

## Project Description

The goal of this project is to design a cache replacement policy. Similar to CA1, your designs will be evaluated against each other to form a championship. The leaderboard will be posted on the website ( [📁 Leaderboard-ECE209-S25](#) ). Please make sure to use the right sheet (CA3). All the credits for the framework go to the original designers and organizers of the framework ([link](#)).

You can do this project in groups of two (unless you are an MSOL student) or submit it individually.

Code:

The infrastructure for the cache replacement can be downloaded from here:

📁 ChampSim\_CRC2

The code is fairly simple. The replacement policy implementations are in the *example* folder. Traces are provided in the *trace* folder.

You can read the README and Description files to learn more about the internals of the framework.

How to Compile and Run:

There are four different configuration files. We only use config1 (Single core with 2MB LLC without a prefetcher).

To compile, type this in the root directory:

```
g++ -Wall --std=c++11 -o lru-config1 example/lru.cc lib/config1.a
```

(If you're using Seasnet servers:)

```
g++ -Wall --std=c++11 -static-libstdc++ -o lru-config1 example/lru.cc  
lib/config1.a
```

If you add a new design, "lru.cc" should be replaced with your file. You can also change the name of the output binary. Note that there might be compile and/or link errors for MAC and Windows. We strongly recommend using a Linux machine to compile and run the code (use SeasNet servers if you don't have access to a Linux machine).

To run the code, type:

```
./lru-config1 -warmup_instructions 1000000 -simulation_instructions  
10000000 -traces trace/bzip2_10M.trace.gz
```

Similar to the above, for a different file and/or different trace, you should adjust the filenames. You can check the README file to learn more about the parameters such as warmup.

During the execution, the program will print a sequence of outputs. What you should report is the miss rate, which is based on this line:

```
LLC TOTAL      ACCESS:      104771  HIT:      84776  MISS:      19995,
```

where the miss rate can be calculated as  $\text{Miss/Total}$ .

There are multiple traces provided in the trace folder. Your final miss rate should be the average of all traces. You should compute this either using a script or by manually running all the traces individually. The final value should be uploaded on the Google Sheet Leaderboard.

## Writing Your Replacement Policy

Write your code by creating a copy from one of the examples and modify the necessary parts. It is up to you whether you want to start a new design from scratch and/or modify the existing code.

## How to Design:


Before you begin, make sure that you watch L11. Similar to CA1, there are numerous resources available that can inspire ideas. To get started, you can search for existing write-ups and designs or read about newer replacement policies. Keep in mind that this aspect is research-oriented and relies on your level of interest and enthusiasm. Feel free to brainstorm your ideas with your classmates, and remember that this is a competition, so you may not want to share too much!!

Also, note that, unlike the original competition, there is no design constraint for your policy (e.g., storage size), nor do you need to test it for other configurations in this project. However, try to consider realistic tradeoffs. In your report (see the details below), you should explain your design decisions and the area overhead of the design.

## What to Submit:

1. Gradescope
  - a. Your code. It should be well-commented (we won't use autograder for now, just upload the code that you have modified).
  - b. A PDF file briefly explaining your design methodology, tradeoffs, and your design storage overhead. There is no specific page limit. Try to be informative but concise.

## 2. Google Sheet

- a. Add the participants and group names (you can name your group whatever you want) and Average Miss rate on the Google Sheet (  Leaderboard-ECE209-S25 ). Make sure to use the correct tab (CA3). Do not modify anything else, and make sure that your number is inserted correctly and matches what is shown on Gradescope. If there is a mismatch, we will use the Gradescope number. The sheet will also show the sorted list. You can work more on your design if you want to further improve your ranking. If you updated your design, don't forget to update BOTH the sheet and Gradescope.

## Grading:

You will be graded based on your efforts (code and report). You will lose points (>50) if you only add very obvious and minor changes to the baseline design. We will not provide feedback on the significance of your design before the deadline, so use your best judgment.