MEMORY SIMULATION

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INTRODUCTION

The objective of this project was to develop and implement a memory simulator capable of evaluating two levels of cache memory (write-allocated and write-back) and a main memory. 8-entry victim caches were included to reduce the degree of associativity, and each was implemented with a Least Recently Used (LRU) replacement policy.

A set of six production traces were used to output data with regards to the memory simulator's cache configuration respective performance. Additionally, simulations were run for the following sizes of bandwidth to main memory: 8, 16, 32, and 64. Comparisons between cost and performance were made in order to determine the most efficient main memory system model, in terms of both cost and performance.

RESULTS

As is evident from Figure 1, execution times for the different configurations and traces show little variance, with the major exceptions being the All Small configuration and the libquantum trace. The libquantum trace exhibits the same execution time for all configurations, and this is due to (CPI being the same?) JEFF EXPLAIN THINGS. Mention that bzip2 also doesn't change very much?

The omnetpp, gobmk, and sjeng traces have a markedly greater execution time for L1 Small and L1 Small 4way, and a significantly greater execution time for All Small. THIS IS BECAUSE REASONS

Figure 1

CPI comparison of all configurations and traces (see Figure 2) again highlights

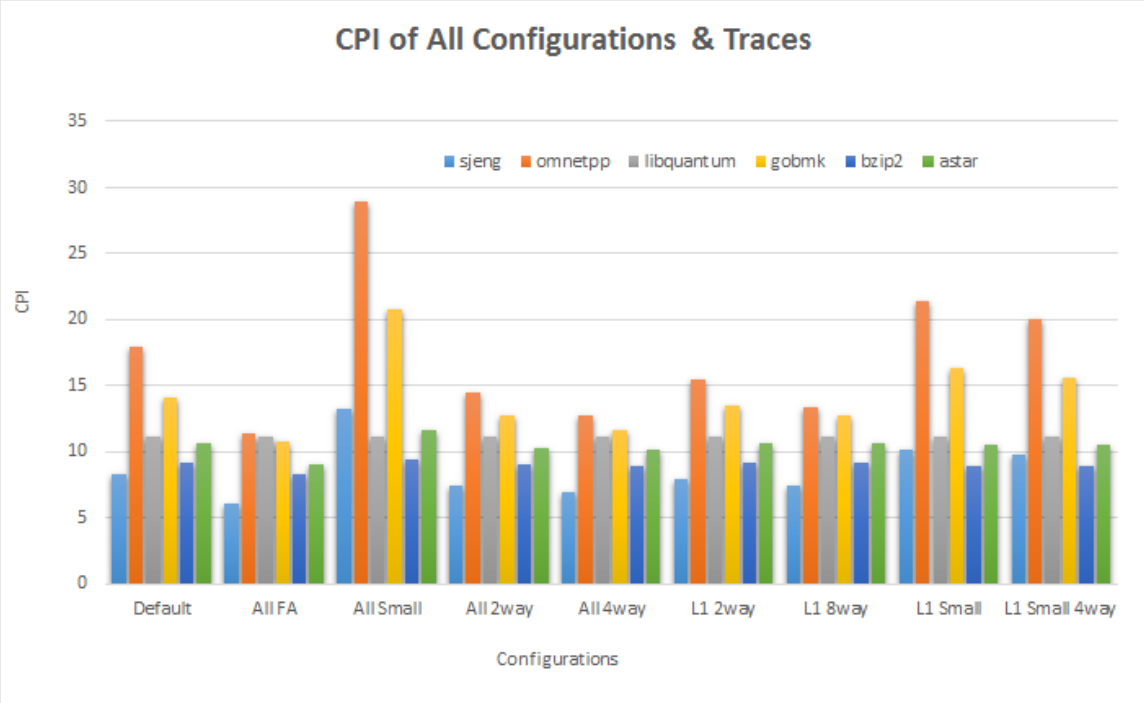

Figure 2

DISCUSSION

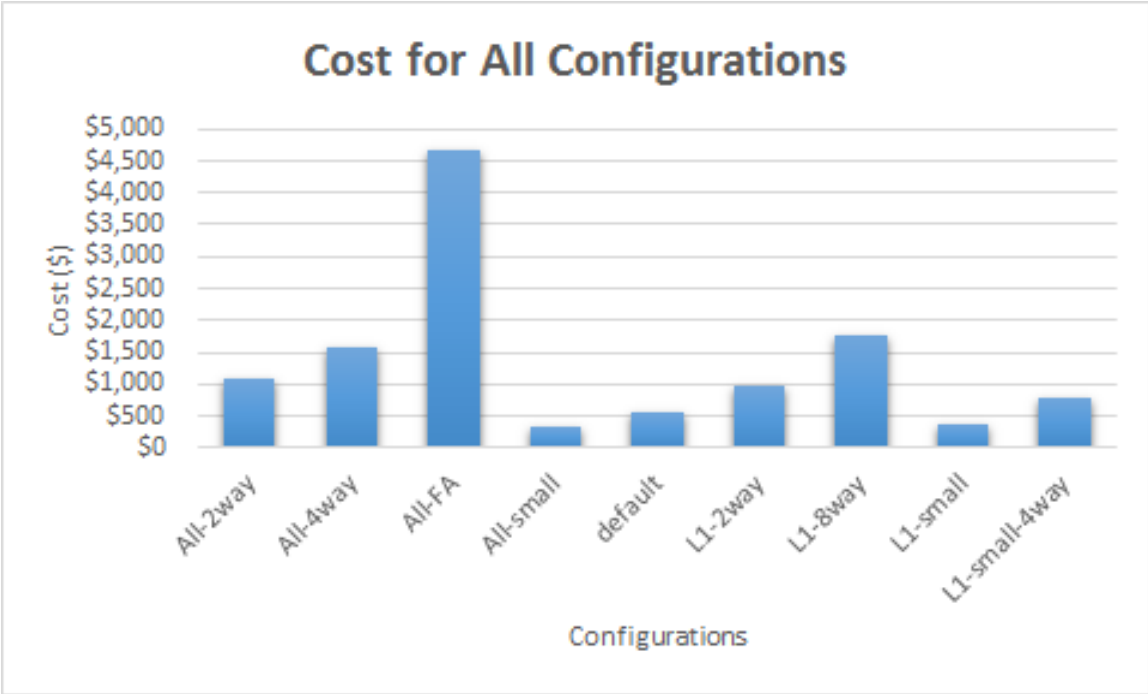

Figure 3

Observation of Fig. # shows a sharp decrease in performance from 8 and 16 bytes. Performance increases slightly as chunksize is increased from 16 bytes, but it is questionable whether or not the increase in cost is worth the larger bandwidth to main memory.

