CS622 Assignment 2

Advanced Computer Architecture

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Part 1

The following number of Machine accesses were recorded when we run our PIN tool "part1.cpp" on the given four programs.

Name of the Program	Number of machine accesses recorded
prog1	128991626
prog2	2524165
prog3	9657813
prog4	1065076

Table 1 : number of machine accesses

On succesive runs of PIN tool on these programs, we observed a slight variation in the total number of machine accesses. This is because for each run, the program gets loaded at different address. So, number of machine accesses can vary.

Part 2

Plots of Cummulative Density vs Access Distance (log-scale)

Program 1

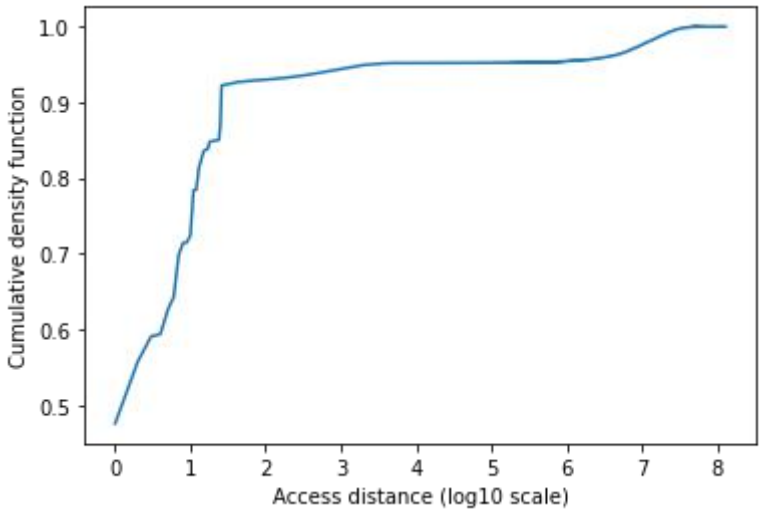

Figure 1 : CDF plot for prog1

Program 2

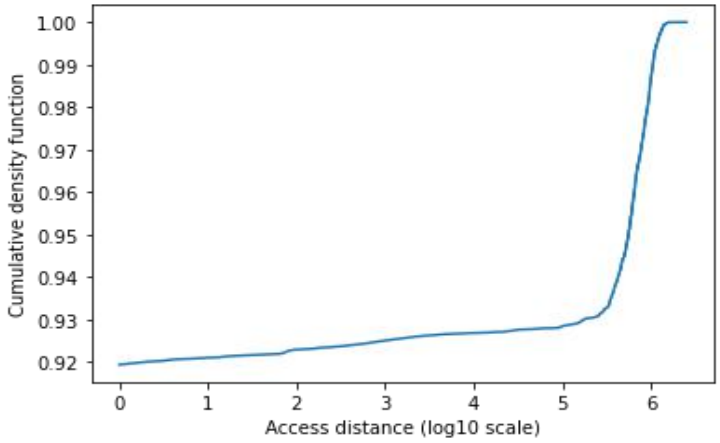

Figure 2 : CDF plot for prog2

