task2

May 20, 2024

```python
[1]: import sys
     sys.path.append('../')
     import executor
     import os
     import matplotlib.pyplot as plt
     from statistics import geometric_mean
     import json
```

```python
[2]: ROOT_DIR = "/home/huawei/dev/ChampSim"
     LFU_CFG = "tasks/task2/configs/lfu.json"
     TASK_2_DIR = "/home/huawei/dev/ChampSim/tasks/task2"
     LRU_CFG = "tasks/task2/configs/lru.json"
     TRACES_DIR = "tasks/traces"
     RESULTS_DIR = "tasks/task2/results"
     WARMUP = 5000000
     INSTRS_COUNT = 20000000
```

```python
[5]: executor.build_sim(LRU_CFG, ROOT_DIR)
```

```
mkdir /home/huawei/dev/ChampSim/.csconfig/32c6145f/obj
mkdir /home/huawei/dev/ChampSim/.csconfig/32c6145f/btbDbasic_btb
mkdir /home/huawei/dev/ChampSim/.csconfig/32c6145f/branchDbimodal
mkdir /home/huawei/dev/ChampSim/.csconfig/32c6145f/prefetcherDno
mkdir /home/huawei/dev/ChampSim/.csconfig/32c6145f/prefetcherDno_instr
mkdir /home/huawei/dev/ChampSim/.csconfig/32c6145f/replacementDlru
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/channel.o
/home/huawei/dev/ChampSim/src/channel.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/ptw.o
```

```
/home/huawei/dev/ChampSim/src/ptw.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/plain_printer.o
/home/huawei/dev/ChampSim/src/plain_printer.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/json_printer.o
/home/huawei/dev/ChampSim/src/json_printer.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/tracereader.o
/home/huawei/dev/ChampSim/src/tracereader.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/ooo_cpu.o
/home/huawei/dev/ChampSim/src/ooo_cpu.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/main.o
/home/huawei/dev/ChampSim/src/main.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/cache.o
/home/huawei/dev/ChampSim/src/cache.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc  -c -o
```

```
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/champsim.o
/home/huawei/dev/ChampSim/src/champsim.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/dram_controller.o
/home/huawei/dev/ChampSim/src/dram_controller.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/vmem.o
/home/huawei/dev/ChampSim/src/vmem.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -Wno-unused-parameter -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/btb/basic_btb -DCHAMPSIM_MODULE
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc -include btbDbasic_btb.inc
-c -o /home/huawei/dev/ChampSim/.csconfig/32c6145f/btbDbasic_btb/basic_btb.o
/home/huawei/dev/ChampSim/btb/basic_btb/basic_btb.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -Wno-unused-parameter -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/branch/bimodal -DCHAMPSIM_MODULE
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc -include branchDbimodal.inc
-c -o /home/huawei/dev/ChampSim/.csconfig/32c6145f/branchDbimodal/bimodal.o
/home/huawei/dev/ChampSim/branch/bimodal/bimodal.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -Wno-unused-parameter -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/prefetcher/no -DCHAMPSIM_MODULE
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc -include prefetcherDno.inc
-c -o /home/huawei/dev/ChampSim/.csconfig/32c6145f/prefetcherDno/no.o
/home/huawei/dev/ChampSim/prefetcher/no/no.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -Wno-unused-parameter -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/prefetcher/no_instr -DCHAMPSIM_MODULE
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc -include
prefetcherDno_instr.inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/prefetcherDno_instr/no.o
/home/huawei/dev/ChampSim/prefetcher/no_instr/no.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -Wno-unused-parameter -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
```

```
-I/home/huawei/dev/ChampSim/replacement/lru -DCHAMPSIM_MODULE
-I/home/huawei/dev/ChampSim/.csconfig/32c6145f/inc -include replacementDlru.inc
-c -o /home/huawei/dev/ChampSim/.csconfig/32c6145f/replacementDlru/lru.o
/home/huawei/dev/ChampSim/replacement/lru/lru.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-L/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/lib