CONCLUSION

SIMULATOR CODE

PRODUCTION TRACE SIMULATION RESULTS

```
-------------------------------------------------------------------------
      astar.All-2way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 2 : block size = 32
    Icache size = 8192 : ways = 2 : block size = 32
    L2-cache size = 32768 : ways = 2 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    69678890572;  Total refs = 10000000882
  Inst refs = 6792328181;  Data refs = 3207672701

  Number of reference types:  [Percentage]
    Reads  =  2570967807    [25.7%]
    Writes =   636704894    [ 6.4%]
    Inst.  =  6792328181    [67.9%]
    Total  = 10000000882

  Total cycles for activities:  [Percentage]
    Reads  = 33906948328    [48.7%]
    Writes = 17659870255    [25.3%]
    Inst.  = 18112071989    [26.0%]
    Total  = 69678890572

  CPI = 10.3
  Ideal: Exec. Time = 16792329063; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 22633347554; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11304267758  Miss Count = 239347
    Total Requests = 11304507105
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 83648; Dirty kickouts = 0; Transfers = 83912
    VC Hit count = 155435

  Memory Level:  L1d
    Hit Count = 4323107977  Miss Count = 213404291
    Total Requests = 4536512268
    Hit Rate = 95.3%   Miss Rate = 4.7%
    Kickouts = 199310538; Dirty kickouts = 84243336; Transfers = 199310802
    VC Hit count = 14093489

  Memory Level:  L2
    Hit Count = 139108988  Miss Count = 144529062
    Total Requests = 283638050
    Hit Rate = 49.0%   Miss Rate = 51.0%
    Kickouts = 139172090; Dirty kickouts = 68853742; Transfers = 139172610
    VC Hit count = 5356452

  L1 cache cost (Icache $400) + (Dcache $400) = $800
  L2 cache cost = $200;  Memory cost = $75  Total cost = $1075
```

```
--------------------------------------------------------------------------
      astar.All-4way       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 4 : block size = 32
    Icache size = 8192 : ways = 4 : block size = 32
    L2-cache size = 32768 : ways = 4 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    68567566925;  Total refs = 10000000882
  Inst refs = 6792328181;  Data refs = 3207672701

  Number of reference types:  [Percentage]
    Reads  =  2570967807    [25.7%]
    Writes =   636704894    [ 6.4%]
    Inst.  =  6792328181    [67.9%]
    Total  = 10000000882

  Total cycles for activities:  [Percentage]
    Reads  = 33040878920    [48.2%]
    Writes = 17424618315    [25.4%]
    Inst.  = 18102069690    [26.4%]
    Total  = 68567566925

  CPI = 10.1
  Ideal: Exec. Time = 16792329063; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 22633347554; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11304448123  Miss Count = 58982
    Total Requests = 11304507105
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 22485; Dirty kickouts = 0; Transfers = 22749
    VC Hit count = 36233

  Memory Level:  L1d
    Hit Count = 4337127391  Miss Count = 199384877
    Total Requests = 4536512268
    Hit Rate = 95.6%   Miss Rate = 4.4%
    Kickouts = 194964024; Dirty kickouts = 82953812; Transfers = 194964288
    VC Hit count = 4420589

  Memory Level:  L2
    Hit Count = 138950267  Miss Count = 138990582
    Total Requests = 277940849
    Hit Rate = 50.0%   Miss Rate = 50.0%
    Kickouts = 134637532; Dirty kickouts = 68487092; Transfers = 134638052
    VC Hit count = 4352530

  L1 cache cost (Icache $600) + (Dcache $600) = $1200
  L2 cache cost = $300;  Memory cost = $75  Total cost = $1575
```

```
--------------------------------------------------------------------------
      astar.All-FA       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 256 : block size = 32
    Icache size = 8192 : ways = 256 : block size = 32
    L2-cache size = 32768 : ways = 512 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    61417825660;  Total refs = 10000000882
  Inst refs = 6792328181;  Data refs = 3207672701

  Number of reference types:  [Percentage]
    Reads  =  2570967807    [25.7%]
    Writes =   636704894    [ 6.4%]
    Inst.  =  6792328181    [67.9%]
    Total  = 10000000882

  Total cycles for activities:  [Percentage]
    Reads  = 26832135633    [43.7%]
    Writes = 16488133847    [26.8%]
    Inst.  = 18097556180    [29.5%]
    Total  = 61417825660

  CPI = 9.0
  Ideal: Exec. Time = 16792329063; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 22633347554; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11304502787  Miss Count = 4318
    Total Requests = 11304507105
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 3968; Dirty kickouts = 0; Transfers = 4232
    VC Hit count = 86

  Memory Level:  L1d
    Hit Count = 4354819762  Miss Count = 181692506
    Total Requests = 4536512268
    Hit Rate = 96.0%   Miss Rate = 4.0%
    Kickouts = 179928510; Dirty kickouts = 79848713; Transfers = 179928774
    VC Hit count = 1763732

  Memory Level:  L2
    Hit Count = 155260644  Miss Count = 104521075
    Total Requests = 259781719
    Hit Rate = 59.8%   Miss Rate = 40.2%
    Kickouts = 104085385; Dirty kickouts = 64156775; Transfers = 104085905
    VC Hit count = 435170

  L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
  L2 cache cost = $1000;  Memory cost = $75  Total cost = $4675
```

```
------------------------------------------------------------------------
      astar.All-small       Simulation Results
------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 1 : block size = 32
    Icache size = 4096 : ways = 1 : block size = 32
    L2-cache size = 16384 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    79303684099;  Total refs = 10000000882
  Inst refs = 6792328181;  Data refs = 3207672701

  Number of reference types:  [Percentage]
    Reads  =  2570967807    [25.7%]
    Writes =   636704894    [ 6.4%]
    Inst.  =  6792328181    [67.9%]
    Total  = 10000000882

  Total cycles for activities:  [Percentage]
    Reads  = 41687468211    [52.6%]
    Writes = 19342697220    [24.4%]
    Inst.  = 18273518668    [23.0%]
    Total  = 79303684099

  CPI = 11.7
  Ideal: Exec. Time = 16792329063; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 22633347554; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11303198813  Miss Count = 1308292
    Total Requests = 11304507105
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 1109964; Dirty kickouts = 0; Transfers = 1110100
    VC Hit count = 198192

  Memory Level:  L1d
    Hit Count = 4027596117  Miss Count = 508916151
    Total Requests = 4536512268
    Hit Rate = 88.8%   Miss Rate = 11.2%
    Kickouts = 230578556; Dirty kickouts = 92441707; Transfers = 230578692
    VC Hit count = 278337459

  Memory Level:  L2
    Hit Count = 137117862  Miss Count = 187012637
    Total Requests = 324130499
    Hit Rate = 42.3%   Miss Rate = 57.7%
    Kickouts = 175211060; Dirty kickouts = 75979408; Transfers = 175211324
    VC Hit count = 11801313

  L1 cache cost (Icache $100) + (Dcache $100) = $200
  L2 cache cost = $50;  Memory cost = $75  Total cost = $325
```

```
---------------------------------------------------------------------
      astar.default       Simulation Results
---------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 1 : block size = 32
    Icache size = 8192 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    71752044381;  Total refs = 10000000882
  Inst refs = 6792328181;  Data refs = 3207672701

  Number of reference types:  [Percentage]
    Reads  =  2570967807    [25.7%]
    Writes =   636704894    [ 6.4%]
    Inst.  =  6792328181    [67.9%]
    Total  = 10000000882

  Total cycles for activities:  [Percentage]
    Reads  = 35358301275    [49.3%]
    Writes = 18227281281    [25.4%]
    Inst.  = 18166461825    [25.3%]
    Total  = 71752044381