Program 3

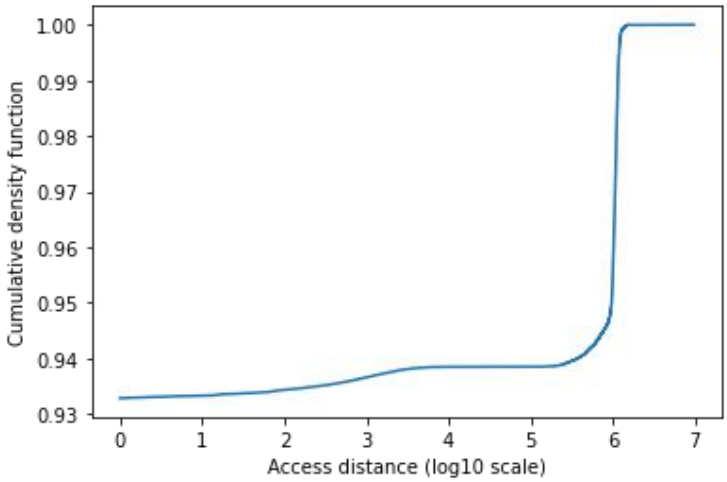

Figure 3 : CDF plot for prog3

Program 4

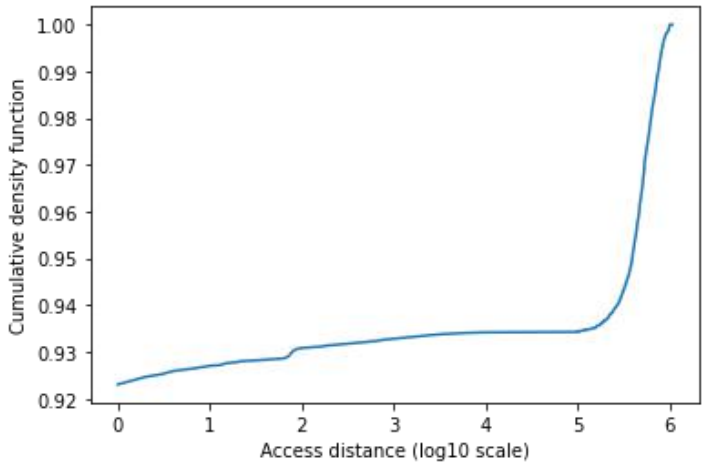

Figure 4 : CDF plot for prog4

From the above plots we can observe that for prog1, large fraction of memory accesses (≈0.9) have an access distance less than 10^2 (or 2 on log-scale). But for prog2, prog3, and prog4, large fraction of memory accesses (≈0.92-0.94) have an access distance less than 10^5 (or 5 on log-scale). So, we can say that prog1 has better temporal locality compared to prog2, prog3, and prog4.

Part 3

Name of the program	Number of Cache hits	Number of Cache miss
prog1	122306382	6685244
prog2	2291673	232492
prog3	9017166	640647
prog4	939603	125473

Table 2 : number of Cache hits and misses

Plots of Cummulative Density vs Access Distance (log-scale) filtered by LRU Cache

