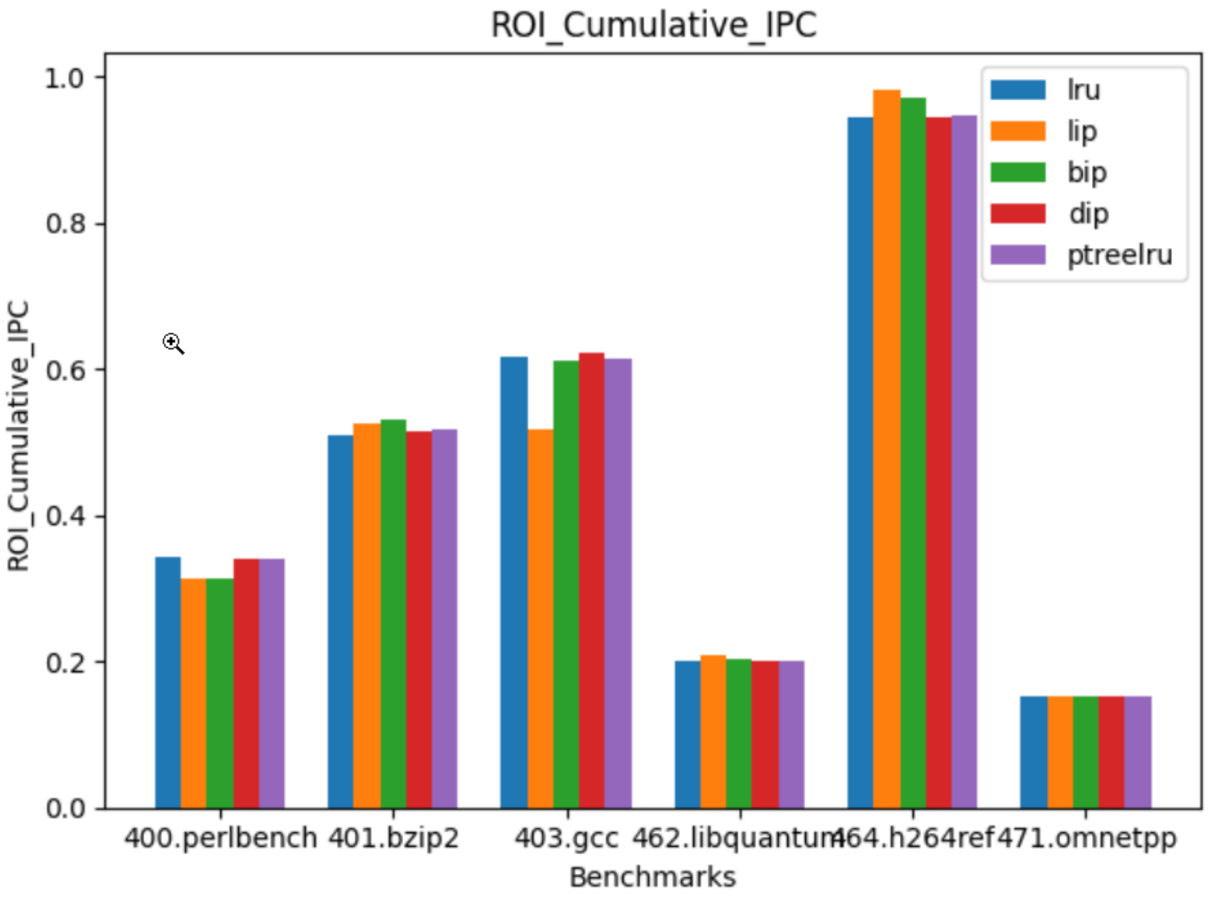