  CPI = 10.6
  Ideal: Exec. Time = 16792329063; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 22633347554; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11303848034  Miss Count = 659071
    Total Requests = 11304507105
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 421517; Dirty kickouts = 0; Transfers = 421781
    VC Hit count = 237290

  Memory Level:  L1d
    Hit Count = 4276756770  Miss Count = 259755498
    Total Requests = 4536512268
    Hit Rate = 94.3%   Miss Rate = 5.7%
    Kickouts = 205412869; Dirty kickouts = 86399517; Transfers = 205413133
    VC Hit count = 54342365

  Memory Level:  L2
    Hit Count = 134971398  Miss Count = 157263033
    Total Requests = 292234431
    Hit Rate = 46.2%   Miss Rate = 53.8%
    Kickouts = 147644858; Dirty kickouts = 69593999; Transfers = 147645378
    VC Hit count = 9617655

  L1 cache cost (Icache $200) + (Dcache $200) = $400
  L2 cache cost = $100;  Memory cost = $75  Total cost = $575
```

```
-------------------------------------------------------------------------
      astar.L1-2way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 2 : block size = 32
    Icache size = 8192 : ways = 2 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    71893575882;  Total refs = 10000000882
  Inst refs = 6792328181;  Data refs = 3207672701

  Number of reference types:  [Percentage]
    Reads  =  2570967807    [25.7%]
    Writes =   636704894    [ 6.4%]
    Inst.  =  6792328181    [67.9%]
    Total  = 10000000882

  Total cycles for activities:  [Percentage]
    Reads  = 35600756858    [49.5%]
    Writes = 18180786925    [25.3%]
    Inst.  = 18112032099    [25.2%]
    Total  = 71893575882

  CPI = 10.6
  Ideal: Exec. Time = 16792329063; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 22633347554; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11304267758  Miss Count = 239347
    Total Requests = 11304507105
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 83648; Dirty kickouts = 0; Transfers = 83912
    VC Hit count = 155435

  Memory Level:  L1d
    Hit Count = 4323107977  Miss Count = 213404291
    Total Requests = 4536512268
    Hit Rate = 95.3%   Miss Rate = 4.7%
    Kickouts = 199310538; Dirty kickouts = 84243336; Transfers = 199310802
    VC Hit count = 14093489

  Memory Level:  L2
    Hit Count = 128014809  Miss Count = 155623241
    Total Requests = 283638050
    Hit Rate = 45.1%   Miss Rate = 54.9%
    Kickouts = 149667456; Dirty kickouts = 70045840; Transfers = 149667976
    VC Hit count = 5955265

  L1 cache cost (Icache $400) + (Dcache $400) = $800
  L2 cache cost = $100;  Memory cost = $75  Total cost = $975
```

```
-------------------------------------------------------------------------
      astar.L1-8way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 8 : block size = 32
    Icache size = 8192 : ways = 8 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    72063482373;  Total refs = 10000000882
  Inst refs = 6792328181;  Data refs = 3207672701

  Number of reference types:  [Percentage]
    Reads  =  2570967807    [25.7%]
    Writes =   636704894    [ 6.4%]
    Inst.  =  6792328181    [67.9%]
    Total  = 10000000882

  Total cycles for activities:  [Percentage]
    Reads  = 35759677909    [49.6%]
    Writes = 18205725889    [25.3%]
    Inst.  = 18098078575    [25.1%]
    Total  = 72063482373

  CPI = 10.6
  Ideal: Exec. Time = 16792329063; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 22633347554; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11304476062  Miss Count = 31043
    Total Requests = 11304507105
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 5788; Dirty kickouts = 0; Transfers = 6052
    VC Hit count = 24991

  Memory Level:  L1d
    Hit Count = 4338980044  Miss Count = 197532224
    Total Requests = 4536512268
    Hit Rate = 95.6%   Miss Rate = 4.4%
    Kickouts = 192466167; Dirty kickouts = 82337101; Transfers = 192466431
    VC Hit count = 5065793

  Memory Level:  L2
    Hit Count = 119032564  Miss Count = 155777020
    Total Requests = 274809584
    Hit Rate = 43.3%   Miss Rate = 56.7%
    Kickouts = 152021853; Dirty kickouts = 70089477; Transfers = 152022373
    VC Hit count = 3754647

  L1 cache cost (Icache $800) + (Dcache $800) = $1600
  L2 cache cost = $100;  Memory cost = $75  Total cost = $1775
```

```
-------------------------------------------------------------------------
      astar.L1-small       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 1 : block size = 32
    Icache size = 4096 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    71347308869;  Total refs = 10000000882
  Inst refs = 6792328181;  Data refs = 3207672701

  Number of reference types:  [Percentage]
    Reads  =  2570967807    [25.7%]
    Writes =   636704894    [ 6.4%]
    Inst.  =  6792328181    [67.9%]
    Total  = 10000000882

  Total cycles for activities:  [Percentage]
    Reads  = 35660283211    [50.0%]
    Writes = 17426674510    [24.4%]
    Inst.  = 18260351148    [25.6%]
    Total  = 71347308869

  CPI = 10.5
  Ideal: Exec. Time = 16792329063; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 22633347554; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11303198813  Miss Count = 1308292
    Total Requests = 11304507105
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 1109964; Dirty kickouts = 0; Transfers = 1110100
    VC Hit count = 198192

  Memory Level:  L1d
    Hit Count = 4027596117  Miss Count = 508916151
    Total Requests = 4536512268
    Hit Rate = 88.8%   Miss Rate = 11.2%
    Kickouts = 230578556; Dirty kickouts = 92441707; Transfers = 230578692
    VC Hit count = 278337459

  Memory Level:  L2
    Hit Count = 177176963  Miss Count = 146953536
    Total Requests = 324130499
    Hit Rate = 54.7%   Miss Rate = 45.3%
    Kickouts = 139281176; Dirty kickouts = 69932457; Transfers = 139281696
    VC Hit count = 7671840

  L1 cache cost (Icache $100) + (Dcache $100) = $200
  L2 cache cost = $100;  Memory cost = $75  Total cost = $375
```

```
-------------------------------------------------------------------------
      astar.L1-small-4way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 4 : block size = 32
    Icache size = 4096 : ways = 4 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    70987210560;  Total refs = 10000000882
  Inst refs = 6792328181;  Data refs = 3207672701

  Number of reference types:  [Percentage]
    Reads  =  2570967807    [25.7%]
    Writes =   636704894    [ 6.4%]
    Inst.  =  6792328181    [67.9%]
    Total  = 10000000882

  Total cycles for activities:  [Percentage]
    Reads  = 35526487154    [50.0%]
    Writes = 17287830794    [24.4%]
    Inst.  = 18172892612    [25.6%]
    Total  = 70987210560

  CPI = 10.5
  Ideal: Exec. Time = 16792329063; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 22633347554; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11303728781  Miss Count = 778324
    Total Requests = 11304507105
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 490903; Dirty kickouts = 0; Transfers = 491039
    VC Hit count = 287285

  Memory Level:  L1d
    Hit Count = 4302603636  Miss Count = 233908632
    Total Requests = 4536512268
    Hit Rate = 94.8%   Miss Rate = 5.2%
    Kickouts = 221374917; Dirty kickouts = 86690773; Transfers = 221375053
    VC Hit count = 12533579

  Memory Level:  L2
    Hit Count = 162759002  Miss Count = 145797863
    Total Requests = 308556865
    Hit Rate = 52.7%   Miss Rate = 47.3%
    Kickouts = 141078993; Dirty kickouts = 70151627; Transfers = 141079513
    VC Hit count = 4718350

  L1 cache cost (Icache $300) + (Dcache $300) = $600
  L2 cache cost = $100;  Memory cost = $75  Total cost = $775
```

```
-------------------------------------------------------------------------
