CS6600 : Computer Architecture
Assignment 2 : Design your own LLC Cache Replacement Policy

Submission Deadline: 11:59 PM, 11th September 2022

In this assignment you are required to implement your own LLC replacement policy using the Champsim simulator and benchmark it against the following replacement policies:

1. *Mockingjay*: https://www.cs.utexas.edu/~lin/papers/hpca22.pdf
2. *Hawkeye*: https://www.cs.utexas.edu/~lin/papers/isca16.pdf
3. *SHiP*: https://mrmgroup.cs.princeton.edu/papers/MICRO11_SHiP_Wu_Final.pdf

The source code of the above replacement policies is open-sourced. The following benchmark traces have to be used: benchmarks_drive_link

1. astar
2. bwaves
3. bzip2
4. cactusADM
5. calculix
6. gcc
7. GemsFDTD
8. lbm
9. leslie3d
10. libquantum

Warm the cache for 200 million instructions and measure the behaviour of the next 1 billion instructions. For the final evaluation, your policy would be compared with other submissions and ranked based on the IPC achieved.

Few resources:

1. Champsim simulator: https://github.com/ChampSim/ChampSim
   Champsim has 4 default cache replacement policies implemented in the *replacement/* folder. You are encouraged to look into the source code and understand how they interact with the simulator.
   To benchmark *Hawkeye* and *Mockingjay* replacement policies, you should port the code from the older version of Champsim to the latest version. The older version of the Champsim simulator can be found here: https://github.com/smn98/ChampSim

2. Cache Replacement Championship 2017: https://crc2.ece.tamu.edu/?page_id=53

3. You are free to refer to any paper. But kindly cite it in your report.

Rules:

1. The default Champsim simulator configuration is to be followed, which can be found in *champsim_config.json* file.

2. Your replacement policy should only use information passed to the *CACHE::update_repalcement_state()* and *CACHE::find_victim()* functions. Any other information should not be used to design your replacement policy.

3. There is no constraint on the storage and hardware budget, that your replacement policy requires. But the feasibility of your storage requirements would be considered to resolve tie-breakers.

4. Replacement policies must not pre-parse the trace or other such cheats.

Submission guidelines:

1. This is a team-based assignment: 2 members per team.

2. Submit only file: *RollNumber_A2*.tar.gz file, containing the following:

   (a) Your report in *RollNumber_A2*.pdf format. The report should contain the following:
      i. Details of your replacement policy, its advantages and limitations.
      ii. Plot of the benchmark results and analyze the results of your policy against the other 3 policies.

   (b) Implementation folders:
      i. *myrepl*, which contains a single source file *myrepl.c*, containing your cache replacement policy.
      ii. *hawkeye*, which contains a single source file *hawkeye.c*, containing Hawkeye replacement policy.
      iii. *mockingjay*, which contains a single source file *mockingjay.c*, containing the Mockingjay replacement policy

   You are not required to submit the entire Champsim framework. Make sure that all the above source codes are compatible with the latest version of Champsim simulator.

   (c) Folder: *tests*, which contains all the scripts/commands used to benchmark the cache replacement policies.