Tools: intel Vtune, Intel Pin, and ChampSim simulator

Deadline for Project: April 27, 2023, 12 PM IST (I cant extend it as I will be in Europe by May 1st week). So, I will freeze the grades by April 30, night. So no extensions, no make-up, no delays plz.

PS: For all the projects, make sure you simulate atleast 30M instructions and warmup 30M instructions.

Topics of interest

Branch predictors for SAT solvers
Branch predictors for Graph Analytics
Memory/Cache hierarchy optimizations for SAT solvers
Memory/Cache hierarchy optimizations for Graph Analytics
Data prefetching for SPEC, SAT solvers, or Graph Analytics
If you have any specific interest and you know what you want to do then do ping me and I will add that.

What will you do?

You will read one or two existing ideas with their source codes and then develop your ideas/enhancements and evaluate them. You need to defend your ideas both quantitatively and qualitatively.

How will you do?

https://biswabandan.medium.com/two-cents-on-computer-architecture-research-104-gollus-kutti-story-solving-a-research-problem-d0e869809bb6

Group of 3

PS: TA/Instructor support will be minimal: This is an opportunity to do things independently. The same goes for lab 5.

ChampSim: https://github.com/casperIITB/ChampSim

Project-1

Branch predictors for SAT solvers
Paper: https://www.irisa.fr/caps/people/seznec/L-TAGE.pdf
Blog: https://comparch.net/2013/06/30/why-tage-is-the-best/
Simulator: ChampSim

Traces:
https://www.dropbox.com/sh/xs2t9y4cuqlgrlp/AACpzGOj6BcSB-BUolGaBjbta?dl=0
Check traces within front-end folder

Feel free to add your own traces based on SAT competition 2022

Task: Implement TAGE predictor in ChampSim simulator. Compare with the hashed_perceptron predictor and improve Branch mispredictions and IPC.

Check the branch folder of ChampSim and add your branch predictor.

Project-2

Branch predictors for Graph Analytics
Paper: https://www.irisa.fr/caps/people/seznec/L-TAGE.pdf
Blog: https://comparch.net/2013/06/30/why-tage-is-the-best/
Simulator: ChampSim
Apps and traces:
https://utexas.app.box.com/s/2k54kp8zvrqdfaa8cdhfquvcxwh7yn85/folder/132804598561 Two to three traces not all

Task: Implement TAGE predictor in ChampSim simulator. Compare with the hashed_perceptron predictor and improve Branch mispredictions and IPC.

Check the branch folder of ChampSim and add your branch predictor.

Project-3

Memory/Cache hierarchy optimizations for SAT solvers
Simulator: ChampSim

Traces:
https://www.dropbox.com/sh/xs2t9y4cuqlgrlp/AACpzGOj6BcSB-BUolGaBjbta?dl=0
Check traces within the back-end folder

Task: Evaluate different cache hierarchies (different sizes of L1, L2, LLC,inclusive/non-inclusive/Exclusive) and cache replacement policies, compare with a baseline cache hierarchy, and improve cache performance.

Check the caches folder of ChampSim and make your changes.

Project-4

Memory/Cache hierarchy optimizations for Graph Analytics
Simulator: ChampSim
Apps: Graph Analytics
Traces:
https://utexas.app.box.com/s/2k54kp8zvrqdfaa8cdhfquvcxwh7yn85/folder/132804598561 Two to three traces, not all

Task: Evaluate different cache hierarchies (different sizes of L1, L2, LLC,inclusive/non-inclusive/Exclusive) and cache replacement policies, compare with a baseline cache hierarchy, and improve cache performance.

Check the caches folder of ChampSim and make your changes.

Project-5

Data prefetching for SPEC, SAT solvers, Servers, and Graph Analytics

Paper: https://dpc3.compas.cs.stonybrook.edu/pdfs/Bouquet.pdf
Simulator: ChampSim
Traces: Graph
https://utexas.app.box.com/s/2k54kp8zvrqdfaa8cdhfquvcxwh7yn85/folder/132804598561

SPEC: https://dpc3.compas.cs.stonybrook.edu/champsim-traces/speccpu/

SERVER:
https://drive.google.com/file/d/1qs8t8-YWc7lLoYbjbH_d3lf1xdoYBznf/view

SAT:
https://www.dropbox.com/sh/xs2t9y4cuqlgrlp/AACpzGOj6BcSB-BUolGaBjbta?dl=0
Check traces within the back-end folder

Task: Evaluate existing prefetchers and propose enhancements
Check the prefetching folder of ChampSim and make your changes