      bzip2.All-2way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 2 : block size = 32
    Icache size = 8192 : ways = 2 : block size = 32
    L2-cache size = 32768 : ways = 2 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    68181000434;  Total refs = 10000001164
  Inst refs = 7566121173;  Data refs = 2433879991

  Number of reference types:  [Percentage]
    Reads  =  1881417428    [18.8%]
    Writes =   552462563    [ 5.5%]
    Inst.  =  7566121173    [75.7%]
    Total  = 10000001164

  Total cycles for activities:  [Percentage]
    Reads  = 24115444613    [35.4%]
    Writes = 24400881099    [35.8%]
    Inst.  = 19664674722    [28.8%]
    Total  = 68181000434

  CPI = 9.0
  Ideal: Exec. Time = 17566122337; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 22200012564; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 12096913205  Miss Count = 11111
    Total Requests = 12096924316
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 9100; Dirty kickouts = 0; Transfers = 9364
    VC Hit count = 1747

  Memory Level:  L1d
    Hit Count = 2376700760  Miss Count = 160266315
    Total Requests = 2536967075
    Hit Rate = 93.7%   Miss Rate = 6.3%
    Kickouts = 158933953; Dirty kickouts = 63191897; Transfers = 158934217
    VC Hit count = 1332098

  Memory Level:  L2
    Hit Count = 65935568  Miss Count = 156199910
    Total Requests = 222135478
    Hit Rate = 29.7%   Miss Rate = 70.3%
    Kickouts = 154403557; Dirty kickouts = 56923245; Transfers = 154404077
    VC Hit count = 1795833

  L1 cache cost (Icache $400) + (Dcache $400) = $800
  L2 cache cost = $200;  Memory cost = $75  Total cost = $1075
```

```
-------------------------------------------------------------------------
      bzip2.All-4way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 4 : block size = 32
    Icache size = 8192 : ways = 4 : block size = 32
    L2-cache size = 32768 : ways = 4 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    67383440400;  Total refs = 10000001164
  Inst refs = 7566121173;  Data refs = 2433879991

  Number of reference types:  [Percentage]
    Reads  =  1881417428    [18.8%]
    Writes =   552462563    [ 5.5%]
    Inst.  =  7566121173    [75.7%]
    Total  = 10000001164

  Total cycles for activities:  [Percentage]
    Reads  = 23796803209    [35.3%]
    Writes = 23922001955    [35.5%]
    Inst.  = 19664635236    [29.2%]
    Total  = 67383440400

  CPI = 8.9
  Ideal: Exec. Time = 17566122337; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 22200012564; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 12096914953  Miss Count = 9363
    Total Requests = 12096924316
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 8989; Dirty kickouts = 0; Transfers = 9253
    VC Hit count = 110

  Memory Level:  L1d
    Hit Count = 2378622038  Miss Count = 158345037
    Total Requests = 2536967075
    Hit Rate = 93.8%   Miss Rate = 6.2%
    Kickouts = 157884316; Dirty kickouts = 62729069; Transfers = 157884580
    VC Hit count = 460457

  Memory Level:  L2
    Hit Count = 68248784  Miss Count = 152374118
    Total Requests = 220622902
    Hit Rate = 30.9%   Miss Rate = 69.1%
    Kickouts = 150923686; Dirty kickouts = 56430744; Transfers = 150924206
    VC Hit count = 1449912

  L1 cache cost (Icache $600) + (Dcache $600) = $1200
  L2 cache cost = $300;  Memory cost = $75  Total cost = $1575
```

```
-------------------------------------------------------------------------
      bzip2.All-FA       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 256 : block size = 32
    Icache size = 8192 : ways = 256 : block size = 32
    L2-cache size = 32768 : ways = 512 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    62913989994;  Total refs = 10000001164
  Inst refs = 7566121173;  Data refs = 2433879991

  Number of reference types:  [Percentage]
    Reads  =  1881417428    [18.8%]
    Writes =   552462563    [ 5.5%]
    Inst.  =  7566121173    [75.7%]
    Total  = 10000001164

  Total cycles for activities:  [Percentage]
    Reads  = 22732621180    [36.1%]
    Writes = 20516738334    [32.6%]
    Inst.  = 19664630480    [31.3%]
    Total  = 62913989994

  CPI = 8.3
  Ideal: Exec. Time = 17566122337; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 22200012564; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 12096914907  Miss Count = 9409
    Total Requests = 12096924316
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 9045; Dirty kickouts = 0; Transfers = 9309
    VC Hit count = 100

  Memory Level:  L1d
    Hit Count = 2379495474  Miss Count = 157471601
    Total Requests = 2536967075
    Hit Rate = 93.8%   Miss Rate = 6.2%
    Kickouts = 157210497; Dirty kickouts = 62437590; Transfers = 157210761
    VC Hit count = 260840

  Memory Level:  L2
    Hit Count = 90769890  Miss Count = 128887770
    Total Requests = 219657660
    Hit Rate = 41.3%   Miss Rate = 58.7%
    Kickouts = 128035659; Dirty kickouts = 55948289; Transfers = 128036179
    VC Hit count = 851591

  L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
  L2 cache cost = $1000;  Memory cost = $75  Total cost = $4675
```

```
-------------------------------------------------------------------------
      bzip2.All-small       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 1 : block size = 32
    Icache size = 4096 : ways = 1 : block size = 32
    L2-cache size = 16384 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    70910807217;  Total refs = 10000001164
  Inst refs = 7566121173;  Data refs = 2433879991

  Number of reference types:  [Percentage]
    Reads  =  1881417428    [18.8%]
    Writes =   552462563    [ 5.5%]
    Inst.  =  7566121173    [75.7%]
    Total  = 10000001164

  Total cycles for activities:  [Percentage]
    Reads  = 25852929583    [36.5%]
    Writes = 25387078192    [35.8%]
    Inst.  = 19670799442    [27.7%]
    Total  = 70910807217

  CPI = 9.4
  Ideal: Exec. Time = 17566122337; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 22200012564; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 12096123209  Miss Count = 801107
    Total Requests = 12096924316
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 33226; Dirty kickouts = 0; Transfers = 33362
    VC Hit count = 767745

  Memory Level:  L1d
    Hit Count = 2333607763  Miss Count = 203359312
    Total Requests = 2536967075
    Hit Rate = 92.0%   Miss Rate = 8.0%
    Kickouts = 169325300; Dirty kickouts = 67486415; Transfers = 169325436
    VC Hit count = 34033876

  Memory Level:  L2
    Hit Count = 67699778  Miss Count = 169145435
    Total Requests = 236845213
    Hit Rate = 28.6%   Miss Rate = 71.4%
    Kickouts = 164138659; Dirty kickouts = 59102821; Transfers = 164138923
    VC Hit count = 5006512

  L1 cache cost (Icache $100) + (Dcache $100) = $200
  L2 cache cost = $50;  Memory cost = $75  Total cost = $325
```

```
-------------------------------------------------------------------------
      bzip2.default       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 1 : block size = 32
    Icache size = 8192 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    69414271706;  Total refs = 10000001164
  Inst refs = 7566121173;  Data refs = 2433879991

  Number of reference types:  [Percentage]
    Reads  =  1881417428    [18.8%]
    Writes =   552462563    [ 5.5%]
    Inst.  =  7566121173    [75.7%]
    Total  = 10000001164

  Total cycles for activities:  [Percentage]
    Reads  = 24692333956    [35.6%]
    Writes = 25053604538    [36.1%]
    Inst.  = 19668333212    [28.3%]
    Total  = 69414271706

  CPI = 9.2
  Ideal: Exec. Time = 17566122337; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 22200012564; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 12096136739  Miss Count = 787577
    Total Requests = 12096924316
