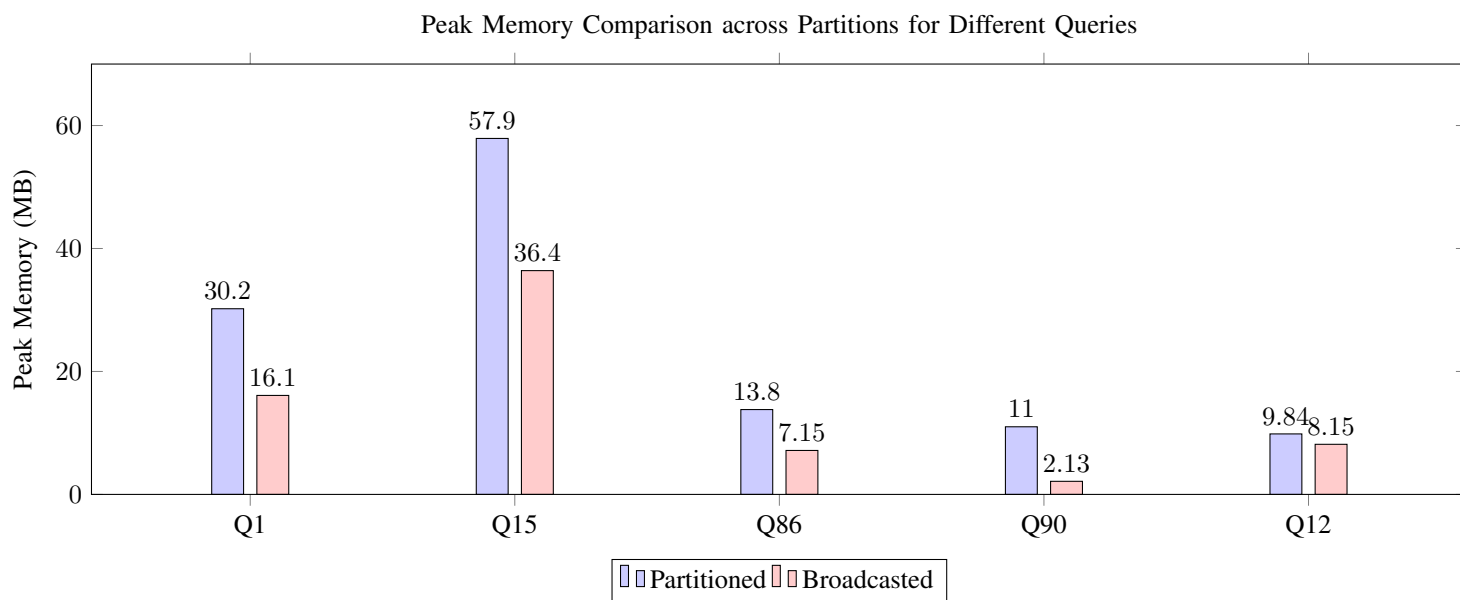


Fig. 11. Peak Memory Comparison across Partitions for Queries Q1, Q15, Q86, Q90, and Q12

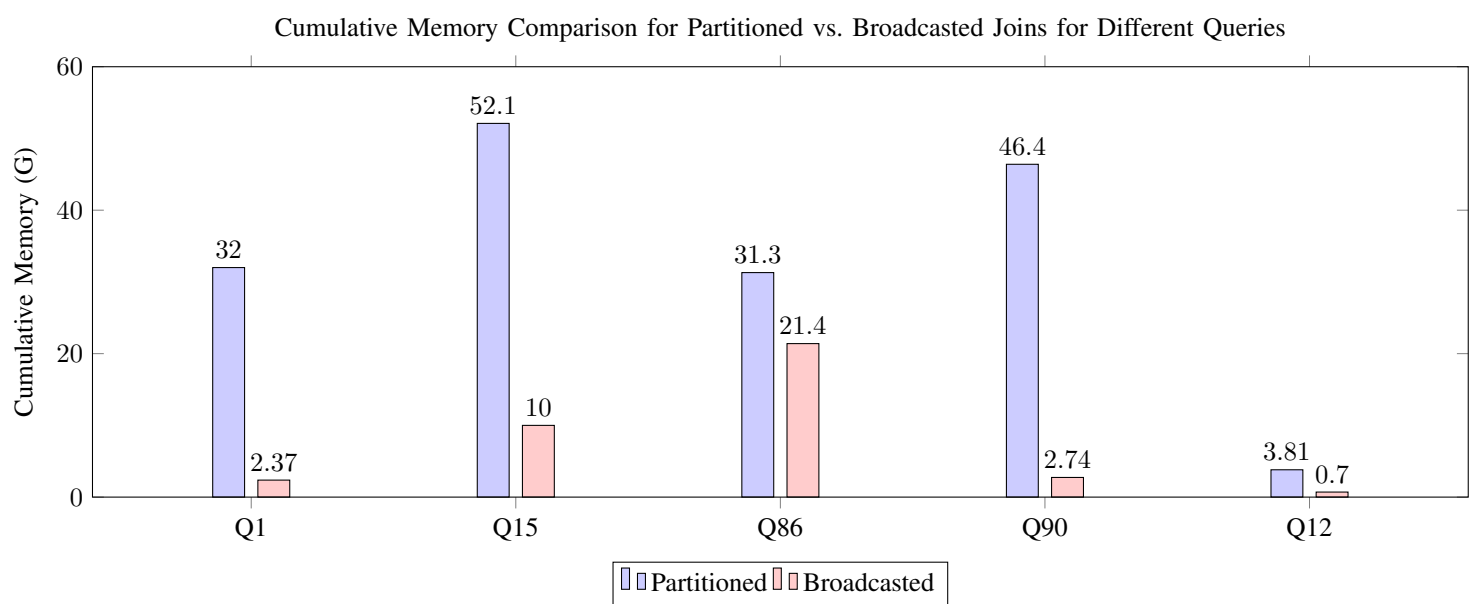


Fig. 12. Cumulative Memory Comparison for Partitioned vs. Broadcasted Joins for Queries Q1, Q15, Q86, Q90, and Q12