

PA-2

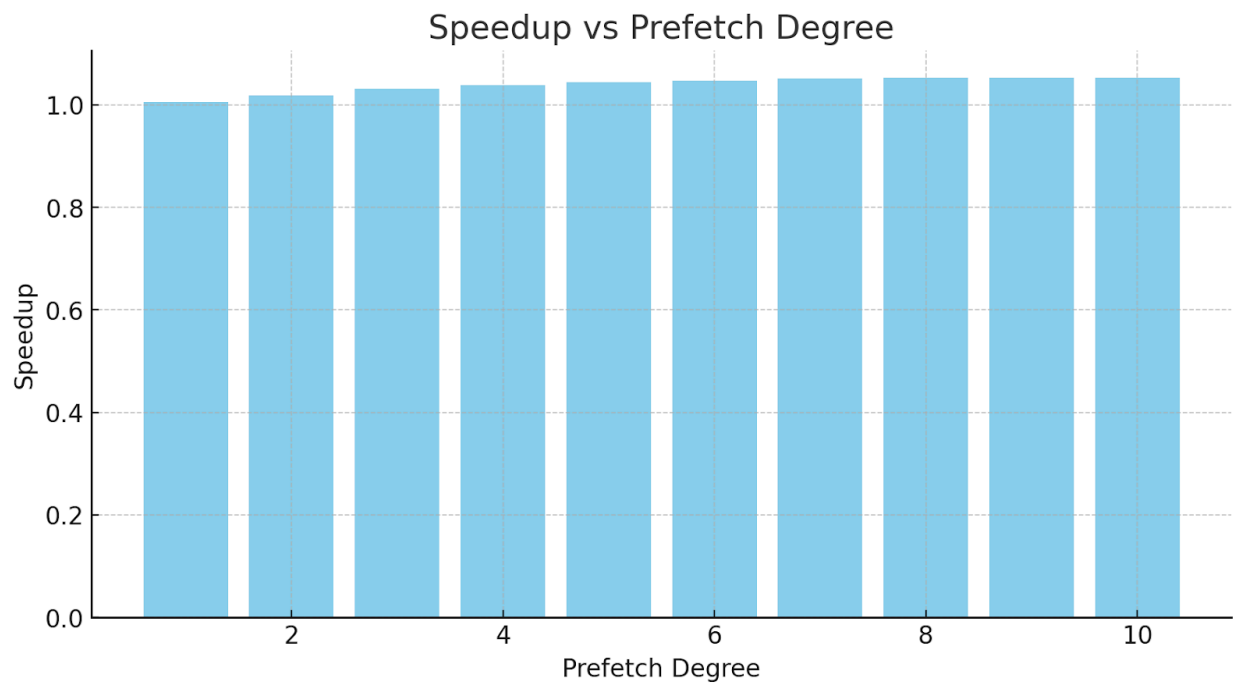
Task 1

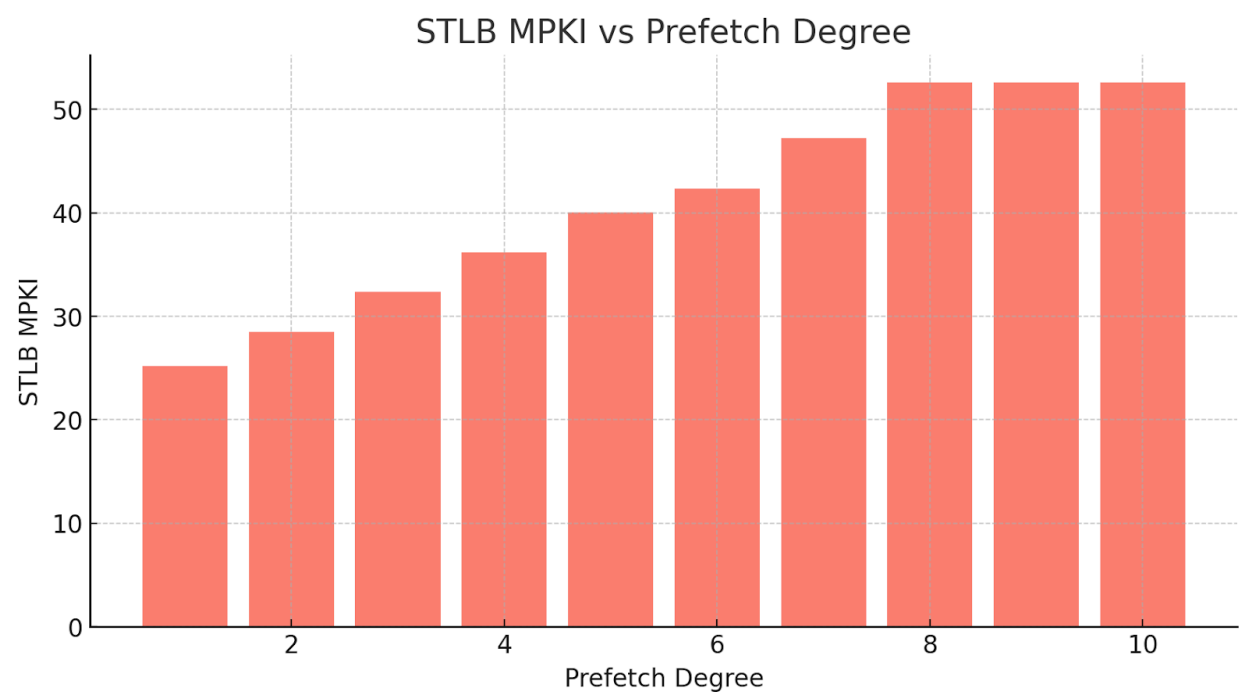
Implementation:

Process:

For TLB access , we see which TLB accesses are missed (when page accessed for the first time) . We take the page offset from that and do prefetch based on these offsets similar to ip_stride mechanism but instead of cl_offset we see here page_offset of pages.

Comparisons:





Prefetch Degree	IPC	STLB MPKI	Speedup
Baseline	0.282799	22.4811	1.000
1	0.284367	25.1648	1.006
2	0.287920	28.4719	1.018
3	0.291642	32.3515	1.031
4	0.293583	36.1390	1.038
5	0.295216	40.0473	1.044
6	0.295978	42.3192	1.047
7	0.297238	47.2113	1.051
8	0.297865	52.6114	1.053
9	0.297865	52.6114	1.053
10	0.297865	52.6114	1.053

Task-2:

Implementation:

IP Stride Prefetcher:

- **Tracker Components:**
 - Maintains a table with:
 - IP address.
 - Last accessed cache line (cl_offset).
 - Stride between consecutive cache accesses.
 - Confidence value to track stride accuracy.

- **Prefetching Mechanism:**
 - Prefetches are initiated when the same stride is observed for two consecutive accesses.
 - The prefetcher issues prefetch requests using the detected stride.
 - Prefetching is done up to a pre-configured *prefetch degree* (5 in this case).