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 21573; Dirty kickouts = 0; Transfers = 21837
    VC Hit count = 765740

  Memory Level:  L1d
    Hit Count = 2358684140  Miss Count = 178282935
    Total Requests = 2536967075
    Hit Rate = 93.0%   Miss Rate = 7.0%
    Kickouts = 160892153; Dirty kickouts = 63990996; Transfers = 160892417
    VC Hit count = 17390518

  Memory Level:  L2
    Hit Count = 61694563  Miss Count = 163210687
    Total Requests = 224905250
    Hit Rate = 27.4%   Miss Rate = 72.6%
    Kickouts = 159485691; Dirty kickouts = 57767871; Transfers = 159486211
    VC Hit count = 3724476

  L1 cache cost (Icache $200) + (Dcache $200) = $400
  L2 cache cost = $100;  Memory cost = $75  Total cost = $575
```

```
-------------------------------------------------------------------------
      bzip2.L1-2way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 2 : block size = 32
    Icache size = 8192 : ways = 2 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    69420214024;  Total refs = 10000001164
  Inst refs = 7566121173;  Data refs = 2433879991

  Number of reference types:  [Percentage]
    Reads  =  1881417428    [18.8%]
    Writes =   552462563    [ 5.5%]
    Inst.  =  7566121173    [75.7%]
    Total  = 10000001164

  Total cycles for activities:  [Percentage]
    Reads  = 24662798843    [35.5%]
    Writes = 25092747689    [36.1%]
    Inst.  = 19664667492    [28.3%]
    Total  = 69420214024

  CPI = 9.2
  Ideal: Exec. Time = 17566122337; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 22200012564; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 12096913205  Miss Count = 11111
    Total Requests = 12096924316
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 9100; Dirty kickouts = 0; Transfers = 9364
    VC Hit count = 1747

  Memory Level:  L1d
    Hit Count = 2376700760  Miss Count = 160266315
    Total Requests = 2536967075
    Hit Rate = 93.7%   Miss Rate = 6.3%
    Kickouts = 158933953; Dirty kickouts = 63191897; Transfers = 158934217
    VC Hit count = 1332098

  Memory Level:  L2
    Hit Count = 59835459  Miss Count = 162300019
    Total Requests = 222135478
    Hit Rate = 26.9%   Miss Rate = 73.1%
    Kickouts = 160206029; Dirty kickouts = 57666398; Transfers = 160206549
    VC Hit count = 2093470

  L1 cache cost (Icache $400) + (Dcache $400) = $800
  L2 cache cost = $100;  Memory cost = $75  Total cost = $975
```

```
-------------------------------------------------------------------------
      bzip2.L1-8way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 8 : block size = 32
    Icache size = 8192 : ways = 8 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    69413909594;  Total refs = 10000001164
  Inst refs = 7566121173;  Data refs = 2433879991

  Number of reference types:  [Percentage]
    Reads  =  1881417428    [18.8%]
    Writes =   552462563    [ 5.5%]
    Inst.  =  7566121173    [75.7%]
    Total  = 10000001164

  Total cycles for activities:  [Percentage]
    Reads  = 24586776122    [35.4%]
    Writes = 25162511042    [36.2%]
    Inst.  = 19664622430    [28.3%]
    Total  = 69413909594

  CPI = 9.2
  Ideal: Exec. Time = 17566122337; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 22200012564; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 12096914965  Miss Count = 9351
    Total Requests = 12096924316
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 8981; Dirty kickouts = 0; Transfers = 9245
    VC Hit count = 106

  Memory Level:  L1d
    Hit Count = 2379130706  Miss Count = 157836369
    Total Requests = 2536967075
    Hit Rate = 93.8%   Miss Rate = 6.2%
    Kickouts = 157495828; Dirty kickouts = 62564308; Transfers = 157496092
    VC Hit count = 340277

  Memory Level:  L2
    Hit Count = 58131594  Miss Count = 161938051
    Total Requests = 220069645
    Hit Rate = 26.4%   Miss Rate = 73.6%
    Kickouts = 160940504; Dirty kickouts = 57251869; Transfers = 160941024
    VC Hit count = 997027

  L1 cache cost (Icache $800) + (Dcache $800) = $1600
  L2 cache cost = $100;  Memory cost = $75  Total cost = $1775
```

```
-------------------------------------------------------------------------
      bzip2.L1-small       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 1 : block size = 32
    Icache size = 4096 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    67322658707;  Total refs = 10000001164
  Inst refs = 7566121173;  Data refs = 2433879991

  Number of reference types:  [Percentage]
    Reads  =  1881417428    [18.8%]
    Writes =   552462563    [ 5.5%]
    Inst.  =  7566121173    [75.7%]
    Total  = 10000001164

  Total cycles for activities:  [Percentage]
    Reads  = 24450460023    [36.3%]
    Writes = 23201599972    [34.5%]
    Inst.  = 19670598712    [29.2%]
    Total  = 67322658707

  CPI = 8.9
  Ideal: Exec. Time = 17566122337; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 22200012564; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 12096123209  Miss Count = 801107
    Total Requests = 12096924316
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 33226; Dirty kickouts = 0; Transfers = 33362
    VC Hit count = 767745

  Memory Level:  L1d
    Hit Count = 2333607763  Miss Count = 203359312
    Total Requests = 2536967075
    Hit Rate = 92.0%   Miss Rate = 8.0%
    Kickouts = 169325300; Dirty kickouts = 67486415; Transfers = 169325436
    VC Hit count = 34033876

  Memory Level:  L2
    Hit Count = 86094651  Miss Count = 150750562
    Total Requests = 236845213
    Hit Rate = 36.4%   Miss Rate = 63.6%
    Kickouts = 146883618; Dirty kickouts = 57445385; Transfers = 146884138
    VC Hit count = 3866424

  L1 cache cost (Icache $100) + (Dcache $100) = $200
  L2 cache cost = $100;  Memory cost = $75  Total cost = $375
```

```
--------------------------------------------------------------------------------
      bzip2.L1-small-4way       Simulation Results
--------------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 4 : block size = 32
    Icache size = 4096 : ways = 4 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    67472679640;  Total refs = 10000001164
  Inst refs = 7566121173;  Data refs = 2433879991

  Number of reference types:  [Percentage]
    Reads  =  1881417428    [18.8%]
    Writes =   552462563    [ 5.5%]
    Inst.  =  7566121173    [75.7%]
    Total  = 10000001164

  Total cycles for activities:  [Percentage]
    Reads  = 24376440930    [36.1%]
    Writes = 23427204277    [34.7%]
    Inst.  = 19669034433    [29.2%]
    Total  = 67472679640

  CPI = 8.9
  Ideal: Exec. Time = 17566122337; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 22200012564; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 12096892362  Miss Count = 31954
    Total Requests = 12096924316
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 29104; Dirty kickouts = 0; Transfers = 29240
    VC Hit count = 2714

  Memory Level:  L1d
    Hit Count = 2370047161  Miss Count = 166919914
    Total Requests = 2536967075
    Hit Rate = 93.4%   Miss Rate = 6.6%
    Kickouts = 165602663; Dirty kickouts = 65475972; Transfers = 165602799
    VC Hit count = 1317115

  Memory Level:  L2
    Hit Count = 80478473  Miss Count = 150629538
    Total Requests = 231108011
    Hit Rate = 34.8%   Miss Rate = 65.2%
    Kickouts = 148851165; Dirty kickouts = 57417179; Transfers = 148851685
    VC Hit count = 1777853

  L1 cache cost (Icache $300) + (Dcache $300) = $600
  L2 cache cost = $100;  Memory cost = $75  Total cost = $775
```

```
-------------------------------------------------------------------------
      gobmk.All-2way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 2 : block size = 32
    Icache size = 8192 : ways = 2 : block size = 32
    L2-cache size = 32768 : ways = 2 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    91112175253;  Total refs = 10000000628