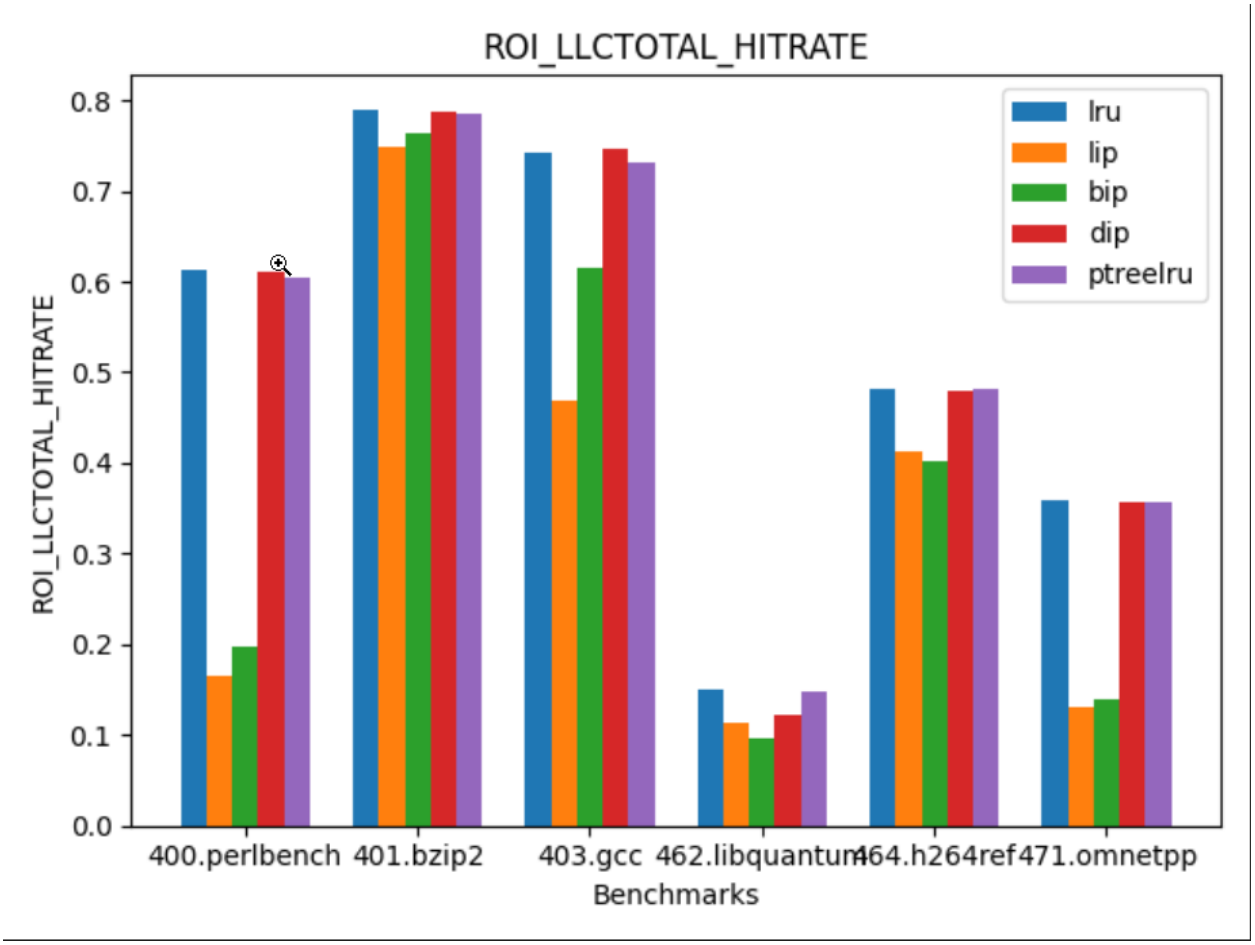