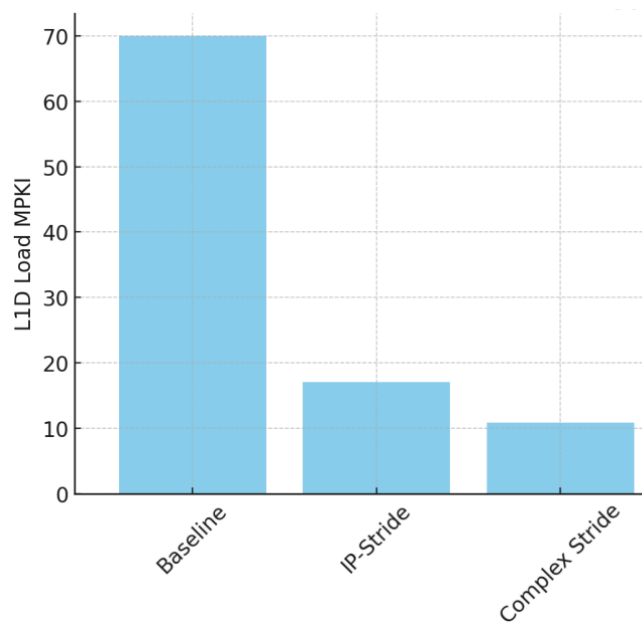
Complex Stride Prefetcher:

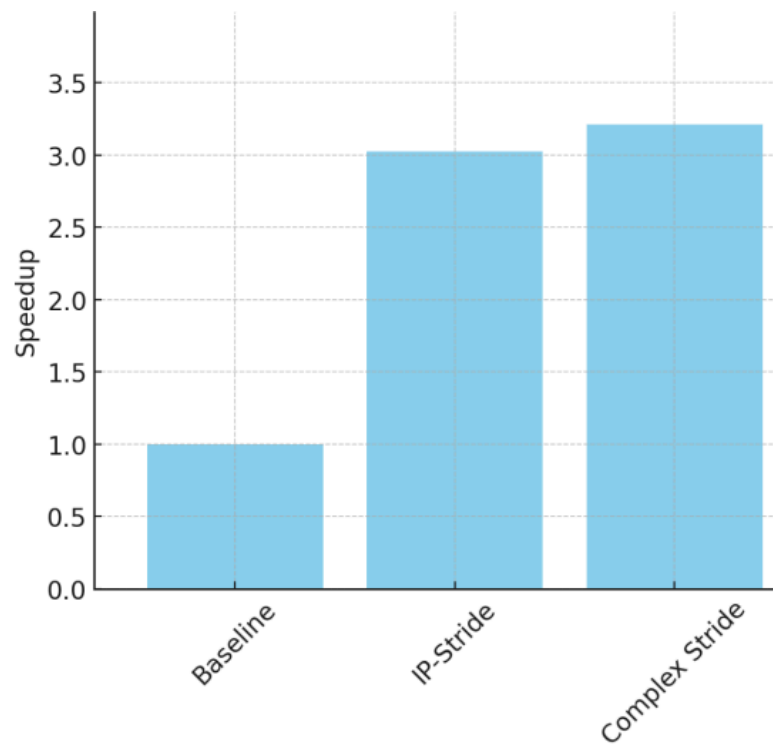
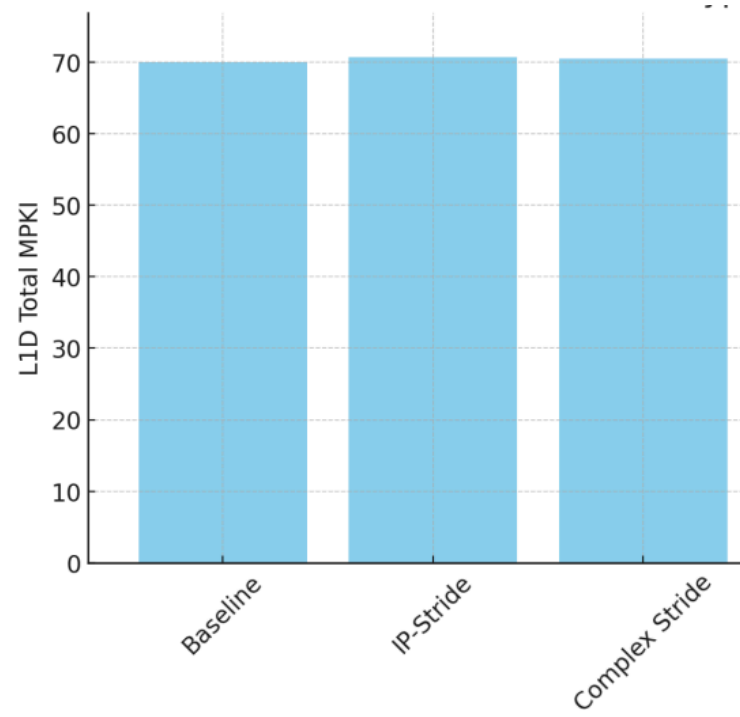
- **Two Tables Structure:**
 - **IP Table:**
 - Contains the instruction pointer (IP) and the last cache line offset.
 - Tracks a *signature* generated by hashing previous strides.
 - **Complex (CPLX) Stride Table:**
 - Indexed by the signature generated from the IP Table.
 - Stores the expected stride and a confidence value associated with that signature.

- **Prefetching Mechanism:**

- When the same stride is detected for two consecutive accesses for a particular signature, the prefetcher becomes confident enough to prefetch.
- Prefetches up to the *prefetch degree* based on the learned stride.
- Prefetch requests are issued only if the prefetch address belongs to the same 4 KB page as the current demand access

Comparisons:





Type	IPC	L1D Total MPKI	L1D Load MPKI	Speedup
Baseline	0.097744	69.9934	69.9647	1.000
IP-Stride	0.295668	70.6938	17.0266	3.025
Complex Stride	0.314003	70.5300	10.8716	3.213