  Inst refs = 7146163623;  Data refs = 2853837005

  Number of reference types:  [Percentage]
    Reads  =  1921584739    [19.2%]
    Writes =   932252266    [ 9.3%]
    Inst.  =  7146163623    [71.5%]
    Total  = 10000000628

  Total cycles for activities:  [Percentage]
    Reads  = 17207873551    [18.9%]
    Writes = 15849868867    [17.4%]
    Inst.  = 58054432835    [63.7%]
    Total  = 91112175253

  CPI = 12.7
  Ideal: Exec. Time = 17146164251; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 23357690826; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11734181234  Miss Count = 425398952
    Total Requests = 12159580186
    Hit Rate = 96.5%   Miss Rate =  3.5%
    Kickouts = 409319349; Dirty kickouts = 0; Transfers = 409319613
    VC Hit count = 16079339

  Memory Level:  L1d
    Hit Count = 3895270880  Miss Count = 156676137
    Total Requests = 4051947017
    Hit Rate = 96.1%   Miss Rate = 3.9%
    Kickouts = 145063307; Dirty kickouts = 90603197; Transfers = 145063571
    VC Hit count = 11612566

  Memory Level:  L2
    Hit Count = 430546692  Miss Count = 214439689
    Total Requests = 644986381
    Hit Rate = 66.8%   Miss Rate = 33.2%
    Kickouts = 209189538; Dirty kickouts = 51745463; Transfers = 209190058
    VC Hit count = 5249631

  L1 cache cost (Icache $400) + (Dcache $400) = $800
  L2 cache cost = $200;  Memory cost = $75  Total cost = $1075
```

```
--------------------------------------------------------------------------
      gobmk.All-4way       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 4 : block size = 32
    Icache size = 8192 : ways = 4 : block size = 32
    L2-cache size = 32768 : ways = 4 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    83531333324;  Total refs = 10000000628
  Inst refs = 7146163623;  Data refs = 2853837005

  Number of reference types:  [Percentage]
    Reads  =  1921584739    [19.2%]
    Writes =   932252266    [ 9.3%]
    Inst.  =  7146163623    [71.5%]
    Total  = 10000000628

  Total cycles for activities:  [Percentage]
    Reads  = 14863345345    [17.8%]
    Writes = 15099405797    [18.1%]
    Inst.  = 53568582182    [64.1%]
    Total  = 83531333324

  CPI = 11.7
  Ideal: Exec. Time = 17146164251; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 23357690826; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11743083509  Miss Count = 416496677
    Total Requests = 12159580186
    Hit Rate = 96.6%   Miss Rate =  3.4%
    Kickouts = 408872203; Dirty kickouts = 0; Transfers = 408872467
    VC Hit count = 7624210

  Memory Level:  L1d
    Hit Count = 3919972896  Miss Count = 131974121
    Total Requests = 4051947017
    Hit Rate = 96.7%   Miss Rate = 3.3%
    Kickouts = 126261957; Dirty kickouts = 80507672; Transfers = 126262221
    VC Hit count = 5711900

  Memory Level:  L2
    Hit Count = 431382038  Miss Count = 184260322
    Total Requests = 615642360
    Hit Rate = 70.1%   Miss Rate = 29.9%
    Kickouts = 179227868; Dirty kickouts = 46019292; Transfers = 179228388
    VC Hit count = 5031934

  L1 cache cost (Icache $600) + (Dcache $600) = $1200
  L2 cache cost = $300;  Memory cost = $75  Total cost = $1575
```

```
--------------------------------------------------------------------------
      gobmk.All-FA       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 256 : block size = 32
    Icache size = 8192 : ways = 256 : block size = 32
    L2-cache size = 32768 : ways = 512 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    77100149273;  Total refs = 10000000628
  Inst refs = 7146163623;  Data refs = 2853837005

  Number of reference types:  [Percentage]
    Reads  =  1921584739    [19.2%]
    Writes =   932252266    [ 9.3%]
    Inst.  =  7146163623    [71.5%]
    Total  = 10000000628

  Total cycles for activities:  [Percentage]
    Reads  = 13693199200    [17.8%]
    Writes = 15023525602    [19.5%]
    Inst.  = 48383424471    [62.8%]
    Total  = 77100149273

  CPI = 10.8
  Ideal: Exec. Time = 17146164251; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 23357690826; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11743282458  Miss Count = 416297728
    Total Requests = 12159580186
    Hit Rate = 96.6%   Miss Rate =  3.4%
    Kickouts = 410857789; Dirty kickouts = 0; Transfers = 410858053
    VC Hit count = 5439675

  Memory Level:  L1d
    Hit Count = 3933989664  Miss Count = 117957353
    Total Requests = 4051947017
    Hit Rate = 97.1%   Miss Rate = 2.9%
    Kickouts = 115457628; Dirty kickouts = 74259657; Transfers = 115457892
    VC Hit count = 2499461

  Memory Level:  L2
    Hit Count = 444563313  Miss Count = 156012289
    Total Requests = 600575602
    Hit Rate = 74.0%   Miss Rate = 26.0%
    Kickouts = 152235194; Dirty kickouts = 41275195; Transfers = 152235714
    VC Hit count = 3776575

  L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
  L2 cache cost = $1000;  Memory cost = $75  Total cost = $4675
```

```
-------------------------------------------------------------------------
      gobmk.All-small       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 1 : block size = 32
    Icache size = 4096 : ways = 1 : block size = 32
    L2-cache size = 16384 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    148938059328;  Total refs = 10000000628
  Inst refs = 7146163623;  Data refs = 2853837005

  Number of reference types:  [Percentage]
    Reads  =  1921584739    [19.2%]
    Writes =   932252266    [ 9.3%]
    Inst.  =  7146163623    [71.5%]
    Total  = 10000000628

  Total cycles for activities:  [Percentage]
    Reads  = 34048330526    [22.9%]
    Writes = 23787912214    [16.0%]
    Inst.  = 91101816588    [61.2%]
    Total  =148938059328

  CPI = 20.8
  Ideal: Exec. Time = 17146164251; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 23357690826; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11545777533  Miss Count = 613802653
    Total Requests = 12159580186
    Hit Rate = 95.0%   Miss Rate =  5.0%
    Kickouts = 581682891; Dirty kickouts = 0; Transfers = 581683027
    VC Hit count = 32119626

  Memory Level:  L1d
    Hit Count = 3733996342  Miss Count = 317950675
    Total Requests = 4051947017
    Hit Rate = 92.2%   Miss Rate = 7.8%
    Kickouts = 246020298; Dirty kickouts = 141853497; Transfers = 246020434
    VC Hit count = 71930241

  Memory Level:  L2
    Hit Count = 533126775  Miss Count = 436430183
    Total Requests = 969556958
    Hit Rate = 55.0%   Miss Rate = 45.0%
    Kickouts = 422519238; Dirty kickouts = 94906712; Transfers = 422519502
    VC Hit count = 13910681

  L1 cache cost (Icache $100) + (Dcache $100) = $200
  L2 cache cost = $50;  Memory cost = $75  Total cost = $325
```

```
--------------------------------------------------------------------------
      gobmk.default       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 1 : block size = 32
    Icache size = 8192 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    100855222203;  Total refs = 10000000628
  Inst refs = 7146163623;  Data refs = 2853837005

  Number of reference types:  [Percentage]
    Reads  =  1921584739    [19.2%]
    Writes =   932252266    [ 9.3%]
    Inst.  =  7146163623    [71.5%]
    Total  = 10000000628

  Total cycles for activities:  [Percentage]
    Reads  = 21249426994    [21.1%]
    Writes = 17212820777    [17.1%]
    Inst.  = 62392974432    [61.9%]
    Total  =100855222203

  CPI = 14.1
  Ideal: Exec. Time = 17146164251; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 23357690826; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11708085009  Miss Count = 451495177
    Total Requests = 12159580186
    Hit Rate = 96.3%   Miss Rate =  3.7%
    Kickouts = 429513323; Dirty kickouts = 0; Transfers = 429513587
