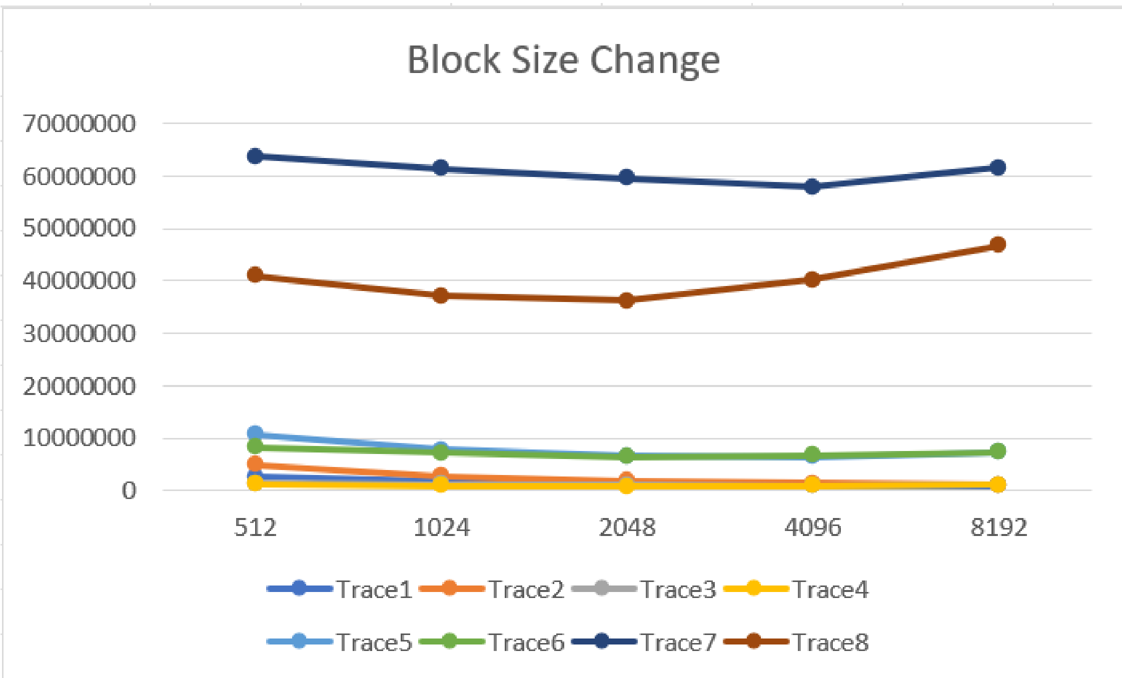
ASSIGNMENT 3

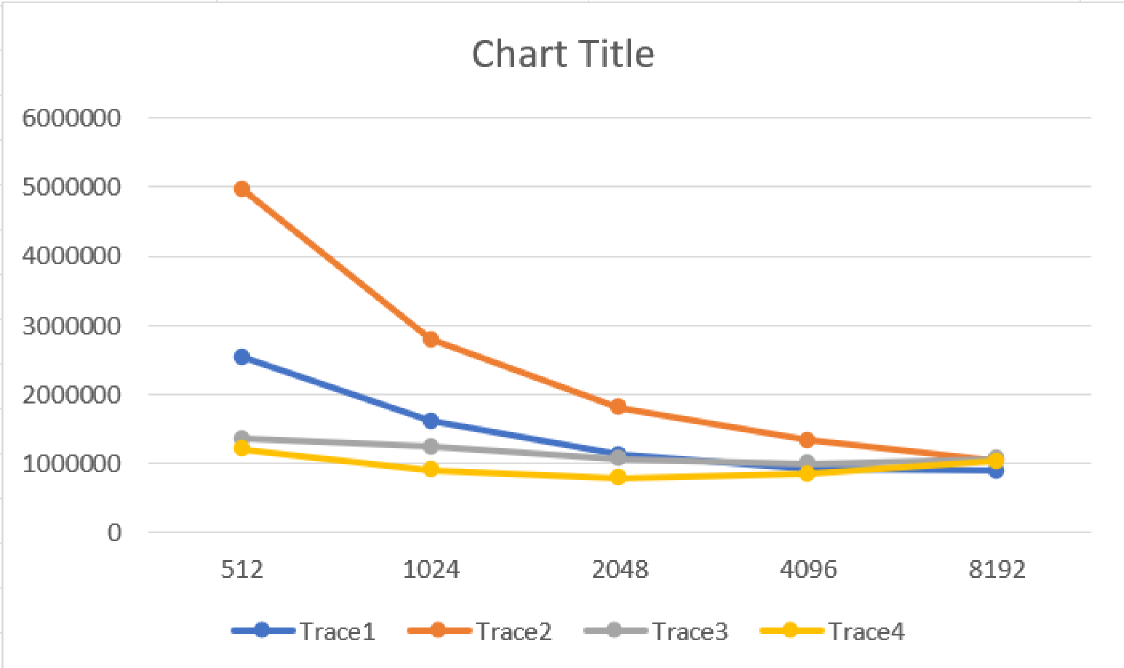
Rishit Singla(2021CS10547)

