
# CS622A
# Advanced Computer Architecture
# Report on Assignment 2

**Abhas Kumar-20111001**
**Anup Roy-20111403**

31 October 2020

**Abstract**

**This document reports results and their analysis after we have conducted some studies to understand the reuse and sharing profiles of a set of parallel program. We instrumented these shared memory parallel programs using PIN and captured the per-thread memory access traces.We have also performed Cache based analysis.**

**Instructor: Prof.Mainak Chaudhuri**

## PART I

| Program | Memory Accesses |
|---|---|
| prog1.c | 128991436 |
| prog2.c | 2546696 |
| prog3.c | 9681968 |
| prog4.c | 1064937 |

Table 1: **Total number of machine accesses recorded in the trace for each of the four programs.**

# PART II

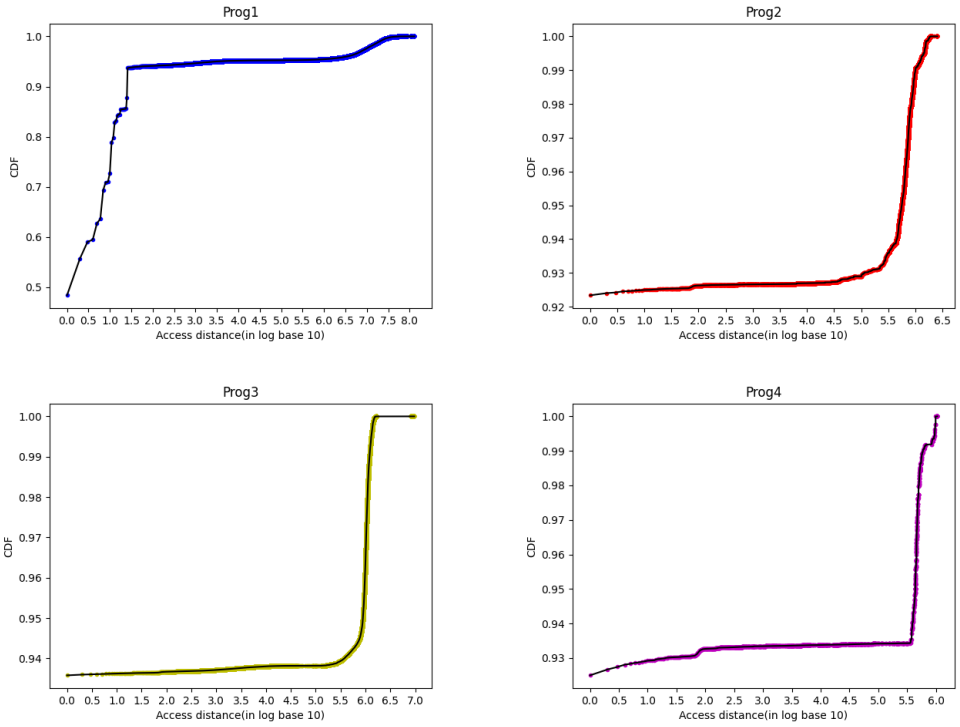
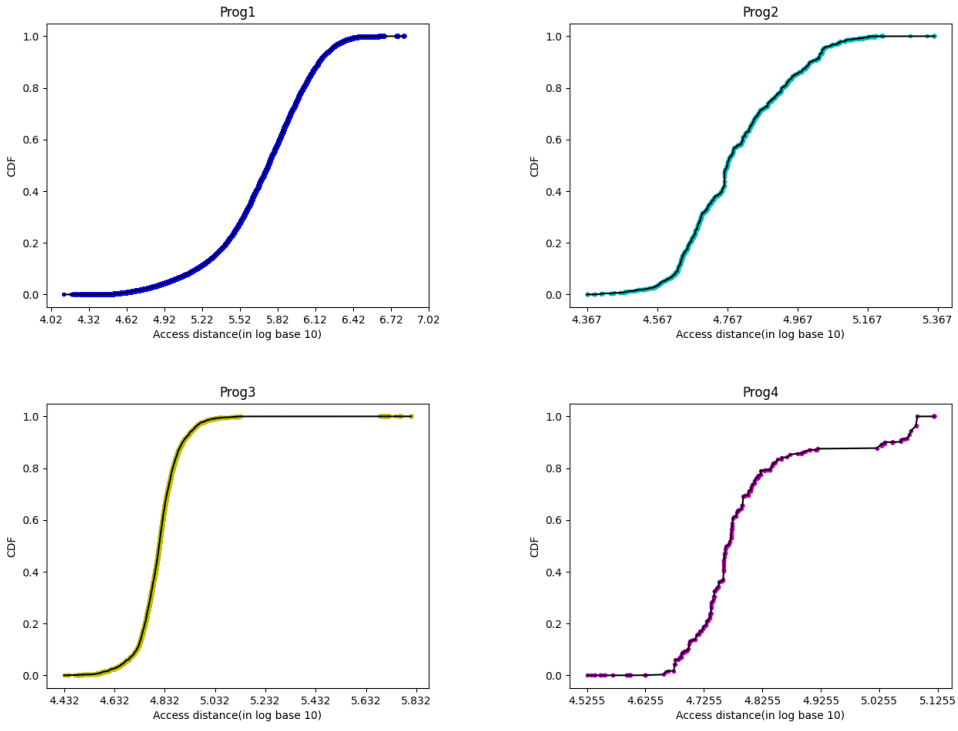