-L/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/lib/manual-link
-L/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/lib
-L/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/lib/manual-link -o
/home/huawei/dev/ChampSim/bin/champsim
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/channel.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/ptw.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/plain_printer.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/json_printer.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/tracereader.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/ooo_cpu.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/main.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/cache.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/champsim.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/dram_controller.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/obj/vmem.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/btbDbasic_btb/basic_btb.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/branchDbimodal/bimodal.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/prefetcherDno/no.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/prefetcherDno_instr/no.o
/home/huawei/dev/ChampSim/.csconfig/32c6145f/replacementDlru/lru.o  -llzma -lz
-lbz2 -lfmt
```

```
[6]: executor.run_traces(TRACES_DIR, f"{RESULTS_DIR}/lru", ROOT_DIR, WARMUP,␣
      ↪INSTRS_COUNT)
```

```
Running
tasks/traces/641.leela_s-149B.champsimtrace.xz…
Running
tasks/traces/603.bwaves_s-2931B.champsimtrace.xz…
Running tasks/traces/619.lbm_s-2676B.champsimtrace.xz…
Running
tasks/traces/607.cactuBSSN_s-2421B.champsimtrace.xz…
Running tasks/traces/654.roms_s-293B.champsimtrace.xz…
Running
tasks/traces/649.fotonik3d_s-1176B.champsimtrace.xz…
Running tasks/traces/627.cam4_s-490B.champsimtrace.xz…
Running tasks/traces/605.mcf_s-1536B.champsimtrace.xz…
Running
tasks/traces/620.omnetpp_s-141B.champsimtrace.xz…
Running
```

```
tasks/traces/600.perlbench_s-1273B.champsimtrace.xz…
Running tasks/traces/657.xz_s-4994B.champsimtrace.xz…
Running tasks/traces/621.wrf_s-575B.champsimtrace.xz…
Running
tasks/traces/638.imagick_s-10316B.champsimtrace.xz…
Running
tasks/traces/631.deepsjeng_s-928B.champsimtrace.xz…
Running
tasks/traces/644.nab_s-12459B.champsimtrace.xz…
Running
tasks/traces/623.xalancbmk_s-165B.champsimtrace.xz…
The results are recorded in
tasks/task2/results/lru/638.imagick_s-10316B.champsimtrace.xz.json.
Running tasks/traces/625.x264_s-12B.champsimtrace.xz…
The results are recorded in
tasks/task2/results/lru/600.perlbench_s-1273B.champsimtrace.xz.json.
Running tasks/traces/602.gcc_s-1850B.champsimtrace.xz…
The results are recorded in
tasks/task2/results/lru/644.nab_s-12459B.champsimtrace.xz.json.
Running tasks/traces/628.pop2_s-17B.champsimtrace.xz…
The results are recorded in
tasks/task2/results/lru/657.xz_s-4994B.champsimtrace.xz.json.
Running
tasks/traces/648.exchange2_s-387B.champsimtrace.xz…
The results are recorded in
tasks/task2/results/lru/621.wrf_s-575B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/607.cactuBSSN_s-2421B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/641.leela_s-149B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/627.cam4_s-490B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/631.deepsjeng_s-928B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/625.x264_s-12B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/623.xalancbmk_s-165B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/654.roms_s-293B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/649.fotonik3d_s-1176B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/628.pop2_s-17B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/648.exchange2_s-387B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/603.bwaves_s-2931B.champsimtrace.xz.json.
```

The results are recorded in
tasks/task2/results/lru/620.omnetpp_s-141B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/602.gcc_s-1850B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/605.mcf_s-1536B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lru/619.lbm_s-2676B.champsimtrace.xz.json.