Achyut Salunkhe(2021CS10121)

1. Block Change

trace no.	8	16	32	64	128
1	2537100	1611560	1127900	915740	892360
2	4965420	2785660	1811820	1330500	1044380
3	1359520	1234560	1062900	998540	1061360
4	1204560	901560	792920	848880	1030420
5	10772600	7866320	6594200	6433860	7386000
6	8220940	7164900	6500640	6706500	7321600
7	63707360	61503140	59634940	57948460	61592220
8	40992140	37158140	36207620	40135320	46784200

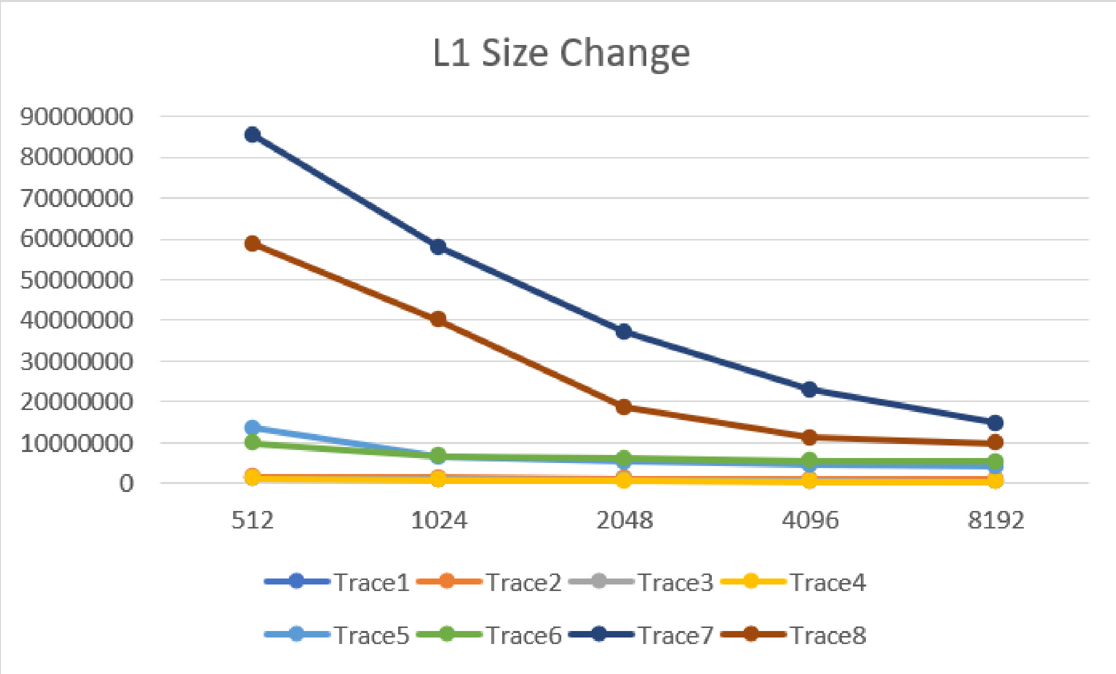


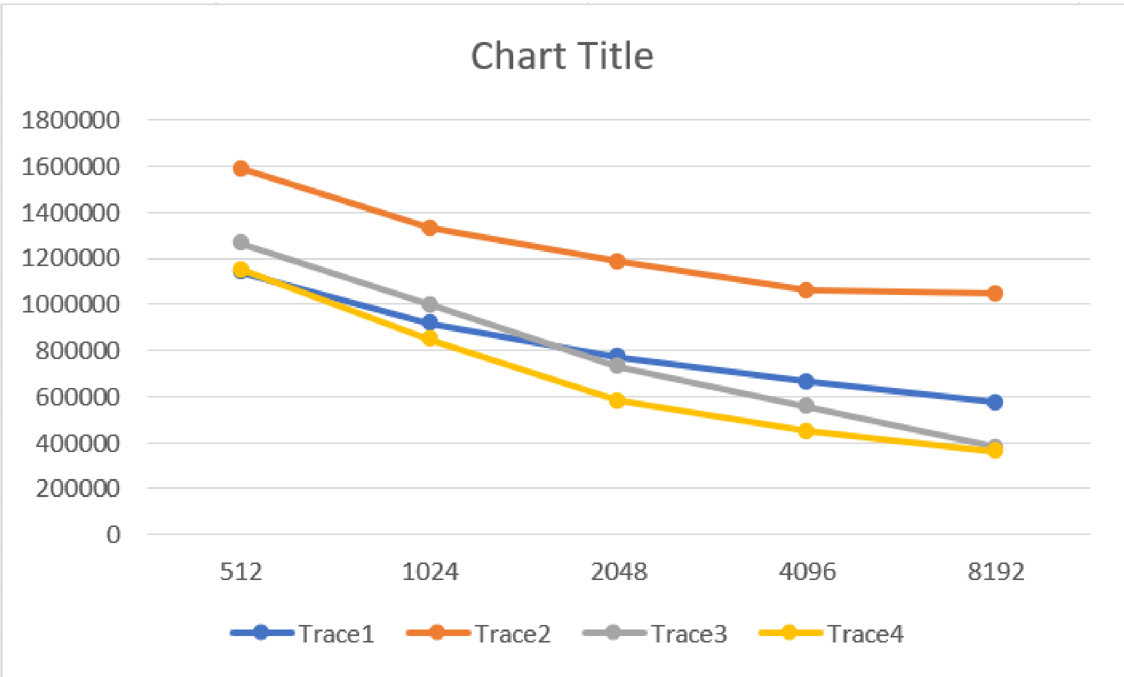


As Block size increases, the cache uses more spacial locality, i.e., more data is retrieved from memory as a single block which is likely to be accessed soon. By fetching more data, we avoid fetching it again when needed later (avoiding misses), thus reducing the time. This can be interpreted from all 8 traces and more prominently from the first 4 traces (small data). For larger data files (last 4 traces) it can also be observed that after a minimum time, the average access time increases with block size. This is because the larger the block size is lesser will be the number of blocks the cache can hold at a time. This leads to more city misses and thus increases the time. The increasing slope (if the slope is considered with the sign) of the graph with increasing block size is also a result of these increasing ng capacity misses.

2. L1 Size Change:

trace no.	512	1024	2048	4096	8192
1	1141280	915740	769680	665300	573820
2	1587680	1330500	1184620	1058120	1046840
3	1263760	998540	730120	556180	377680
4	1149600	848880	581480	447540	361900
5	13614080	6433860	5212780	4473920	4046280
6	9872940	6706500	6124480	5562900	5402980
7	85373840	57948460	37192640	22896880	14806620
8	58819680	40135320	18687360	11130400	9805480