    VC Hit count = 21981590

  Memory Level:  L1d
    Hit Count = 3837245587  Miss Count = 214701430
    Total Requests = 4051947017
    Hit Rate = 94.7%   Miss Rate = 5.3%
    Kickouts = 172054301; Dirty kickouts = 105609028; Transfers = 172054565
    VC Hit count = 42646865

  Memory Level:  L2
    Hit Count = 455069403  Miss Count = 252107777
    Total Requests = 707177180
    Hit Rate = 64.4%   Miss Rate = 35.6%
    Kickouts = 242306410; Dirty kickouts = 60522492; Transfers = 242306930
    VC Hit count = 9800847

  L1 cache cost (Icache $200) + (Dcache $200) = $400
  L2 cache cost = $100;  Memory cost = $75  Total cost = $575
```

```
--------------------------------------------------------------------------
      gobmk.L1-2way       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 2 : block size = 32
    Icache size = 8192 : ways = 2 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    96366209773;  Total refs = 10000000628
  Inst refs = 7146163623;  Data refs = 2853837005

  Number of reference types:  [Percentage]
    Reads  =  1921584739    [19.2%]
    Writes =   932252266    [ 9.3%]
    Inst.  =  7146163623    [71.5%]
    Total  = 10000000628

  Total cycles for activities:  [Percentage]
    Reads  = 18715919321    [19.4%]
    Writes = 16815519867    [17.4%]
    Inst.  = 60834770585    [63.1%]
    Total  = 96366209773

  CPI = 13.5
  Ideal: Exec. Time = 17146164251; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 23357690826; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11734181234  Miss Count = 425398952
    Total Requests = 12159580186
    Hit Rate = 96.5%   Miss Rate =  3.5%
    Kickouts = 409319349; Dirty kickouts = 0; Transfers = 409319613
    VC Hit count = 16079339

  Memory Level:  L1d
    Hit Count = 3895270880  Miss Count = 156676137
    Total Requests = 4051947017
    Hit Rate = 96.1%   Miss Rate = 3.9%
    Kickouts = 145063307; Dirty kickouts = 90603197; Transfers = 145063571
    VC Hit count = 11612566

  Memory Level:  L2
    Hit Count = 406468620  Miss Count = 238517761
    Total Requests = 644986381
    Hit Rate = 63.0%   Miss Rate = 37.0%
    Kickouts = 232707915; Dirty kickouts = 56078496; Transfers = 232708435
    VC Hit count = 5809326

  L1 cache cost (Icache $400) + (Dcache $400) = $800
  L2 cache cost = $100;  Memory cost = $75  Total cost = $975
```

```
--------------------------------------------------------------------------
      gobmk.L1-8way       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 8 : block size = 32
    Icache size = 8192 : ways = 8 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    90787682371;  Total refs = 10000000628
  Inst refs = 7146163623;  Data refs = 2853837005

  Number of reference types:  [Percentage]
    Reads  =  1921584739    [19.2%]
    Writes =   932252266    [ 9.3%]
    Inst.  =  7146163623    [71.5%]
    Total  = 10000000628

  Total cycles for activities:  [Percentage]
    Reads  = 15403593361    [17.0%]
    Writes = 15874844369    [17.5%]
    Inst.  = 59509244641    [65.5%]
    Total  = 90787682371

  CPI = 12.7
  Ideal: Exec. Time = 17146164251; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 23357690826; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11743485158  Miss Count = 416095028
    Total Requests = 12159580186
    Hit Rate = 96.6%   Miss Rate =  3.4%
    Kickouts = 407983919; Dirty kickouts = 0; Transfers = 407984183
    VC Hit count = 8110845

  Memory Level:  L1d
    Hit Count = 3928282406  Miss Count = 123664611
    Total Requests = 4051947017
    Hit Rate = 96.9%   Miss Rate = 3.1%
    Kickouts = 119775183; Dirty kickouts = 77066252; Transfers = 119775447
    VC Hit count = 3889164

  Memory Level:  L2
    Hit Count = 383914125  Miss Count = 220911757
    Total Requests = 604825882
    Hit Rate = 63.5%   Miss Rate = 36.5%
    Kickouts = 217013449; Dirty kickouts = 48241529; Transfers = 217013969
    VC Hit count = 3897788

  L1 cache cost (Icache $800) + (Dcache $800) = $1600
  L2 cache cost = $100;  Memory cost = $75  Total cost = $1775
```

```
--------------------------------------------------------------------------
      gobmk.L1-small       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 1 : block size = 32
    Icache size = 4096 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    116679259078;  Total refs = 10000000628
  Inst refs = 7146163623;  Data refs = 2853837005

  Number of reference types:  [Percentage]
    Reads  =  1921584739    [19.2%]
    Writes =   932252266    [ 9.3%]
    Inst.  =  7146163623    [71.5%]
    Total  = 10000000628

  Total cycles for activities:  [Percentage]
    Reads  = 26101645336    [22.4%]
    Writes = 19289948924    [16.5%]
    Inst.  = 71287664818    [61.1%]
    Total  =116679259078

  CPI = 16.3
  Ideal: Exec. Time = 17146164251; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 23357690826; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11545777533  Miss Count = 613802653
    Total Requests = 12159580186
    Hit Rate = 95.0%   Miss Rate =  5.0%
    Kickouts = 581682891; Dirty kickouts = 0; Transfers = 581683027
    VC Hit count = 32119626

  Memory Level:  L1d
    Hit Count = 3733996342  Miss Count = 317950675
    Total Requests = 4051947017
    Hit Rate = 92.2%   Miss Rate = 7.8%
    Kickouts = 246020298; Dirty kickouts = 141853497; Transfers = 246020434
    VC Hit count = 71930241

  Memory Level:  L2
    Hit Count = 680346776  Miss Count = 289210182
    Total Requests = 969556958
    Hit Rate = 70.2%   Miss Rate = 29.8%
    Kickouts = 275231307; Dirty kickouts = 71157719; Transfers = 275231827
    VC Hit count = 13978355

  L1 cache cost (Icache $100) + (Dcache $100) = $200
  L2 cache cost = $100;  Memory cost = $75  Total cost = $375
```

```
--------------------------------------------------------------------------
      gobmk.L1-small-4way       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 4 : block size = 32
    Icache size = 4096 : ways = 4 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    111164437425;  Total refs = 10000000628
  Inst refs = 7146163623;  Data refs = 2853837005

  Number of reference types:  [Percentage]
    Reads  =  1921584739    [19.2%]
    Writes =   932252266    [ 9.3%]
    Inst.  =  7146163623    [71.5%]
    Total  = 10000000628

  Total cycles for activities:  [Percentage]
    Reads  = 22709779454    [20.4%]
    Writes = 19387546707    [17.4%]
    Inst.  = 69067111264    [62.1%]
    Total  =111164437425

  CPI = 15.6
  Ideal: Exec. Time = 17146164251; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 23357690826; CPI =  3.3

  Memory Level:  L1i
    Hit Count = 11613499635  Miss Count = 546080551
    Total Requests = 12159580186
    Hit Rate = 95.5%   Miss Rate =  4.5%
    Kickouts = 528200732; Dirty kickouts = 0; Transfers = 528200868
    VC Hit count = 17879683

  Memory Level:  L1d
    Hit Count = 3840153605  Miss Count = 211793412
    Total Requests = 4051947017
    Hit Rate = 94.8%   Miss Rate = 5.2%
    Kickouts = 201658370; Dirty kickouts = 122286013; Transfers = 201658506
    VC Hit count = 10134906

  Memory Level:  L2
    Hit Count = 575079363  Miss Count = 277066024
    Total Requests = 852145387
    Hit Rate = 67.5%   Miss Rate = 32.5%
    Kickouts = 268818958; Dirty kickouts = 66836864; Transfers = 268819478
    VC Hit count = 8246546

  L1 cache cost (Icache $300) + (Dcache $300) = $600
  L2 cache cost = $100;  Memory cost = $75  Total cost = $775
```

```
-------------------------------------------------------------------------
      libquantum.All-2way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 2 : block size = 32
    Icache size = 8192 : ways = 2 : block size = 32
    L2-cache size = 32768 : ways = 2 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    138261563722;  Total refs = 16506492546