[36]: `executor.build_sim(LFU_CFG, ROOT_DIR)`

```
mkdir /home/huawei/dev/ChampSim/.csconfig/452c291c/obj
mkdir /home/huawei/dev/ChampSim/.csconfig/452c291c/btbDbasic_btb
mkdir /home/huawei/dev/ChampSim/.csconfig/452c291c/branchDbimodal
mkdir /home/huawei/dev/ChampSim/.csconfig/452c291c/prefetcherDno
mkdir /home/huawei/dev/ChampSim/.csconfig/452c291c/prefetcherDno_instr
mkdir /home/huawei/dev/ChampSim/.csconfig/452c291c/replacementDlfu
mkdir /home/huawei/dev/ChampSim/.csconfig/452c291c/replacementDlru
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/channel.o
/home/huawei/dev/ChampSim/src/channel.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/ptw.o
/home/huawei/dev/ChampSim/src/ptw.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/plain_printer.o
/home/huawei/dev/ChampSim/src/plain_printer.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/json_printer.o
/home/huawei/dev/ChampSim/src/json_printer.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
```

```
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/tracereader.o
/home/huawei/dev/ChampSim/src/tracereader.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/ooo_cpu.o
/home/huawei/dev/ChampSim/src/ooo_cpu.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/main.o
/home/huawei/dev/ChampSim/src/main.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/cache.o
/home/huawei/dev/ChampSim/src/cache.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/champsim.o
/home/huawei/dev/ChampSim/src/champsim.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/dram_controller.o
/home/huawei/dev/ChampSim/src/dram_controller.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/src
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/vmem.o
/home/huawei/dev/ChampSim/src/vmem.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -Wno-unused-parameter -MMD
```

```
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/btb/basic_btb -DCHAMPSIM_MODULE
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc -include btbDbasic_btb.inc
-c -o /home/huawei/dev/ChampSim/.csconfig/452c291c/btbDbasic_btb/basic_btb.o
/home/huawei/dev/ChampSim/btb/basic_btb/basic_btb.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -Wno-unused-parameter -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/branch/bimodal -DCHAMPSIM_MODULE
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc -include branchDbimodal.inc
-c -o /home/huawei/dev/ChampSim/.csconfig/452c291c/branchDbimodal/bimodal.o
/home/huawei/dev/ChampSim/branch/bimodal/bimodal.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -Wno-unused-parameter -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/prefetcher/no -DCHAMPSIM_MODULE
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc -include prefetcherDno.inc
-c -o /home/huawei/dev/ChampSim/.csconfig/452c291c/prefetcherDno/no.o
/home/huawei/dev/ChampSim/prefetcher/no/no.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -Wno-unused-parameter -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/prefetcher/no_instr -DCHAMPSIM_MODULE
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc -include
prefetcherDno_instr.inc  -c -o
/home/huawei/dev/ChampSim/.csconfig/452c291c/prefetcherDno_instr/no.o
/home/huawei/dev/ChampSim/prefetcher/no_instr/no.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -Wno-unused-parameter -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/replacement/lfu -DCHAMPSIM_MODULE
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc -include replacementDlfu.inc
-c -o /home/huawei/dev/ChampSim/.csconfig/452c291c/replacementDlfu/lfu.o
/home/huawei/dev/ChampSim/replacement/lfu/lfu.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -Wno-unused-parameter -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-I/home/huawei/dev/ChampSim/replacement/lru -DCHAMPSIM_MODULE
-I/home/huawei/dev/ChampSim/.csconfig/452c291c/inc -include replacementDlru.inc
-c -o /home/huawei/dev/ChampSim/.csconfig/452c291c/replacementDlru/lru.o
/home/huawei/dev/ChampSim/replacement/lru/lru.cc
g++ --std=c++17 -O3 -Wall -Wextra -Wshadow -Wpedantic -MMD
-I/home/huawei/dev/ChampSim/inc -isystem
/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/include
-L/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/lib