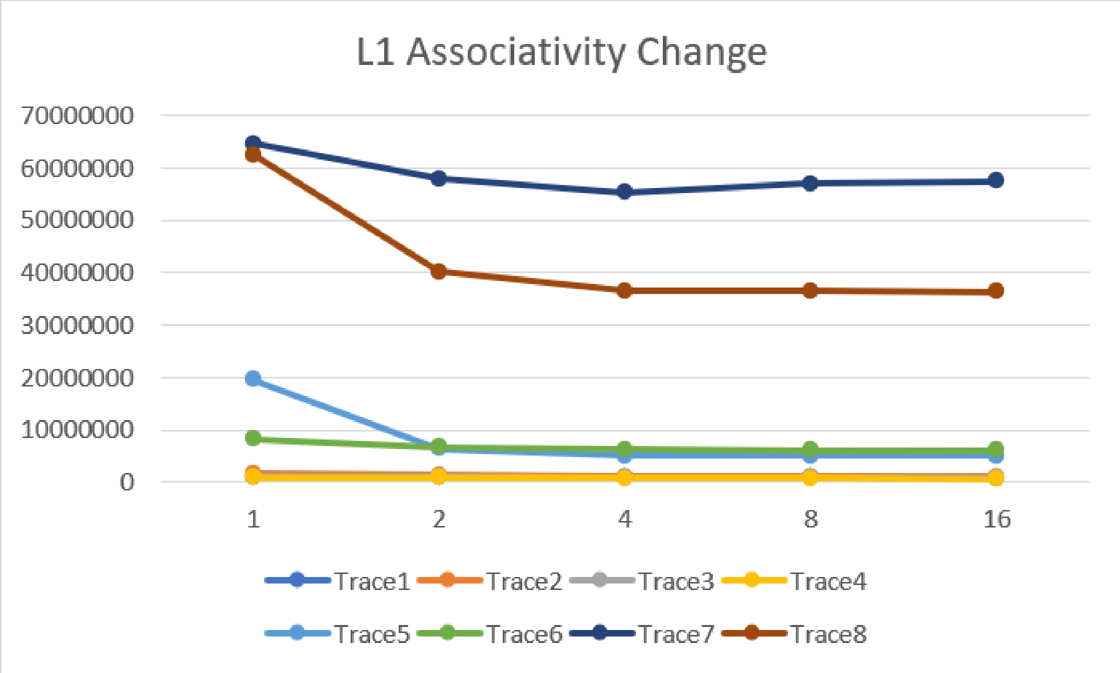


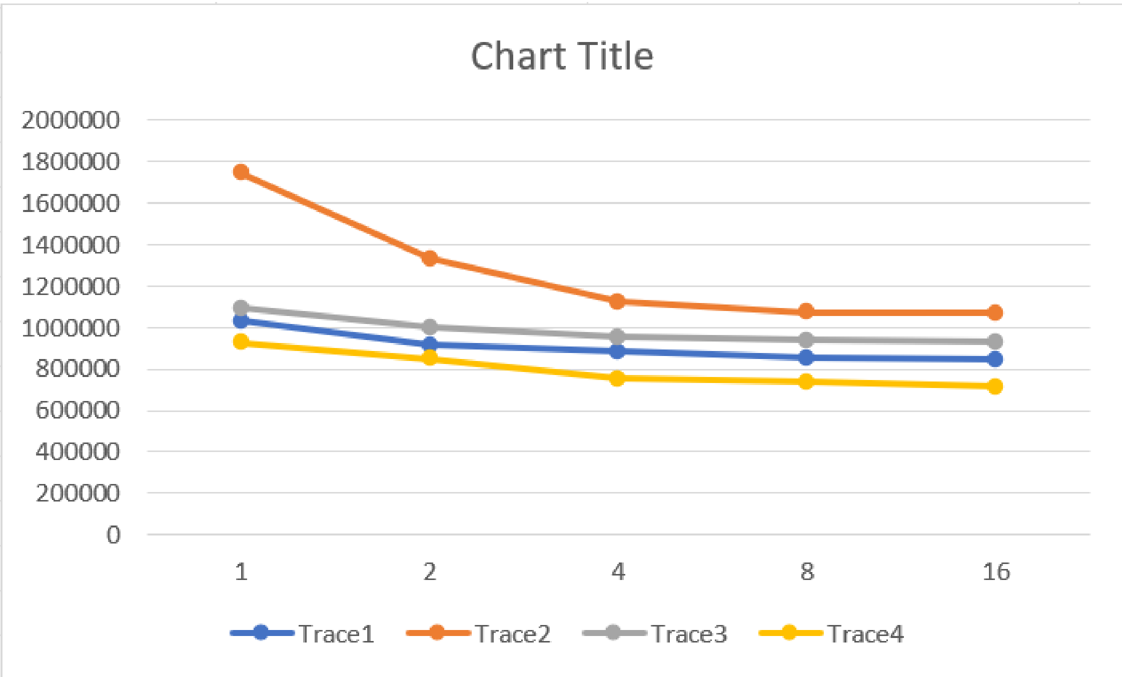
As size of L1 increases, more data can be fetched from L2. Thus it will reduce the total number of capacity misses in L1 and hence the total access time. In reality as size of L1 increases, the memory access time for L1 also increases. But in our model the time is constant. Thus in our simulation there is no negative impact in increasing the size of L1.