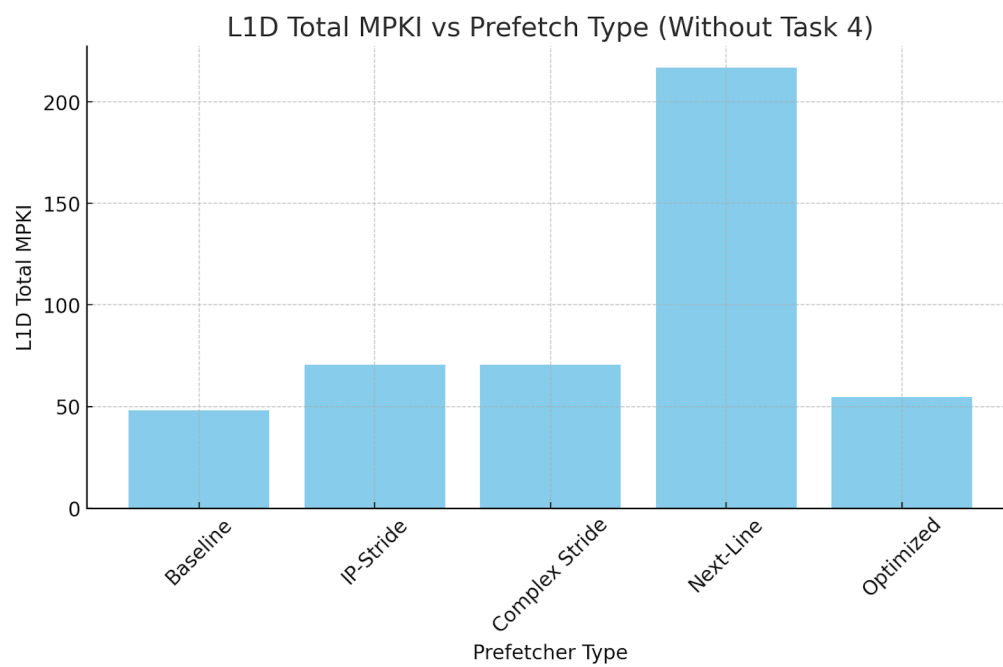
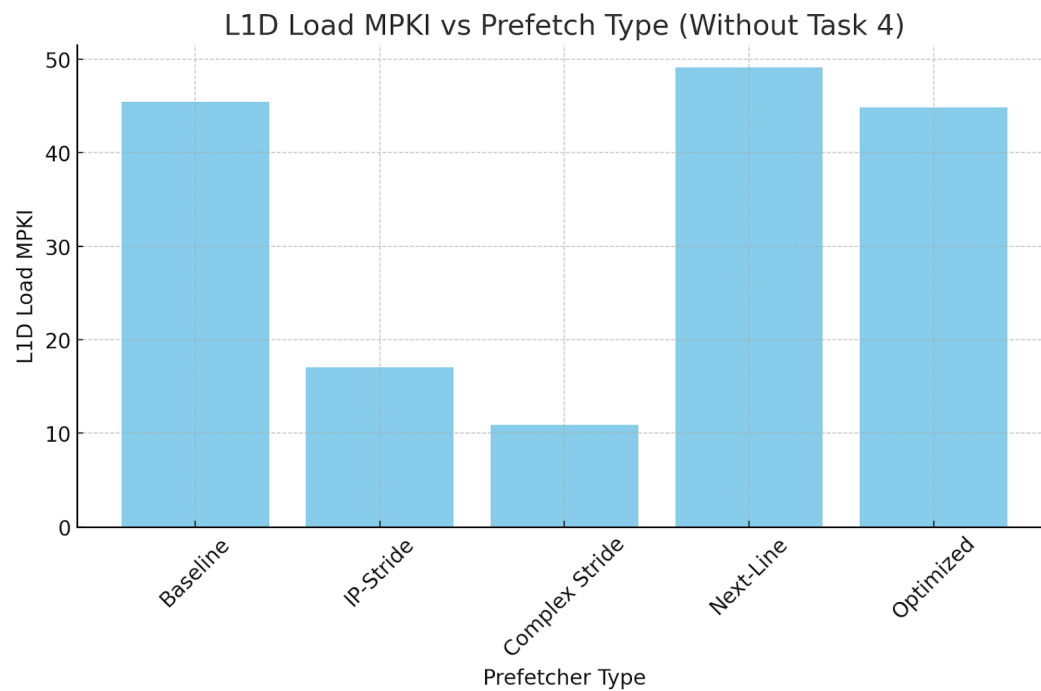
Task-3:

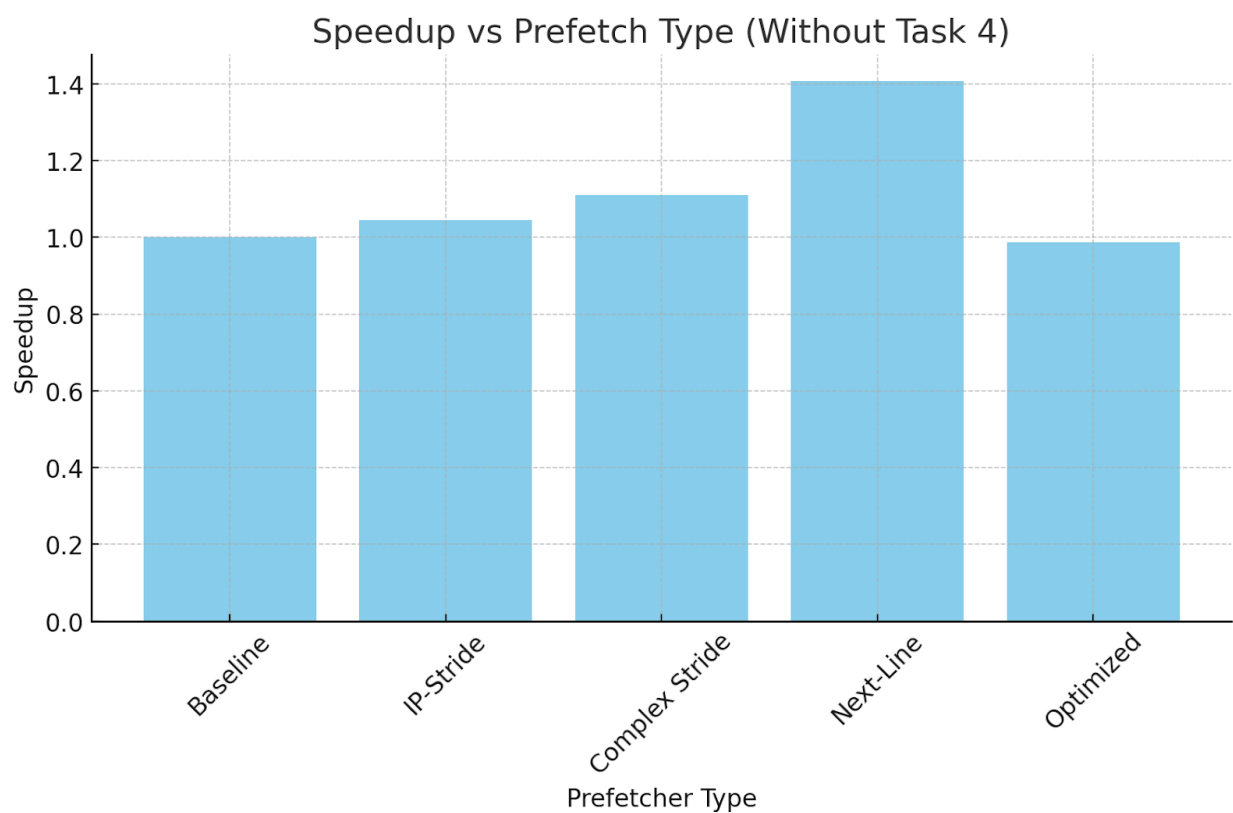
Implementation:

In this task we check the accuracy of 3 prefetchers (NEXT LINE , IP STRIDE,Complex Stride) for particular PHASE LENGTH(10000) that for each prefetcher we measure its accuracy after PHASE LENGTH number of prefetch_line requests done by each prefetcher and measure prefetch accuracy of these and use the prefetcher which has the highest prefetch accuracy for the rest of the time.