-L/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/lib/manual-link
-L/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/lib
```

```
-L/home/huawei/dev/ChampSim/vcpkg_installed/x64-linux/lib/manual-link -o
/home/huawei/dev/ChampSim/bin/champsim
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/channel.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/ptw.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/plain_printer.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/json_printer.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/tracereader.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/ooo_cpu.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/main.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/cache.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/champsim.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/dram_controller.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/obj/vmem.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/btbDbasic_btb/basic_btb.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/branchDbimodal/bimodal.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/prefetcherDno/no.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/prefetcherDno_instr/no.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/replacementDlfu/lfu.o
/home/huawei/dev/ChampSim/.csconfig/452c291c/replacementDlru/lru.o  -llzma -lz
-lbz2 -lfmt
```

[37]:
```
executor.run_traces(TRACES_DIR, f"{RESULTS_DIR}/lfu", ROOT_DIR, WARMUP,
     INSTRS_COUNT)
```

```
Running
tasks/traces/641.leela_s-149B.champsimtrace.xz…
Running
tasks/traces/603.bwaves_s-2931B.champsimtrace.xz…
Running tasks/traces/619.lbm_s-2676B.champsimtrace.xz…
Running
tasks/traces/607.cactuBSSN_s-2421B.champsimtrace.xz…
Running tasks/traces/654.roms_s-293B.champsimtrace.xz…
Running
tasks/traces/649.fotonik3d_s-1176B.champsimtrace.xz…
Running tasks/traces/627.cam4_s-490B.champsimtrace.xz…
Running tasks/traces/605.mcf_s-1536B.champsimtrace.xz…
Running
tasks/traces/620.omnetpp_s-141B.champsimtrace.xz…
Running
tasks/traces/600.perlbench_s-1273B.champsimtrace.xz…
Running tasks/traces/657.xz_s-4994B.champsimtrace.xz…
Running tasks/traces/621.wrf_s-575B.champsimtrace.xz…
Running
tasks/traces/638.imagick_s-10316B.champsimtrace.xz…
Running
tasks/traces/631.deepsjeng_s-928B.champsimtrace.xz…
Running
tasks/traces/644.nab_s-12459B.champsimtrace.xz…
```

```
Running
tasks/traces/623.xalancbmk_s-165B.champsimtrace.xz…
The results are recorded in
tasks/task2/results/lfu/638.imagick_s-10316B.champsimtrace.xz.json.
Running tasks/traces/625.x264_s-12B.champsimtrace.xz…
The results are recorded in
tasks/task2/results/lfu/621.wrf_s-575B.champsimtrace.xz.json.
Running tasks/traces/602.gcc_s-1850B.champsimtrace.xz…
The results are recorded in
tasks/task2/results/lfu/600.perlbench_s-1273B.champsimtrace.xz.json.
Running tasks/traces/628.pop2_s-17B.champsimtrace.xz…
The results are recorded in
tasks/task2/results/lfu/657.xz_s-4994B.champsimtrace.xz.json.
Running
tasks/traces/648.exchange2_s-387B.champsimtrace.xz…
The results are recorded in
tasks/task2/results/lfu/644.nab_s-12459B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/623.xalancbmk_s-165B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/627.cam4_s-490B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/641.leela_s-149B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/631.deepsjeng_s-928B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/654.roms_s-293B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/607.cactuBSSN_s-2421B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/625.x264_s-12B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/649.fotonik3d_s-1176B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/628.pop2_s-17B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/648.exchange2_s-387B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/603.bwaves_s-2931B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/620.omnetpp_s-141B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/602.gcc_s-1850B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/605.mcf_s-1536B.champsimtrace.xz.json.
The results are recorded in
tasks/task2/results/lfu/619.lbm_s-2676B.champsimtrace.xz.json.