As larger files (last four traces) have more capacity misses, the reduction in their total time is most prominent as seen in the graph by large negative slopes.

3. L1 Associativity Change:

trace no.	1	2	4	8	16
1	1030580	915740	882620	855040	847140
2	1743240	1330500	1124600	1072060	1069140
3	1091940	998540	951640	937920	929960
4	926920	848880	751880	735640	714600
5	19505720	6433860	5041900	5044060	5039460
6	8189160	6706500	6210360	6155800	6153680
7	64675680	57948460	55249260	57053000	57434380
8	62442600	40135320	36516340	36483580	36443420

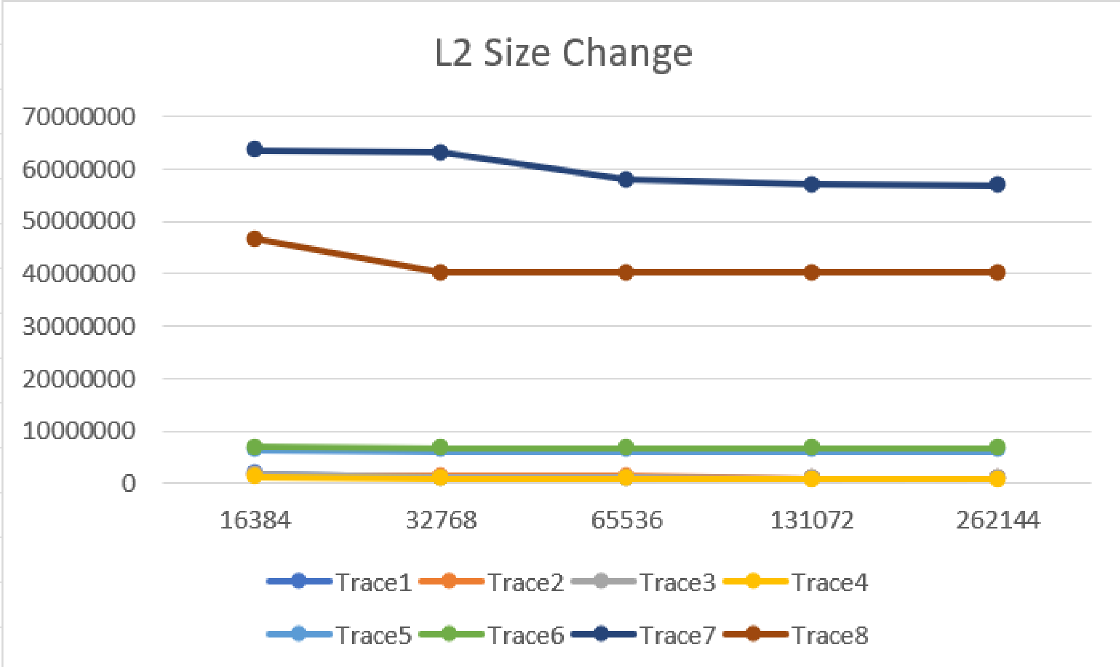


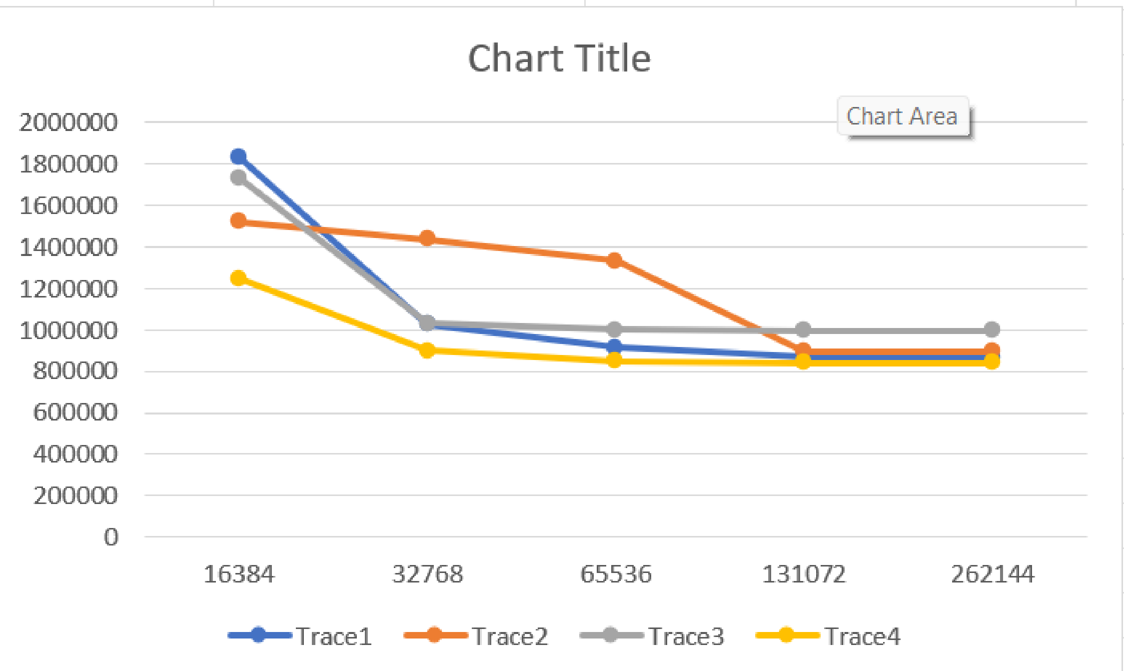


As associativity of L1 increases, total number of conflict misses reduces. Thus total time also reduces. But conflict misses are quite less in number as compared to other types of misses in a large data set and even a slight increase in associativity can reduce these conflicts considerably. Hence, the time becomes constant for large associativity. Same pattern is followed in all 8 trace files.

4. L2 Size Change:

trace no.	16384	32768	65536	131072	262144
1	1834540	1025140	915740	869340	867540
2	1520100	1435700	1330500	895500	895300
3	1733540	1030140	998540	997340	997340
4	1247480	900080	848880	840680	840680
5	6460660	6433860	6433860	6433860	6433860
6	6872700	6706500	6706500	6706500	6706500
7	63628060	63143660	57948460	56971860	56910860
8	46666120	40135320	40135320	40135320	40135320