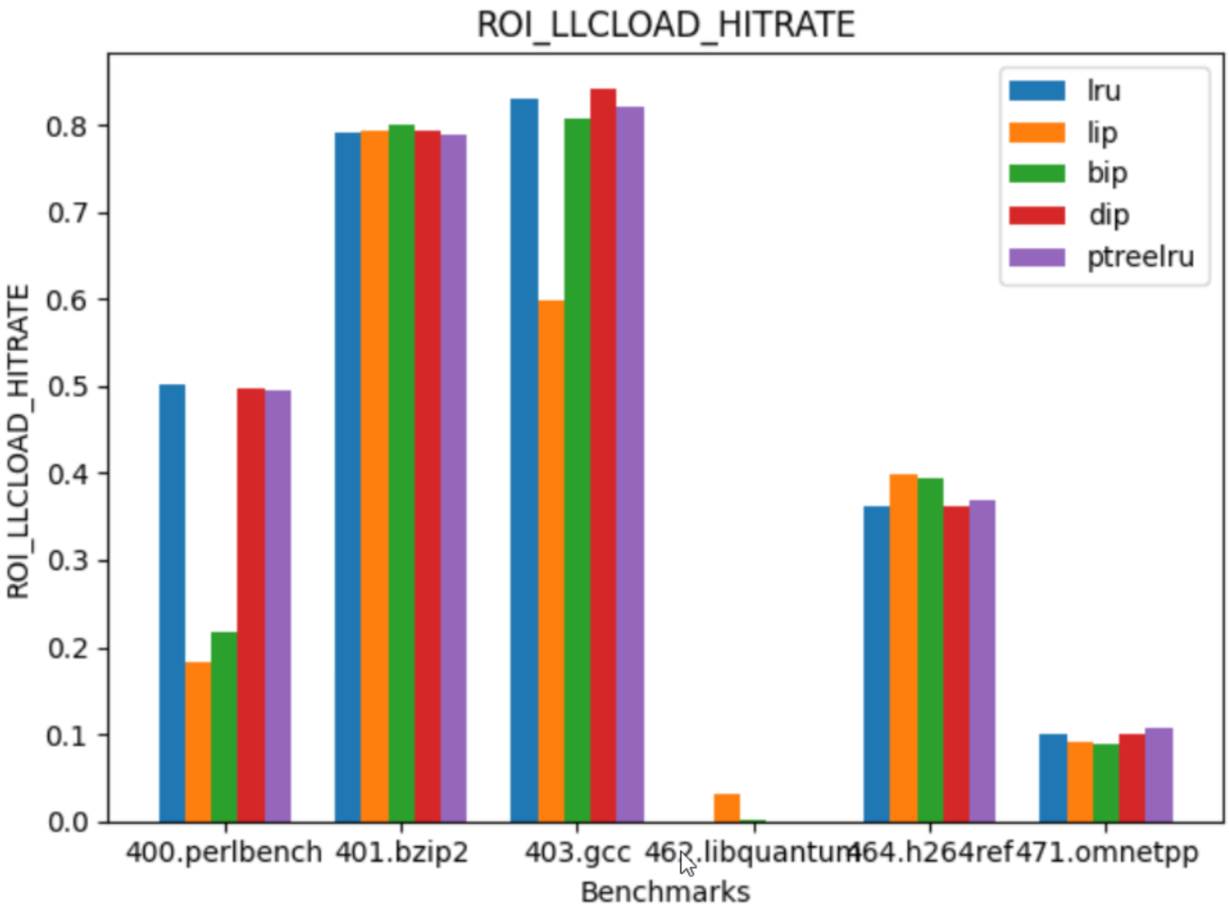
CPEN411 Assignment2

