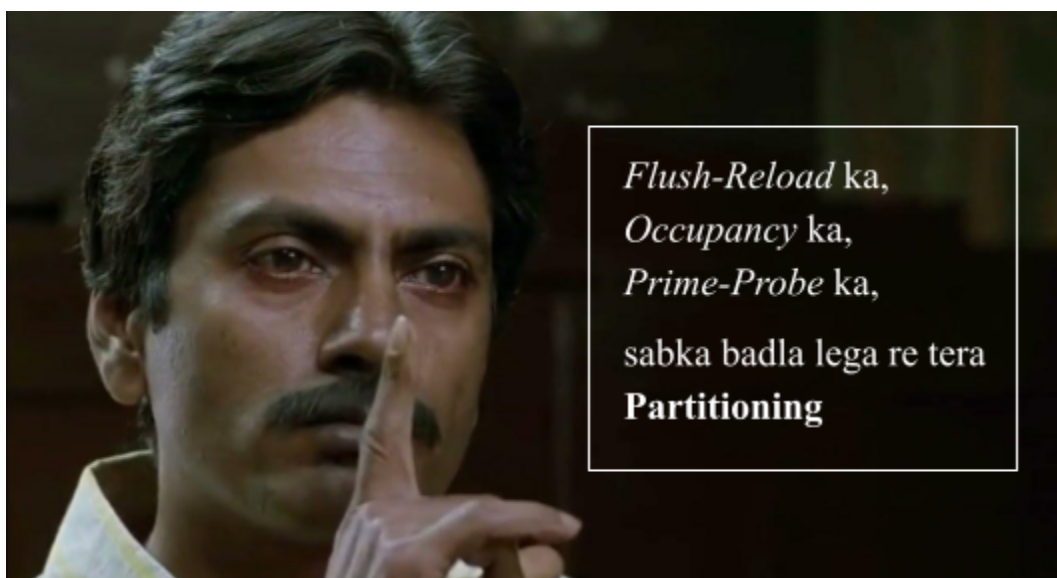


**Programming Assignment 2 - “Dilwale Dulhania “NAHI” Le Jayenge”**  
**CS 773: Computer Architecture for Performance and Security, Spring 2025**  
**Computer Science and Engineering**  
**Indian Institute of Technology, Bombay**  
**CASPER group: <https://casper-iitb.github.io/>**

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*\* Disclaimer: The names and dialogues included in this document are intended solely for fun learning. They are not meant to offend, mislead, or be taken as factual information. Please enjoy them in the spirit of fun learning.*



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Part 1: Kitne “Ways” the ..??		
1A	Implementing Way Partitioning in Champsim	5 points
Part 2: Cache Set Partitioning		
2A	Rang-De-Basanti	5 points
2B	Tumse Na Ho Payega !	5 points

***Just a friendly reminder:** if you think copying code is a clever shortcut, think again. It’s not only easily spotted but also a great way to miss out on the chance to actually learn something. Why not impress us with your own work?*

## Part 1: Kitne “Ways” the...?

You have to partition the Last Level Cache (LLC) so that no two cores can access the same *cache way*.

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### 1A. Implementing Way Partitioning in Champsim

You'll be implementing way partitioning in Champsim. To do so, you need to take the following steps.

**Initialization** - Assign cache-ways to each core.

**Replacement policy**- Make the necessary changes in your replacement policy to restrict cross-core evictions.

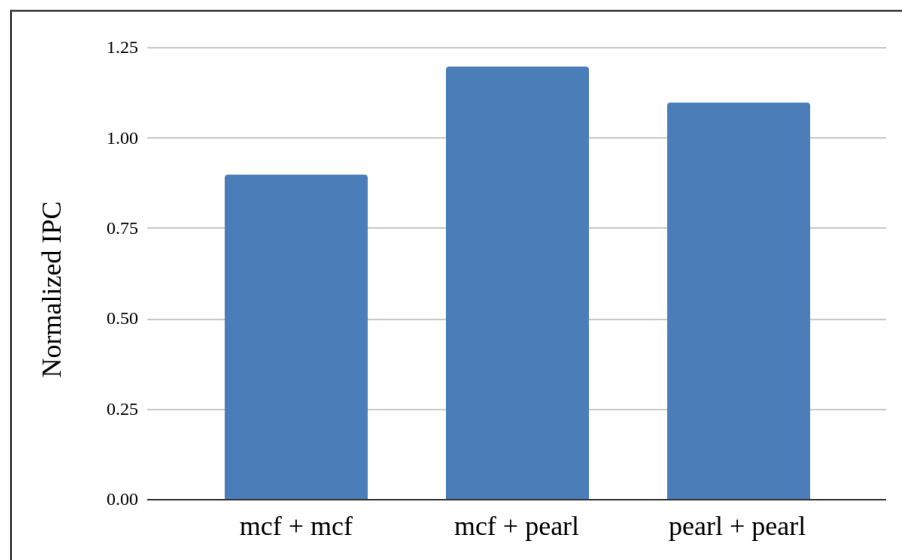
**Enforcing isolation** - Ensure that a core can only bring data to and get data from its allotted ways.