Comparisons:

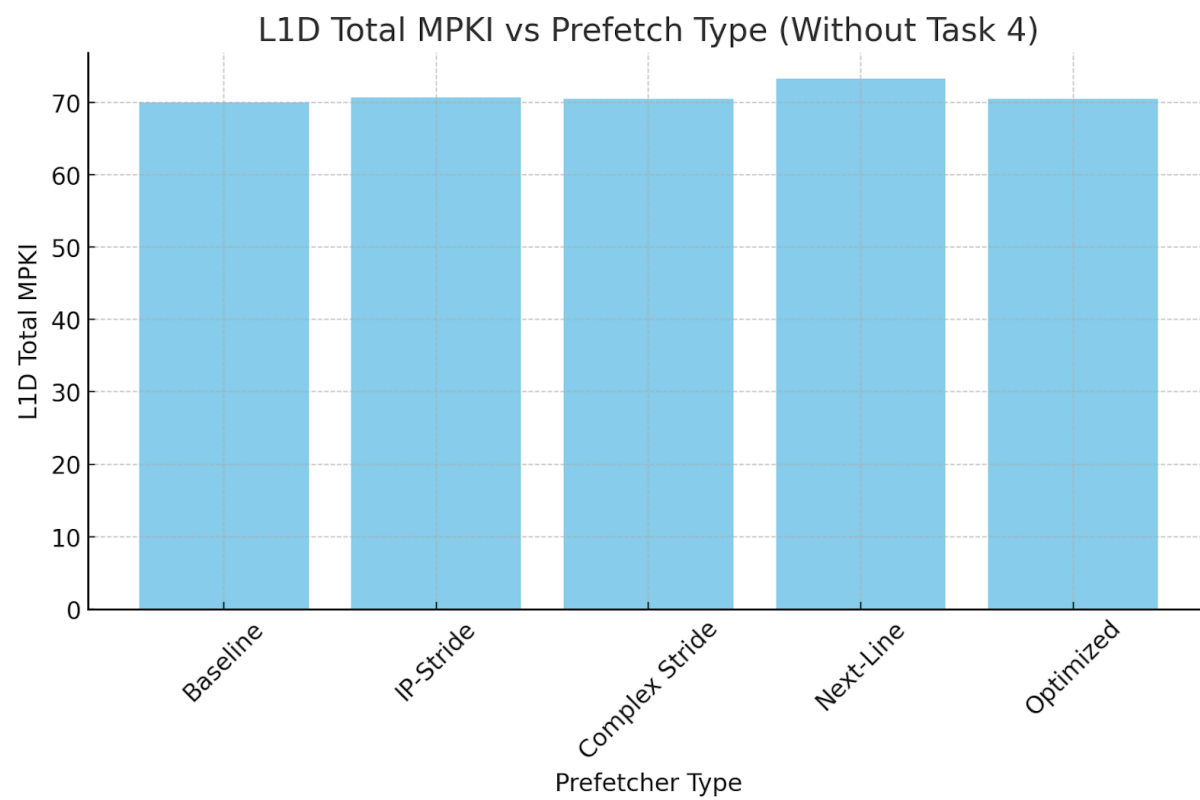
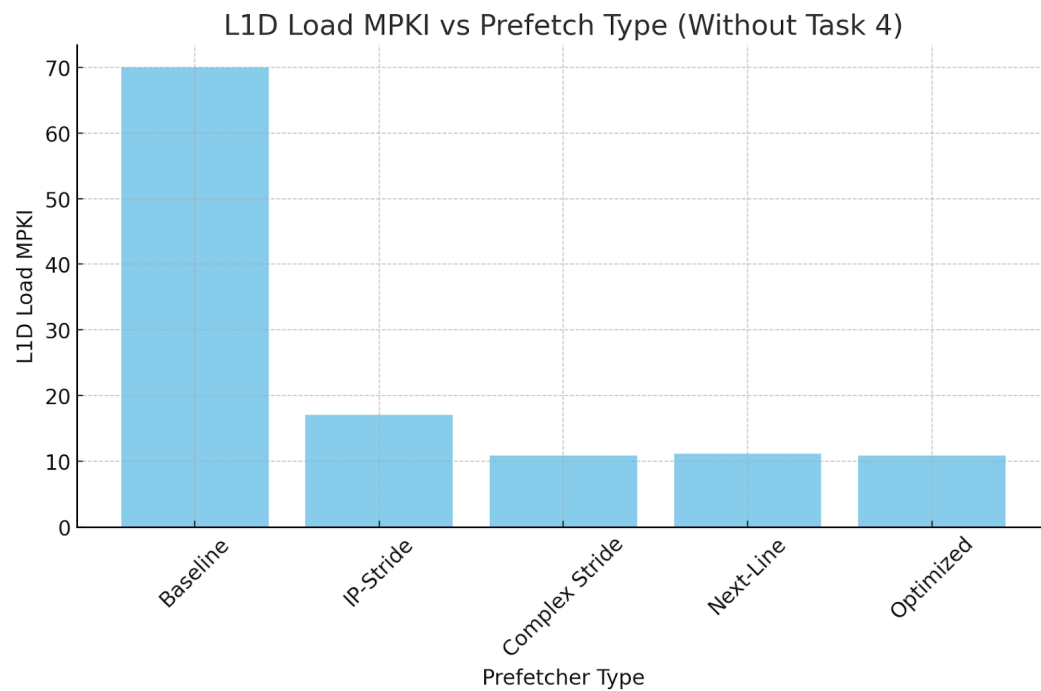
Trace1:

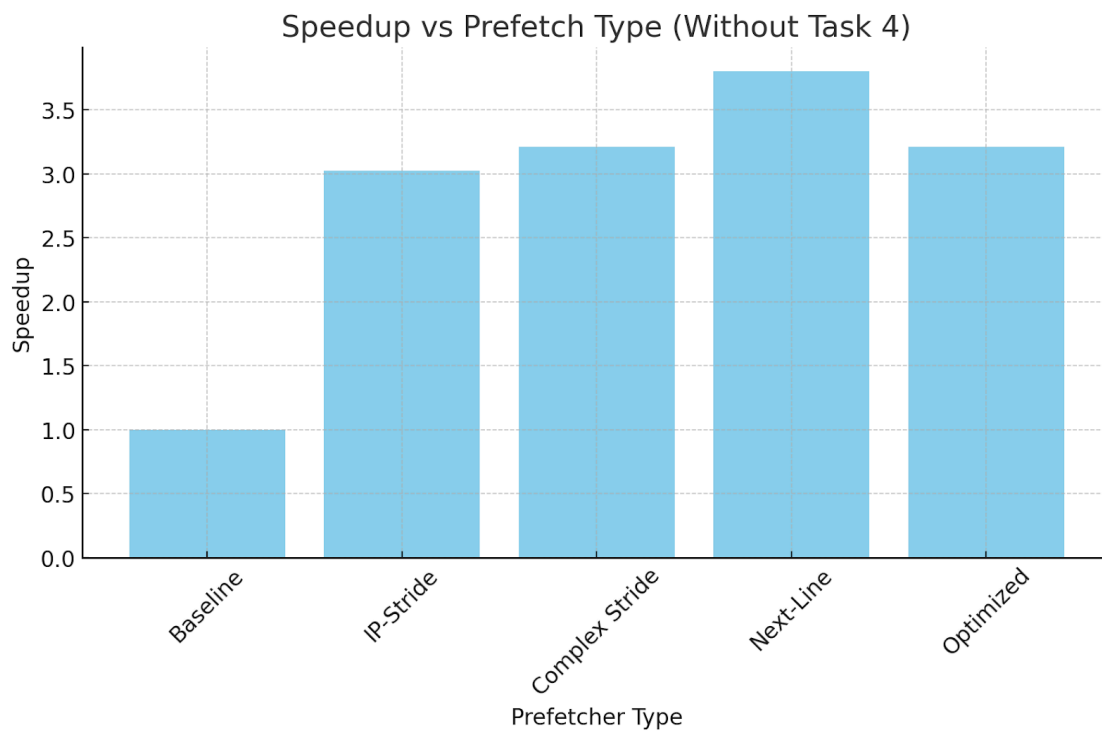




Type	IPC	L1D Total MPKI	L1D Load MPKI	Speedup
Baseline	0.282799	48.2100	45.4355	1.000
IP-Stride	0.295668	70.6938	17.0266	1.046
Complex Stride	0.314003	70.5300	10.8716	1.110
Next-Line	0.397688	216.7270	49.1029	1.406
Optimized	0.279074	54.5036	44.8727	0.987

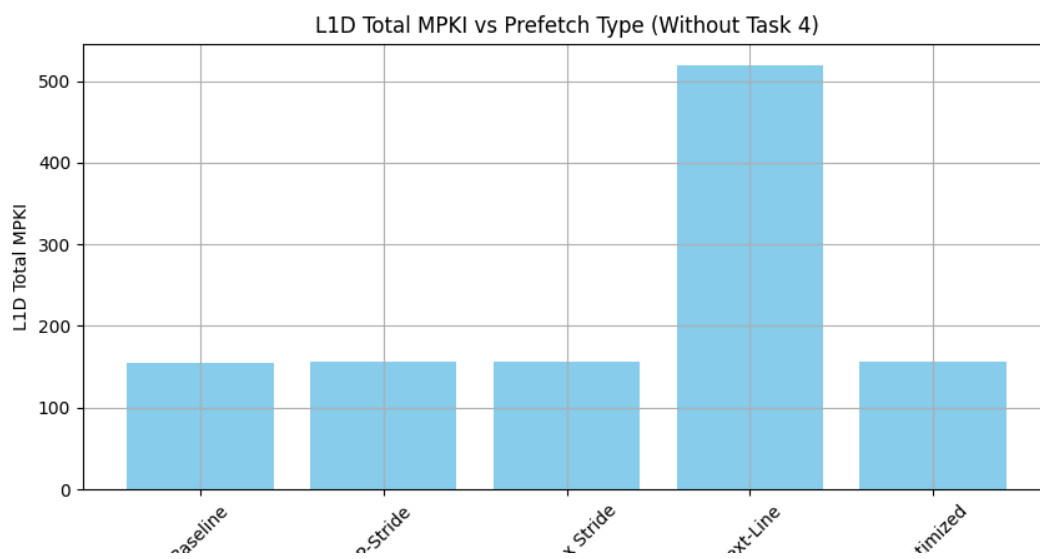
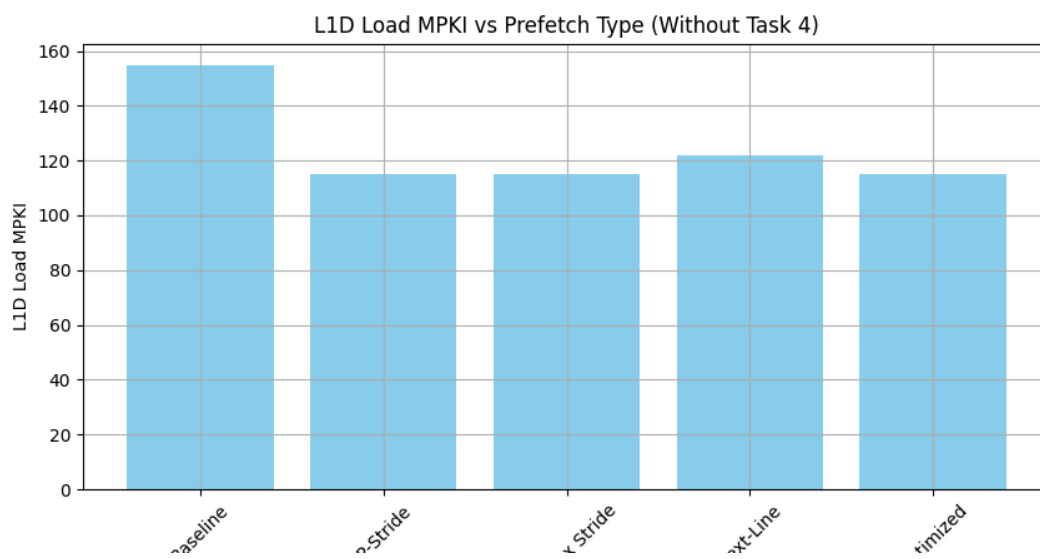
Trace2:





Type	IPC	L1D Total MPKI	L1D Load MPKI	Speedup
Baseline	0.097744	69.9934	69.9647	1.000
IP-Stride	0.295668	70.6938	17.0266	3.025
Complex Stride	0.314003	70.5300	10.8716	3.213
Next-Line	0.371488	73.2590	11.1521	3.801
Optimized	0.313937	70.5337	10.8831	3.212

Trace-3:



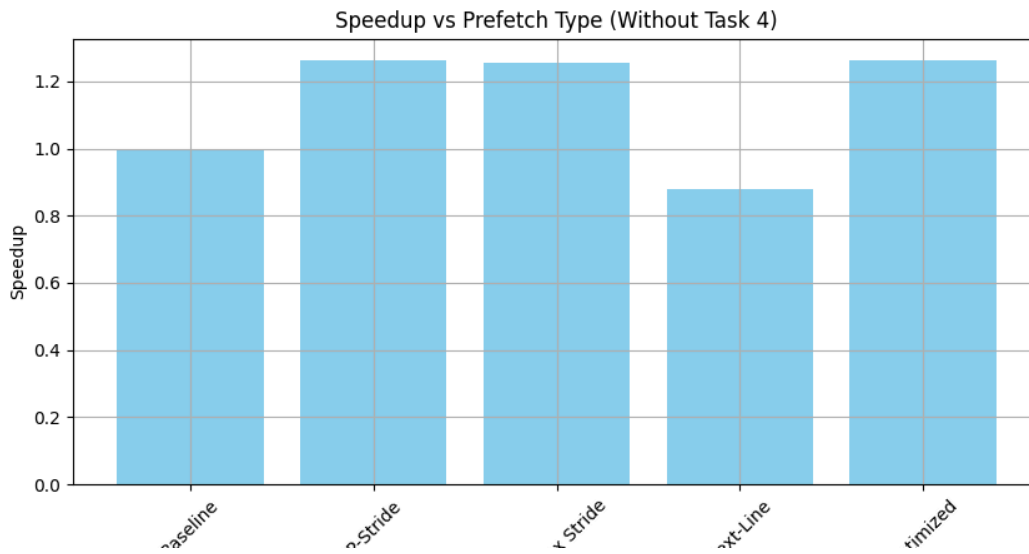


Table without Task 4

Type	IPC	L1D Total MPKI	L1D Load MPKI	Speedup
Baseline	0.14018	155.279	154.963	1.0
IP-Stride	0.177263	155.919	115.029	1.264538450563561
Complex Stride	0.176104	156.314	115.213	1.2562705093451279
Next-Line	0.123355	519.913	121.98	0.8799757454701099
Optimized	0.177012	156.075	115.035	1.2627478955628477

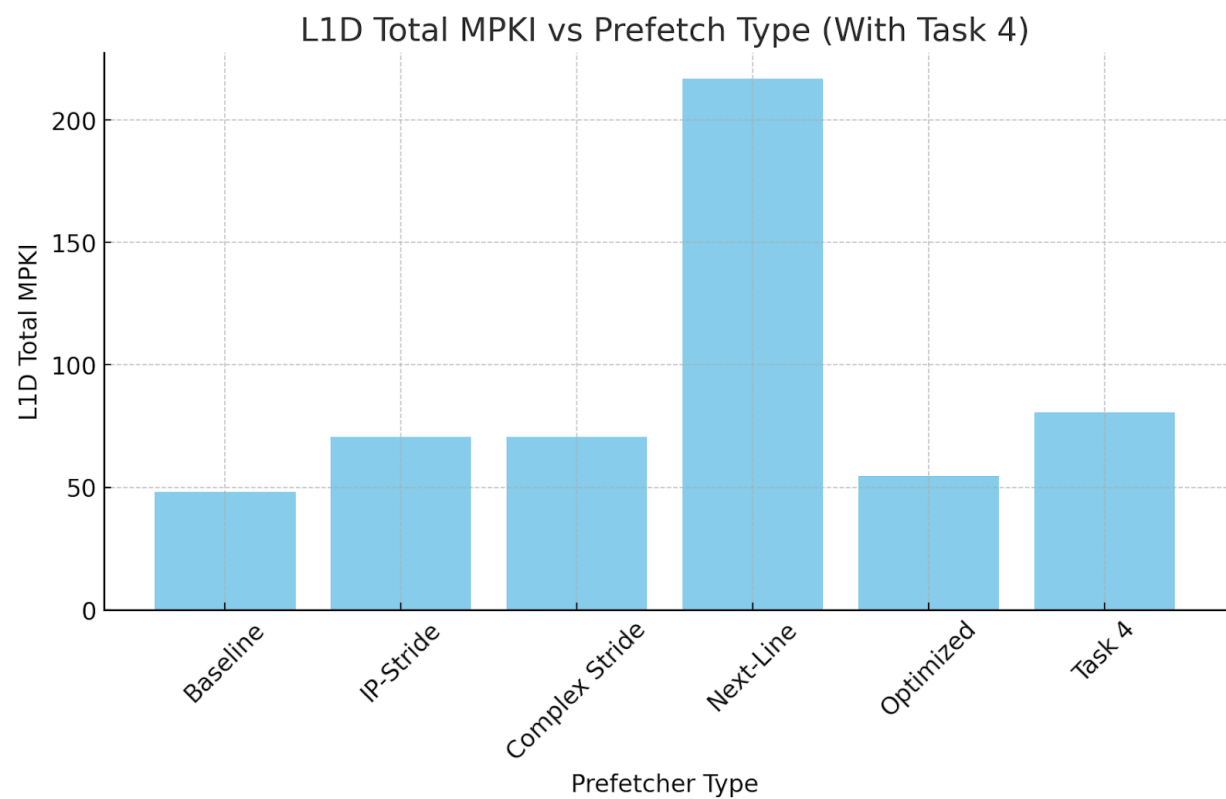
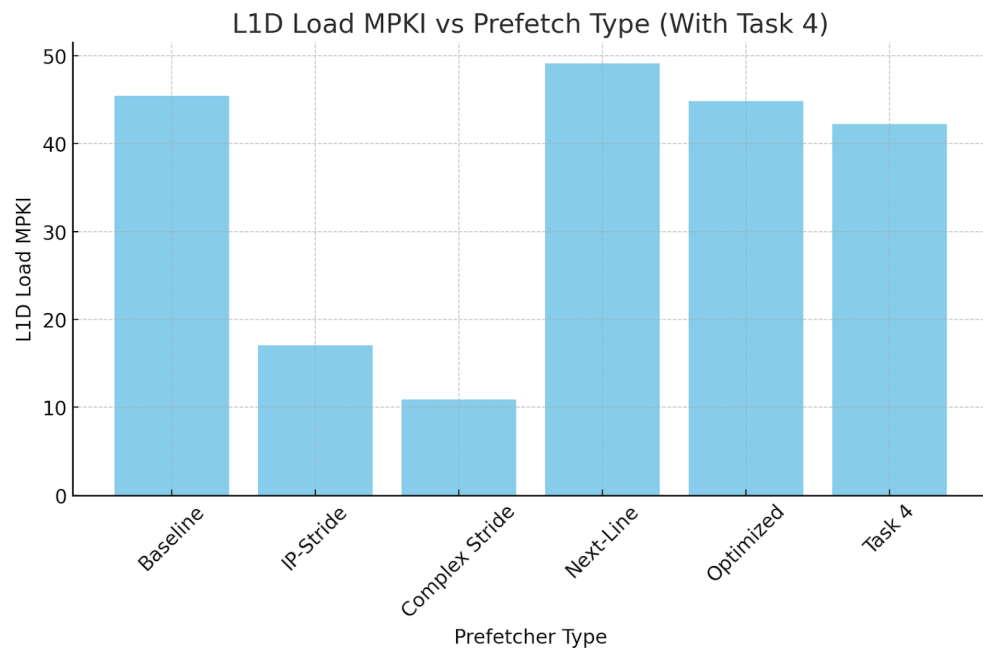
Task-4:

Implementation:

For this part we combined the optimized prefetcher for L1D and ASP prefetcher for STL