1. Implementation
   - LIP: The only difference LIP makes upon LRU is that it inserts a new line into the LRU instead of MRU.
   - BIP: BIP chooses to insert a new line at LRU or MRU with a probability given by epsilon.
   - DIP: DIP assigns some sample sets to both LRU and BIP and uses a PSEL counter to record the difference in cache misses between the two policies. It then applies the policy that generates less cumulative misses on sample sets to following sets.
   - PTreeLRU: PTreeLRU uses a binary tree to emulate the LRU policy. The last layer of the tree points to all the ways in a set. Each node in the tree saves a bit tracks the cache usage history. When a cache hit or cache fill happens, all the nodes on the path from tree root to the destination way are updated to point to the other side of the path. The way that is connected to the tree root is the next evicted path.

2. Graphs




ROI_LLCTOTAL_HITRATE
ROI_LLCTOTAL_HITRATE
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
400.perlbench
401.bzip2
403.gcc
462.libquantum
464.h264ref
471.omnetpp
Benchmarks
lru
lip
bip
dip
ptreelru


ROI_LLCLOAD_HITRATE
ROI_LLCLOAD_HITRATE
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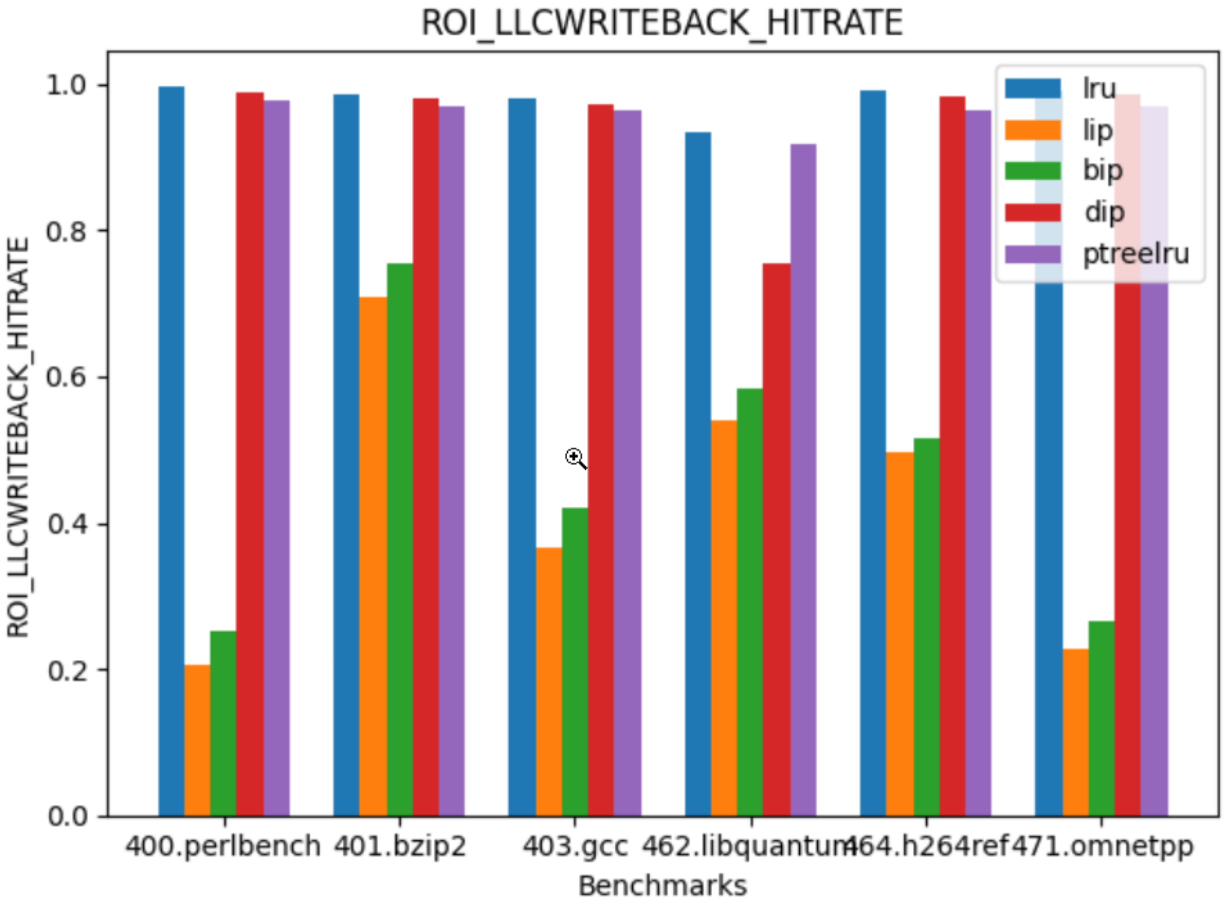
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
lru
lip
bip
dip
ptreelru
400.perlbench
401.bzip2
403.gcc
462.libquantum
464.h264ref
471.omnetpp
Benchmarks