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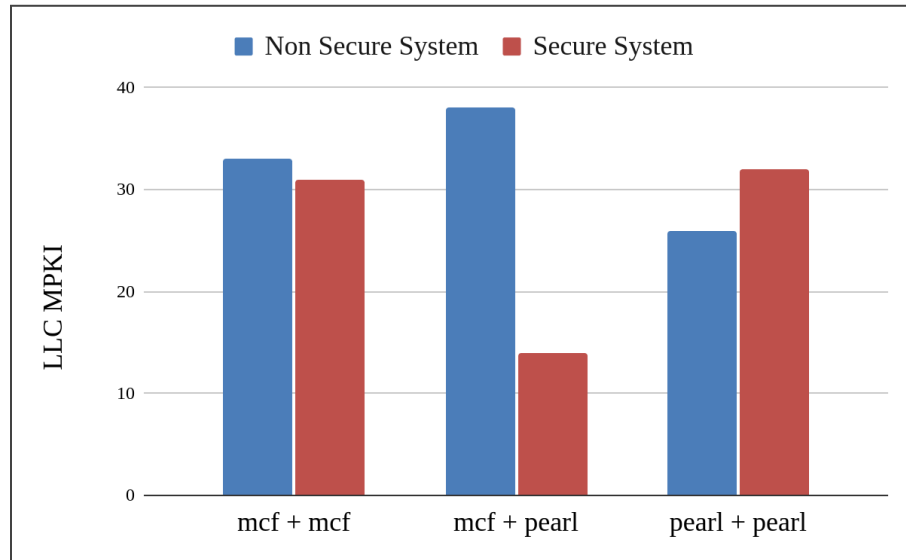
### Key Deliverables

Comparison of the partitioning approach with a baseline non-secure system. The evaluation will be done for the benchmarks: *mcf* and *perl*

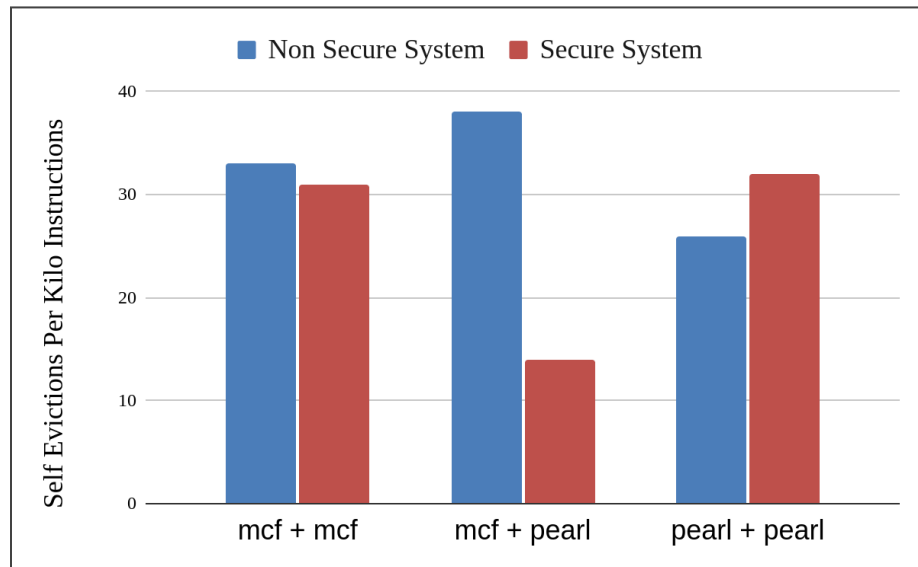
1. *Normalized IPC*: All the numbers should be normalized with respect to the **baseline**, where the baseline is non-partitioned LLC.



2. *LLC MPKI Comparison*: You need to report the average LLC MPKI for both baseline and partitioned cache in the format shown below.



3. *Self-Evictions per Kilo Instructions*: Self-eviction happens when a core removes its own data block from the cache. Your task is to count these self-evictions and report the number per 1000 instructions.



## Part 2: Cache Set Partitioning

*“Did you notice the limitation of way partitioning?”*

In way partitioning, we limited the number of cores in our multicore system by the associativity of the cache.

So now, let's make the system scalable by implementing set partitioning. You have to implement set partitioning in the Last Level Cache (LLC) so that no two cores can access the same set.

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### 2A. Rang-De-Basanti - Static Set partitioning

You'll be implementing set partitioning in Champsim. To do so, you need to take the following steps.

**Page coloring** - Allot pages to a core so that no two cores can map their addresses to the same set.

**Enforcing isolation** - Ensure that a core can only bring data to and get data from its allotted **sets**.

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### Key Deliverables

Comparison of the partitioning approach with a baseline non-secure system. The evaluation will be done for the benchmarks: *mcf* and *pearl*

- Normalized Speedup
- LLC MPKI Comparison
- Self Evictions per Kilo Instructions

The plots over here will be similar to the ones in Task1

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## 2B. Tumse Na Ho Payega !

*Woohoo, Great! Now you've provided scalability via set partitioning, but what about performance?*



So, your next task is implementing dynamic set partitioning to see if you can bridge this performance gap. You'll be implementing this in champsim. The basic idea is to monitor the cache usage and partition the cache accordingly.

**Initialization** -Initially assign sets to each core.

**Monitor cache usage**- You need to come up with a heuristic in order to monitor the cache usage in Champsim.

**Enforcing isolation** - Ensure that a core can only bring data to and get data from its allotted sets.

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### Key Deliverables

Comparison of the set partitioning approach with a baseline non-secure system. The evaluation will be done for the benchmarks: *mcf* and *pearl*

- Normalized Speedup
- LLC MPKI Comparison
- Self Evictions per Kilo Instructions

The plots over here will be similar to the ones in Task 1

## Submission Guidelines

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**Deadline:** Mar 18, 2025 5:00 PM



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All the best! We are always there to help you!