```

Collect stats

```python
class Stats:
    mpki: float
    hits: float
    misses: float

    def __init__(self, instrs, cycles, hits, misses):
        self.hits = hits
        self.misses = misses
        self.ipc = float(instrs) / cycles

stats = {}
```

```python
os.chdir(TASK_2_DIR)
pols = ["lru", "lfu"]
for pol in pols:
    stats_dir_name = f"results/{pol}"
    stats_dir = os.fsencode(stats_dir_name)

    stats.update({pol: {}})
    for file in os.listdir(stats_dir):
        file = file.decode("ascii")
        file_path = f"{stats_dir_name}/{file}"
        with open(file_path) as f:
            data = json.load(f)[0]["sim"]

        instrs = data["cores"][0]["instructions"]
        cycles = data["cores"][0]["cycles"]

        hits = sum(map(lambda x: x["hit"][0], [data["cpu0_L2C"]["LOAD"],
 ↪data["cpu0_L2C"]["WRITE"], data["cpu0_L2C"]["TRANSLATION"]]))
        misses = sum(map(lambda x: x["miss"][0], [data["cpu0_L2C"]["LOAD"],
 ↪data["cpu0_L2C"]["WRITE"], data["cpu0_L2C"]["TRANSLATION"]]))

        stats[pol].update({ file: Stats(instrs, cycles, hits, misses) })
```

```python
tests = []
hit_rates = {}
ipcs = {}

for test in stats["lru"]:
    tests.append(test)

for pol in stats:
    hit_rates.update({pol: []})
    ipcs.update({pol: []})
    for test in stats[pol]:
```
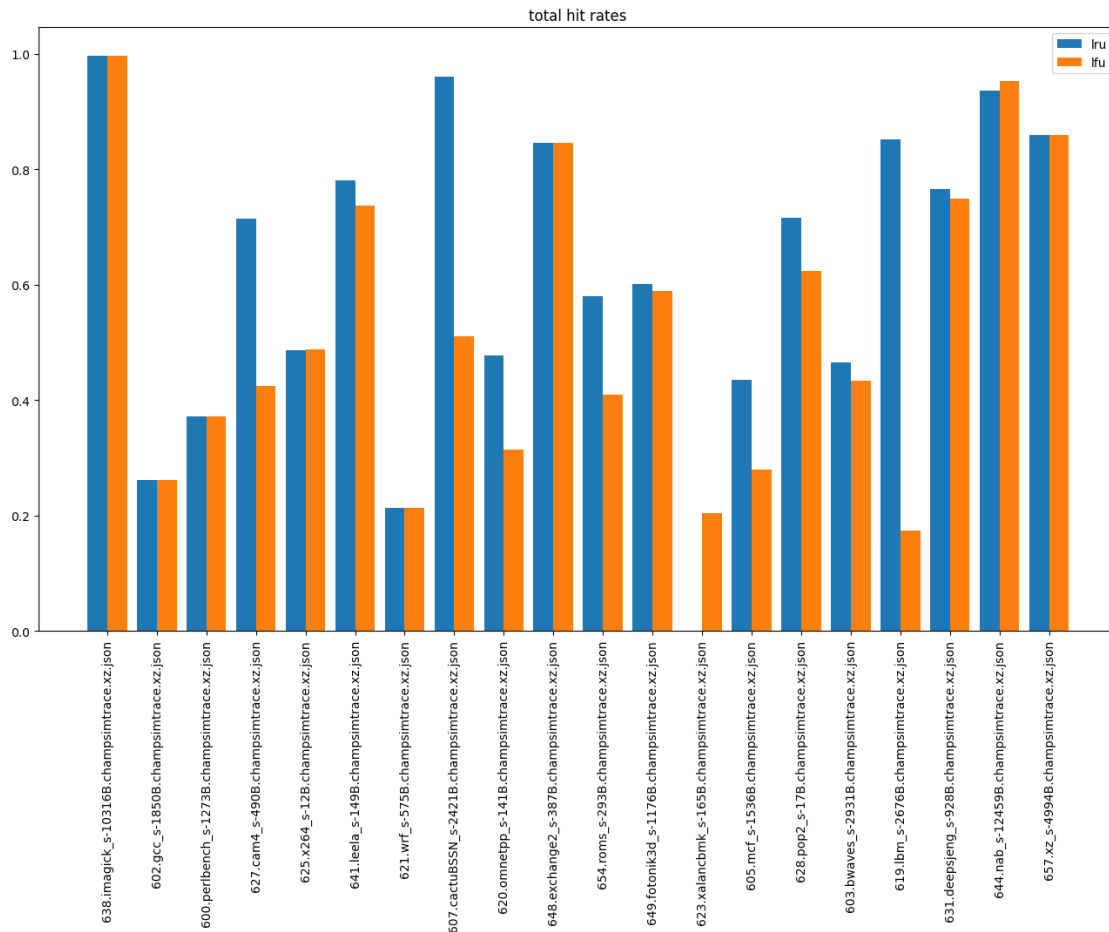
```
        hit_rates[pol].append(stats[pol][test].hits / (stats[pol][test].hits +␣
    ↪stats[pol][test].misses))
        ipcs[pol].append(stats[pol][test].ipc)
```

[42]:
```
fig, ax = plt.subplots()
fig.set_figwidth(16)