Figure 1: Cumulative density function(**CDF**) plots of access distances from the traces of 4 programs

## PART III

| Program | HIT | MISS |
|---|---|---|
| prog1.c | 122313054 | 6678548 |
| prog2.c | 2330286 | 222798 |
| prog3.c | 9075922 | 633411 |
| prog4.c | 937074 | 127862 |

Table 2: Number of hits and misses for each trace.




**CDF** plots of the miss trace for each of the 4 programs.

**OBSERVATIONS AND EXPLANATIONS.**

**For relatively large access distances in PART-II plots at one point CDF becomes almost CONSTANT because distances for which the CDF doesn't increase significantly were observed for a very small number of times , so such a small increase in the CDF is not noticeable in the graph.**
**For larger values of access distances in PART-II plots, CDF start increasing again implying that those access distances are observed for a significant number of times.It means that some blocks that were being accessed a while ago, reused again at same access distance. Here , The count for larger access distances increases until CDF become 1 for maximum access distance.**

**In PART III plots, a steep curve is observed for access distances lying in some range (say upto K, where K $\in$ X-axis coordinate values). So, the accesses occurring during this particular range(K) are targeting different blocks resulting into many blocks being replaced due to conflict or capacity misses and missing when accessed again in the cache.**

**After steep curve ends,for larger access distance CDF observed to be almost constant, it is due to the reason that some blocks which missed in the initial stage of execution start missing again. Blocks must have been replaced due to the LRU policy which is observed in the constant curve in the above plot(PART III).It implies these blocks are not used as frequently as other blocks which had lesser access distance between two misses to the same block.**

**As we can see PART-III plots represent only the miss trace. Suppose two consecutive elements of array being accessed so access distance(i.e reuse distance) between them would be 1, then this access distance can be observed only in PART-II plots In PART-III plot lower access distance are not observed as its traces do not account for accesses that hit in the simulated cache with LRU replacement policy.**

## PART IV

| NO.OF BLOCK SHARED BY | Prog1 | Prog2 | Prog3 | Prog4 |
|---|---|---|---|---|
| PRIVATE(1-THREADS) | 350 | 367 | 376 | 8559 |
| 2-THREADS | 83 | 8273 | 68 | 57430 |
| 3-THREADS | 1895 | 16397 | 20 | 14 |
| 4-THREADS | 32462 | 40962 | 3 | 1 |
| 5-THREADS | 143258 | 11 | 2 | 0 |
| 6-THREADS | 244973 | 0 | 0 | 0 |
| 7-THREADS | 173832 | 1 | 0 | 1 |
| 8-THREADS | 124529 | 10 | 65546 | 10 |
| **TOTAL** | 721382 | 66021 | 66015 | 66015 |

Table 3: **The number of memory blocks that are private, or shared by two threads, or shared by three threads, ..., or shared by eight threads.**