Program 1

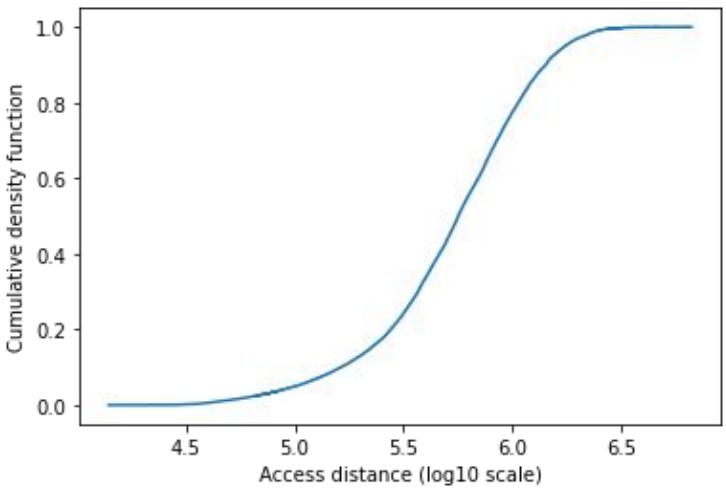

Figure 5 : CDF plot for prog1

Program 2

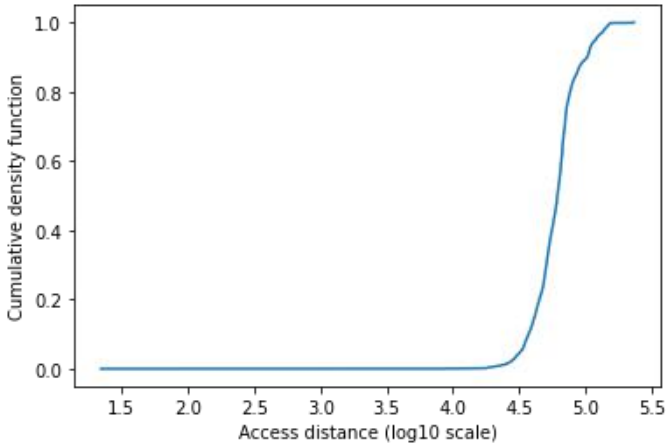

Figure 6 : CDF plot for prog2

Program 3

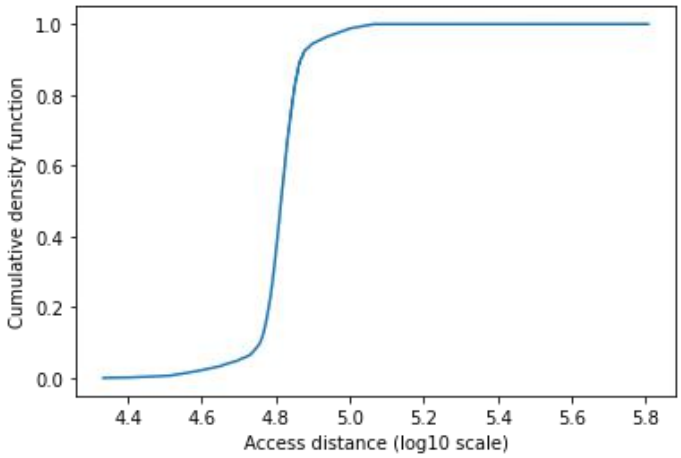

Figure 7 : CDF plot for prog3

Program 4

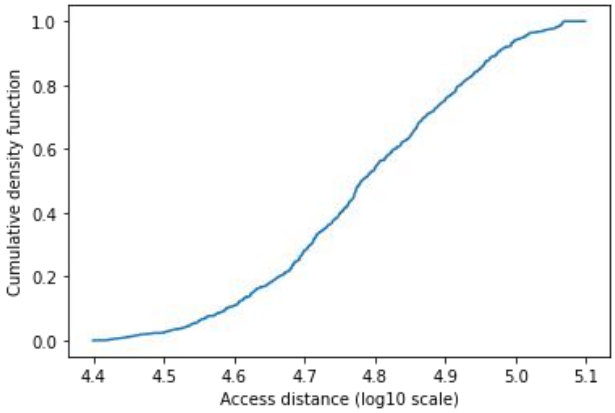

Figure 8 : CDF plot for prog4

As we can see that the plots obtained in Part-III are different from Part-II. It is because we filtered the trace by using an LRU Cache. So, now we are plotting the CDF corresponding to addresses which only miss in the Cache. We can observe that we are not getting any density value for access distance less than $10^{4.4}$ (4.4 on log-scale) ≈ 25000 memory blocks which is a crude approximation of Cache size (32K) memory blocks.

Part 4

	prog1	**prog2**	**prog3**	**prog4**
1-Shared (Private)	409	404	411	8594
2-Shared	63	8255	56	57403
3-Shared	1872	16384	0	6
4-Shared	32456	40958	1	0
5-Shared	143251	5	1	0
6-Shared	244970	0	0	0
7-Shared	173381	0	0	1
8-Shared	124527	9	65545	10
Total Memory Blocks	721379	66015	66014	66014

Table 3 : Sharing profile for all programs.

From the above table, we can observe that,

prog1 : most of the blocks are accessed by more than 4 threads.

prog2 : Almost all memory blocks are accessed by less than 4 threads.

prog3 : most of the memory blocks are shared by eight threads.

prog4: almost all the memory blocks are accessed by only one or two threads.