fig.set_figheight(9)
executor.bar_plot(ax, hit_rates, title="total hit rates", xticks=tests)
plt.show()
```
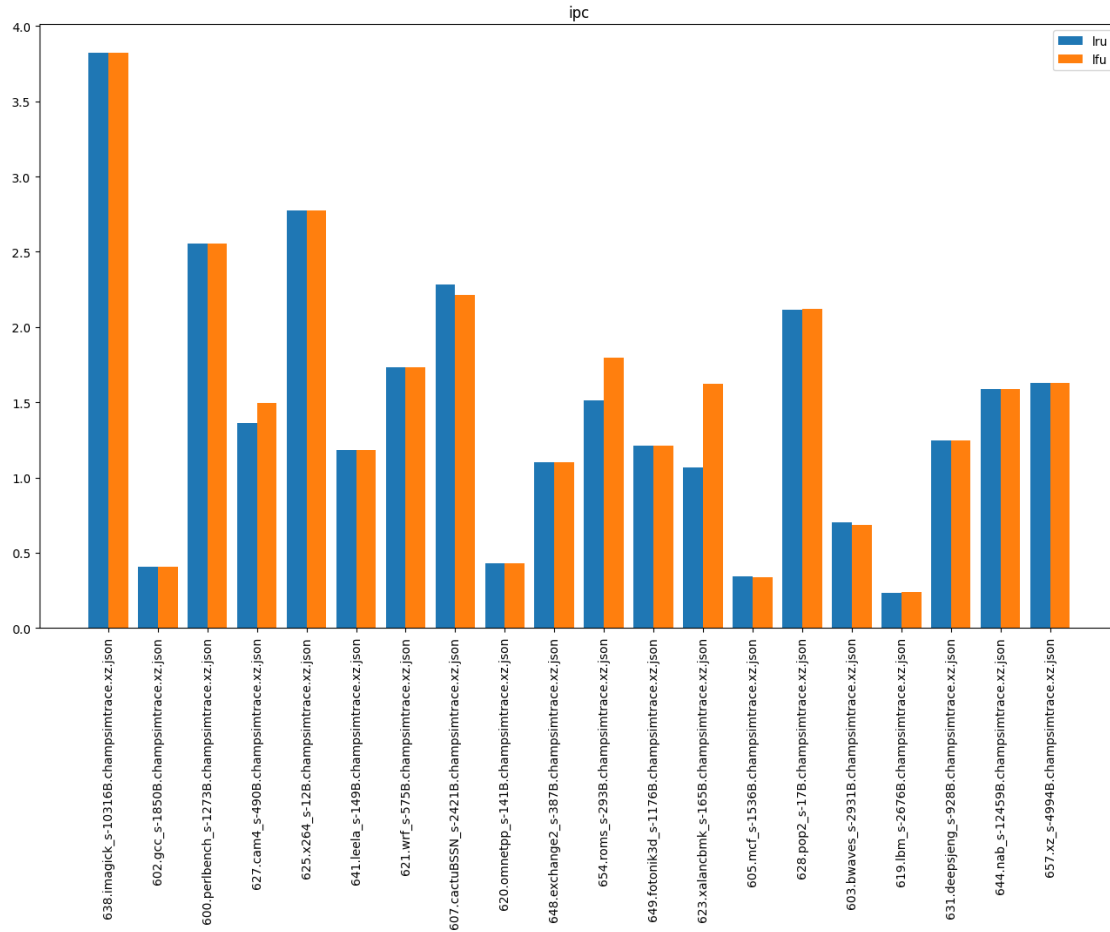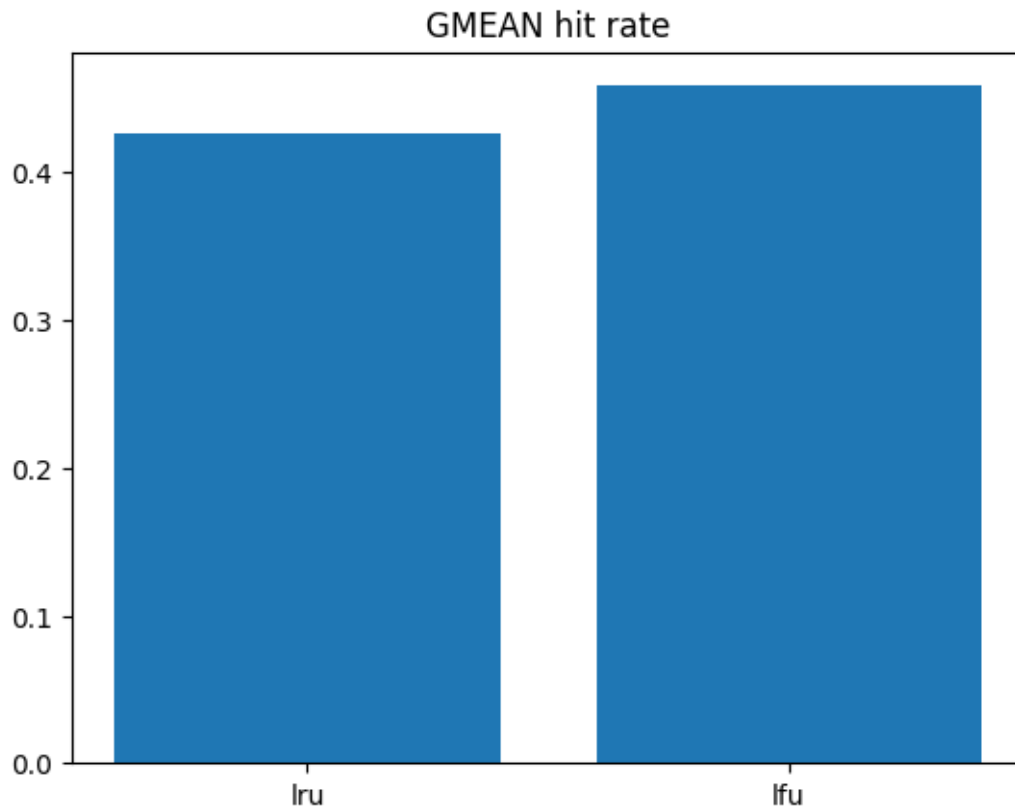

[43]:
```
fig, ax = plt.subplots()
fig.set_figwidth(16)
fig.set_figheight(9)
executor.bar_plot(ax, ipcs, title="ipc", xticks=tests)
plt.show()
```

ipc

```
[44]: gmean = []
      for pol in hit_rates.keys():
          gmean.append(geometric_mean(hit_rates[pol]))

      plt.bar(hit_rates.keys(), gmean)
      plt.title("GMEAN hit rate")
      plt.show()
```

GMEAN hit rate


```
[45]:  gmean = []
       for bp in ipcs.keys():
           gmean.append(geometric_mean(ipcs[bp]))

       plt.bar(ipcs.keys(), gmean)
       plt.title("GMEAN IPC")
       plt.show()
```

GMEAN IPC