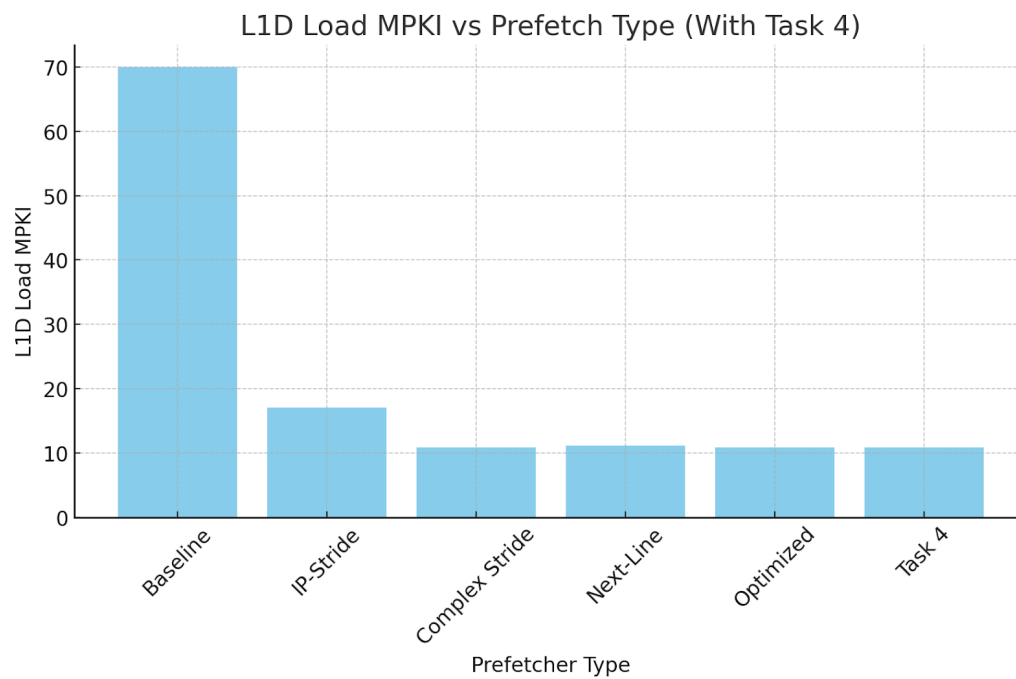
Comparisons:

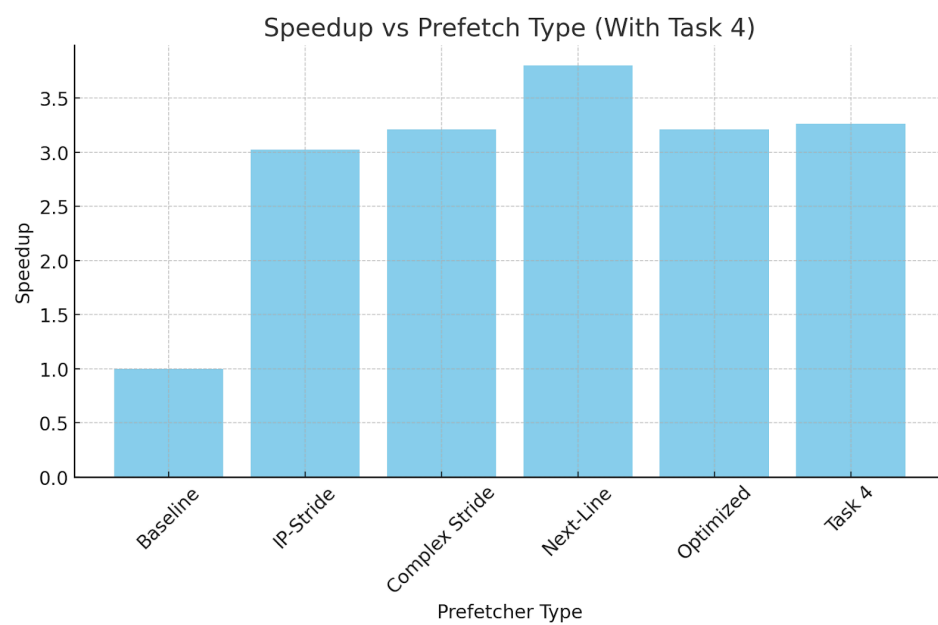
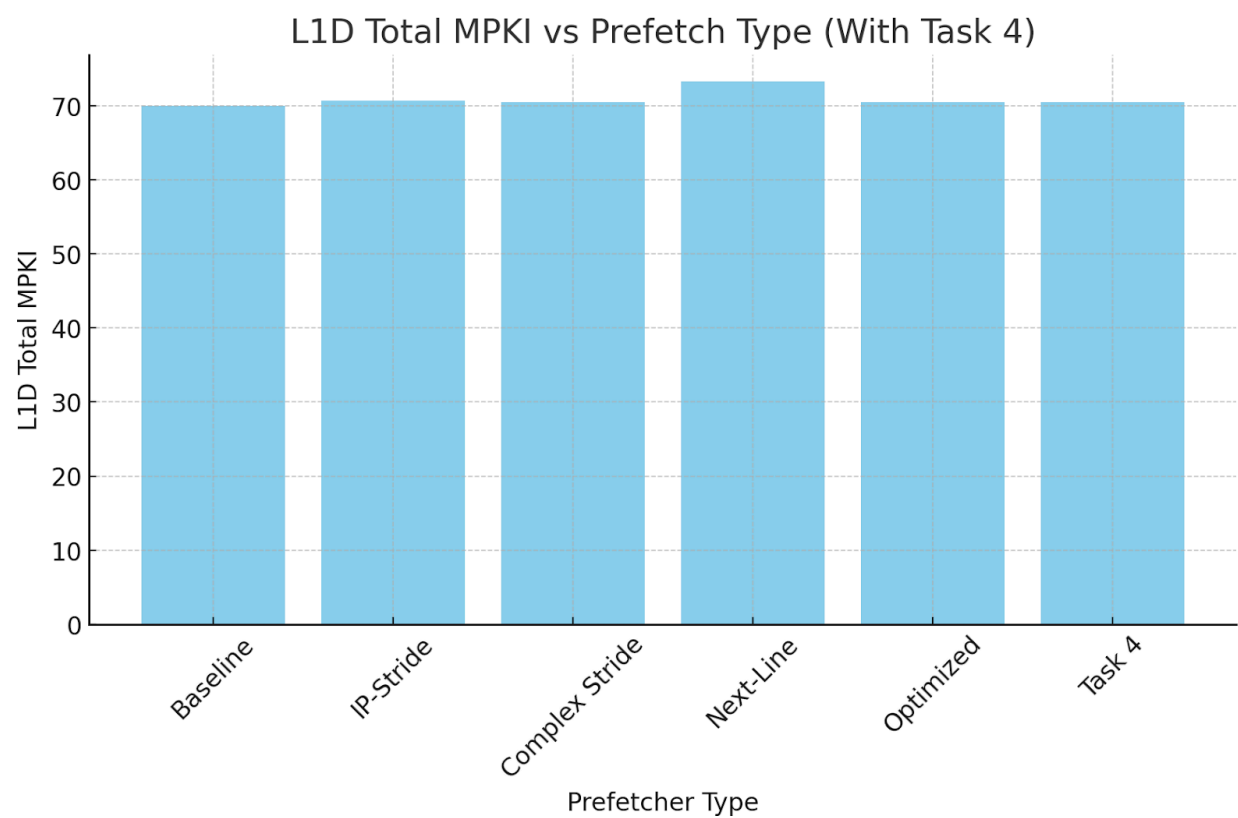
Trace1:



Type	IPC	L1D Total MPKI	L1D Load MPKI	Speedup
Baseline	0.282799	48.2100	45.4355	1.000
IP-Stride	0.295668	70.6938	17.0266	1.046
Complex Stride	0.314003	70.5300	10.8716	1.110
Next-Line	0.397688	216.7270	49.1029	1.406
Optimized	0.279074	54.5036	44.8727	0.987
Task 4	0.296746	80.6840	42.2118	1.049

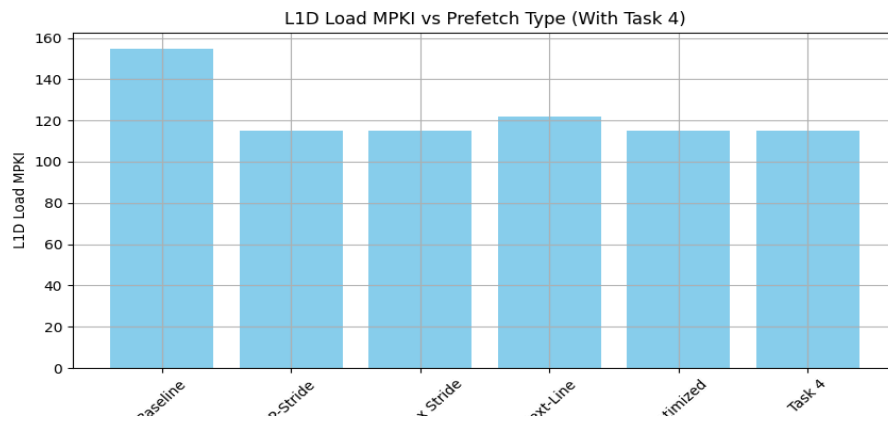
Trace2:





Type	IPC	L1D Total MPKI	L1D Load MPKI	Speedup
Baseline	0.097744	69.9934	69.9647	1.000
IP-Stride	0.295668	70.6938	17.0266	3.025
Complex Stride	0.314003	70.5300	10.8716	3.213
Next-Line	0.371488	73.2590	11.1521	3.801
Optimized	0.313937	70.5337	10.8831	3.212
Task 4	0.319107	70.5371	10.8080	3.265

Trace3:



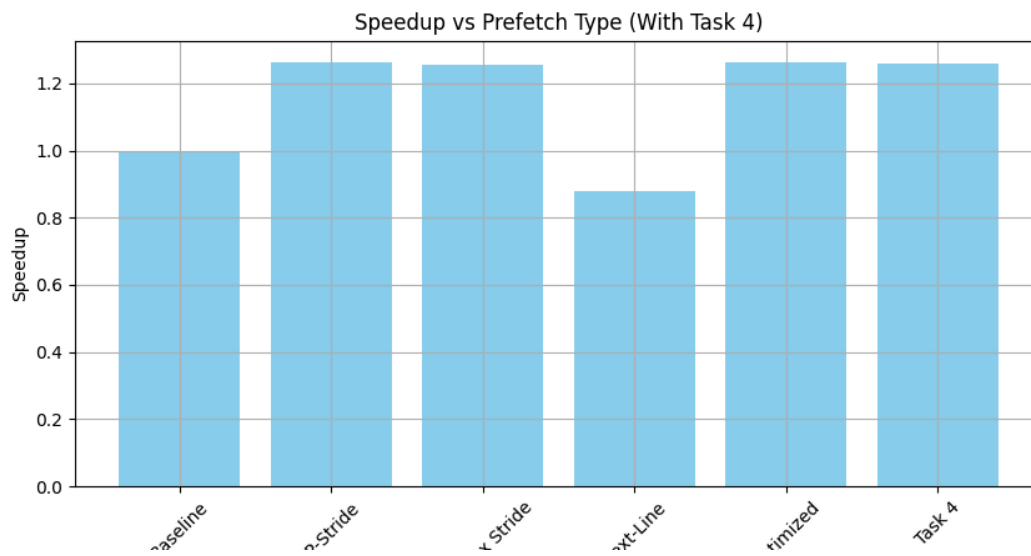
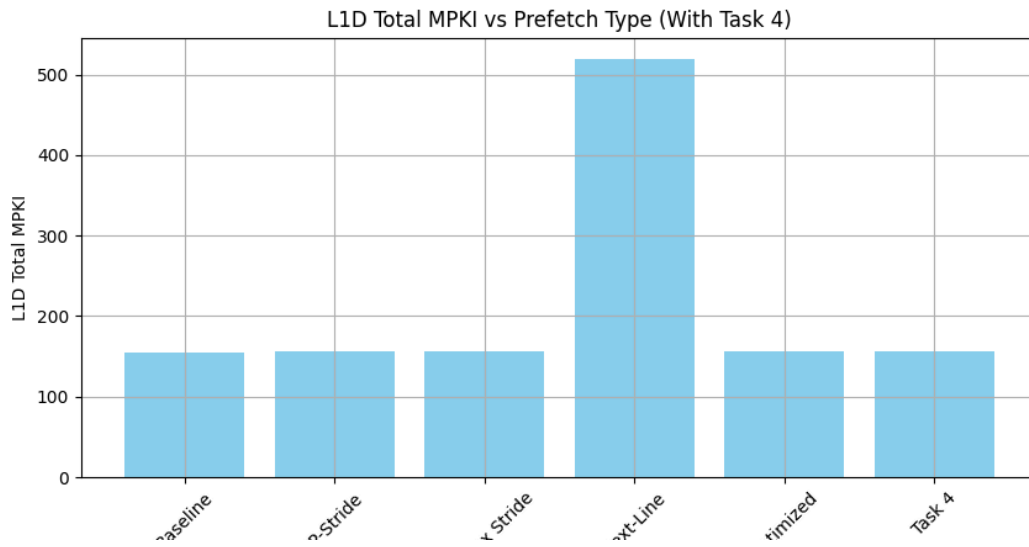


Table with Task 4

Type	IPC	L1D Total MPKI	L1D Load MPKI	Speedup
Baseline	0.14018	155.279	154.963	1.0
IP-Stride	0.177263	155.919	115.029	1.264538450563561
Complex Stride	0.176104	156.314	115.213	1.2562705093451279
Next-Line	0.123355	519.913	121.98	0.8799757454701099
Optimized	0.177012	156.075	115.035	1.2627478955628477
Task 4	0.176681	156.478	114.954	1.2603866457411899