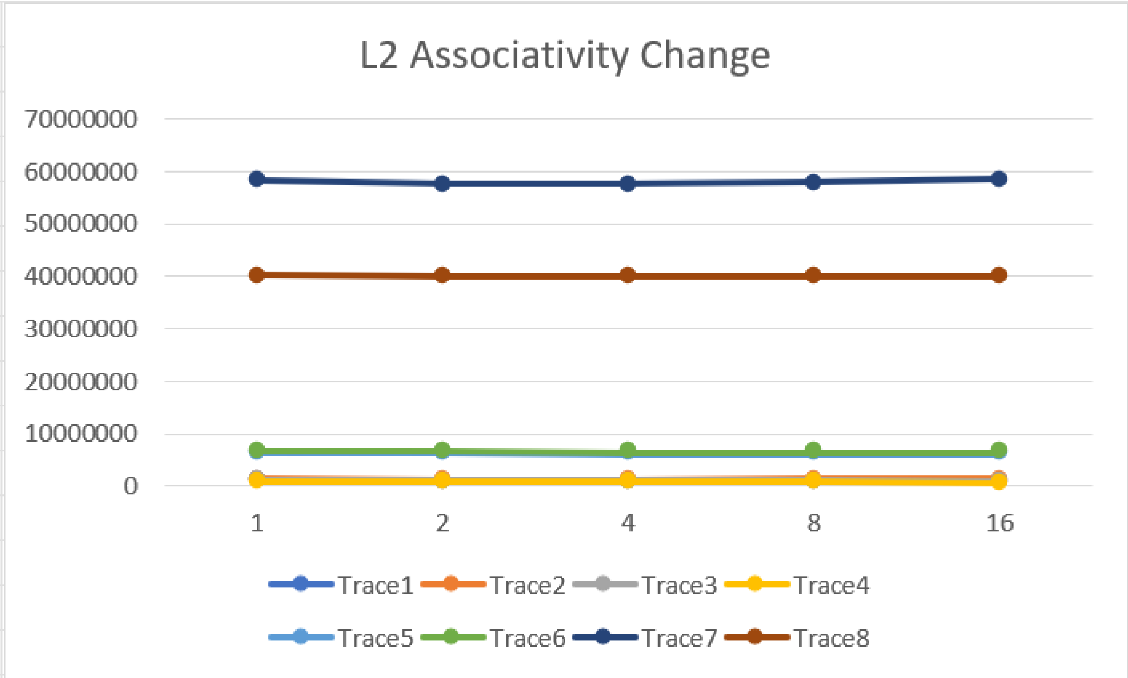


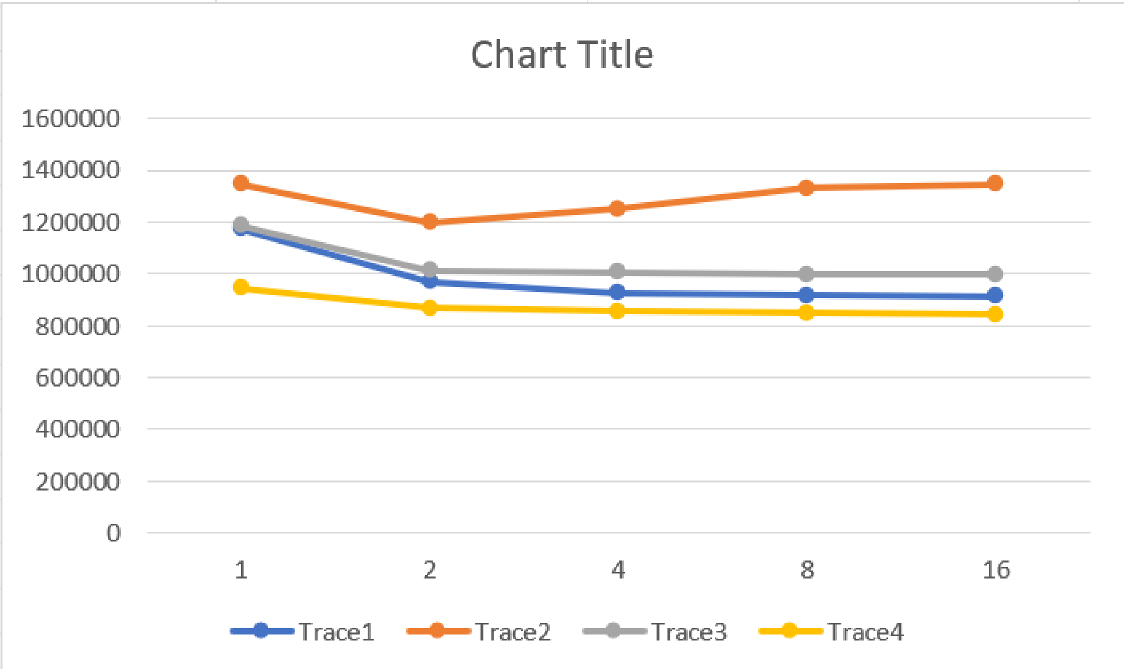


As size of L2 increases, more data can be fetched from DRAM. Thus it will reduce the total number of capacity misses in L2 and hence the total access time. In reality as size of L2 increases, the memory access time for L2 also increases. But in our model the time is constant. Thus in our simulation there is no negative impact in increasing the size of L2.

5. L2 Associativity Change:

trace no.	1	2	4	8	16
1	1175140	970740	926940	915740	914140
2	1346700	1198300	1250500	1330500	1346700
3	1186940	1012340	1008140	998540	997340
4	946080	868680	855080	848880	844080
5	6439860	6436260	6433860	6433860	6433860
6	6718300	6707100	6706500	6706500	6706500
7	58386660	57589860	57643460	57948460	58457060
8	40142520	40135320	40135320	40135320	40135320





As associativity of L2 increases, total number of conflict misses reduces. Thus total time also reduces. But conflict misses are quite less in number as compared to other types of misses in a large data set and even a slight increase in associativity can reduce these conflicts considerably. Hence, the time becomes constant for large associativity. Same pattern is followed in all 8 trace files.