ROI_LLCWRITEBACK_HITRATE
ROI_LLCWRITEBACK_HITRATE
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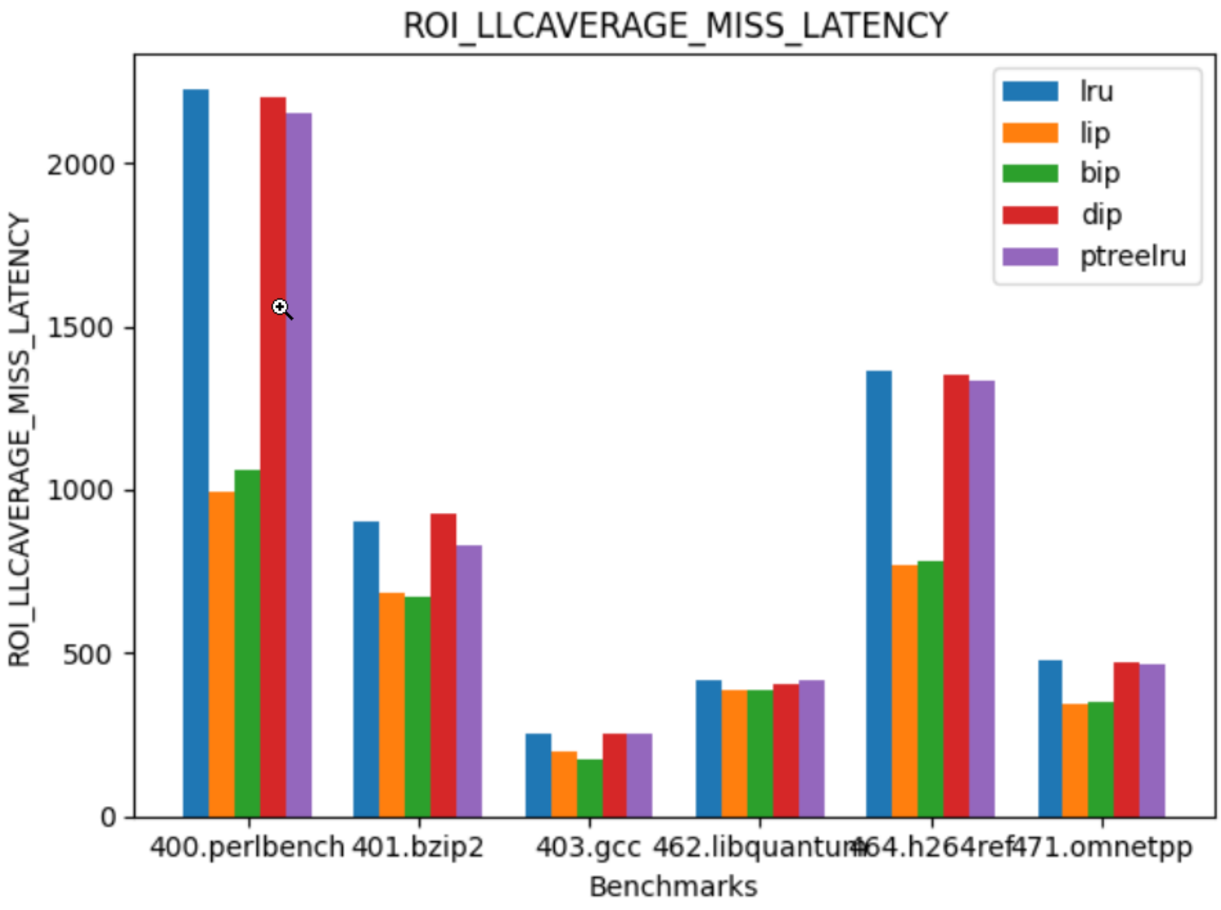
0.8
0.6
0.4
0.2
0.0
lru
lip
bip
dip
ptreelru
400.perlbench
401.bzip2
403.gcc
462.libquantum
464.h264ref
471.omnetpp
Benchmarks



3. IPC comparison

Workload: 400.perlbench

lip Speedup: 1.0948

bip Speedup: 1.0947

dip Speedup: 1.0021

ptreelru Speedup: 1.0025

Workload: 401.bzip2

lip Speedup: 0.9710

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bip Speedup: 0.9583
dip Speedup: 0.9913
ptreelru Speedup: 0.9865

Workload: 403.gcc
lip Speedup: 1.1939
bip Speedup: 1.0124
dip Speedup: 0.9914
ptreelru Speedup: 1.0058

Workload: 462.libquantum
lip Speedup: 0.9658
bip Speedup: 0.9900
dip Speedup: 1.0007
ptreelru Speedup: 1.0010

Workload: 464.h264ref
lip Speedup: 0.9607
bip Speedup: 0.9720
dip Speedup: 1.0009
ptreelru Speedup: 0.9972

Workload: 471.omnetpp
lip Speedup: 0.9927
bip Speedup: 0.9992
dip Speedup: 1.0003
ptreelru Speedup: 0.9913
```

400.perlbench Geometric Mean Speedup: 1.0378

401.bzip2 Geometric Mean Speedup: 0.9813

403.gcc Geometric Mean Speedup: 1.0380

462.libquantum Geometric Mean Speedup: 0.9914

464.h264ref Geometric Mean Speedup: 0.9860

471.omnetpp Geometric Mean Speedup: 0.9967