  Inst refs = 12487578510;  Data refs = 4018914036

  Number of reference types:  [Percentage]
    Reads  =  3526260463    [21.4%]
    Writes =   492653573    [ 3.0%]
    Inst.  = 12487578510    [75.7%]
    Total  = 16506492546

  Total cycles for activities:  [Percentage]
    Reads  =107870165668    [78.0%]
    Writes =  1280994626    [ 0.9%]
    Inst.  = 29110403428    [21.1%]
    Total  =138261563722

  CPI = 11.1
  Ideal: Exec. Time = 28994071056; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 35948584560; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 16621376882  Miss Count = 12171
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 7184; Dirty kickouts = 0; Transfers = 7448
    VC Hit count = 4723

  Memory Level:  L1d
    Hit Count = 6262734512  Miss Count = 576882485
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 576837953; Dirty kickouts = 237725652; Transfers = 576838217
    VC Hit count = 44268

  Memory Level:  L2
    Hit Count = 525629688  Miss Count = 288941629
    Total Requests = 814571317
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 288903228; Dirty kickouts = 133533315; Transfers = 288903748
    VC Hit count = 37881

  L1 cache cost (Icache $400) + (Dcache $400) = $800
  L2 cache cost = $200;  Memory cost = $75  Total cost = $1075
```

```
-------------------------------------------------------------------------
      libquantum.All-4way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 4 : block size = 32
    Icache size = 8192 : ways = 4 : block size = 32
    L2-cache size = 32768 : ways = 4 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    138249947007;  Total refs = 16506492546
  Inst refs = 12487578510;  Data refs = 4018914036

  Number of reference types:  [Percentage]
    Reads  =  3526260463    [21.4%]
    Writes =   492653573    [ 3.0%]
    Inst.  = 12487578510    [75.7%]
    Total  = 16506492546

  Total cycles for activities:  [Percentage]
    Reads  =107858685657    [78.0%]
    Writes =  1281028655    [ 0.9%]
    Inst.  = 29110232695    [21.1%]
    Total  =138249947007

  CPI = 11.1
  Ideal: Exec. Time = 28994071056; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 35948584560; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 16621380615  Miss Count = 8438
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 6389; Dirty kickouts = 0; Transfers = 6653
    VC Hit count = 1785

  Memory Level:  L1d
    Hit Count = 6262778660  Miss Count = 576838337
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 576837856; Dirty kickouts = 237725396; Transfers = 576838120
    VC Hit count = 217

  Memory Level:  L2
    Hit Count = 525712559  Miss Count = 288857610
    Total Requests = 814570169
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 288845649; Dirty kickouts = 133531469; Transfers = 288846169
    VC Hit count = 11441

  L1 cache cost (Icache $600) + (Dcache $600) = $1200
  L2 cache cost = $300;  Memory cost = $75  Total cost = $1575
```

```
-------------------------------------------------------------------------
      libquantum.All-FA       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 256 : block size = 32
    Icache size = 8192 : ways = 256 : block size = 32
    L2-cache size = 32768 : ways = 512 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    138248028359;  Total refs = 16506492546
  Inst refs = 12487578510;  Data refs = 4018914036

  Number of reference types:  [Percentage]
    Reads  =  3526260463    [21.4%]
    Writes =   492653573    [ 3.0%]
    Inst.  = 12487578510    [75.7%]
    Total  = 16506492546

  Total cycles for activities:  [Percentage]
    Reads  =107861475297    [78.0%]
    Writes =  1276672179    [ 0.9%]
    Inst.  = 29109880883    [21.1%]
    Total  =138248028359

  CPI = 11.1
  Ideal: Exec. Time = 28994071056; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 35948584560; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 16621383227  Miss Count = 5826
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 5054; Dirty kickouts = 0; Transfers = 5318
    VC Hit count = 508

  Memory Level:  L1d
    Hit Count = 6262778712  Miss Count = 576838285
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 576837784; Dirty kickouts = 237725270; Transfers = 576838048
    VC Hit count = 237

  Memory Level:  L2
    Hit Count = 525731076  Miss Count = 288837560
    Total Requests = 814568636
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 288836869; Dirty kickouts = 133530957; Transfers = 288837389
    VC Hit count = 171

  L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
  L2 cache cost = $1000;  Memory cost = $75  Total cost = $4675
```

```
--------------------------------------------------------------------------
      libquantum.All-small       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 1 : block size = 32
    Icache size = 4096 : ways = 1 : block size = 32
    L2-cache size = 16384 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    138297748643;  Total refs = 16506492546
  Inst refs = 12487578510;  Data refs = 4018914036

  Number of reference types:  [Percentage]
    Reads  =  3526260463    [21.4%]
    Writes =   492653573    [ 3.0%]
    Inst.  = 12487578510    [75.7%]
    Total  = 16506492546

  Total cycles for activities:  [Percentage]
    Reads  =107904967657    [78.0%]
    Writes =  1276386378    [ 0.9%]
    Inst.  = 29116394608    [21.1%]
    Total  =138297748643

  CPI = 11.1
  Ideal: Exec. Time = 28994071056; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 35948584560; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 16621282284  Miss Count = 106769
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 31651; Dirty kickouts = 0; Transfers = 31787
    VC Hit count = 74982

  Memory Level:  L1d
    Hit Count = 6246339741  Miss Count = 593277256
    Total Requests = 6839616997
    Hit Rate = 91.3%   Miss Rate = 8.7%
    Kickouts = 576863753; Dirty kickouts = 237729680; Transfers = 576863889
    VC Hit count = 16413367

  Memory Level:  L2
    Hit Count = 525194259  Miss Count = 289431097
    Total Requests = 814625356
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 288963091; Dirty kickouts = 133547529; Transfers = 288963355
    VC Hit count = 467742

  L1 cache cost (Icache $100) + (Dcache $100) = $200
  L2 cache cost = $50;  Memory cost = $75  Total cost = $325
```

```
--------------------------------------------------------------------------
      libquantum.default       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 1 : block size = 32
    Icache size = 8192 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    138307664954;  Total refs = 16506492546
  Inst refs = 12487578510;  Data refs = 4018914036

  Number of reference types:  [Percentage]
    Reads  =  3526260463    [21.4%]
    Writes =   492653573    [ 3.0%]
    Inst.  = 12487578510    [75.7%]
    Total  = 16506492546

  Total cycles for activities:  [Percentage]
    Reads  =107923473243    [78.0%]
    Writes =  1272550513    [ 0.9%]
    Inst.  = 29111641198    [21.0%]
    Total  =138307664954

  CPI = 11.1
  Ideal: Exec. Time = 28994071056; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 35948584560; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 16621371498  Miss Count = 17555
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 13001; Dirty kickouts = 0; Transfers = 13265
    VC Hit count = 4290

  Memory Level:  L1d
    Hit Count = 6253546800  Miss Count = 586070197
    Total Requests = 6839616997
    Hit Rate = 91.4%   Miss Rate = 8.6%
    Kickouts = 576852561; Dirty kickouts = 237727424; Transfers = 576852825
    VC Hit count = 9217372

  Memory Level:  L2
    Hit Count = 524986509  Miss Count = 289607005
    Total Requests = 814593514
    Hit Rate = 64.4%   Miss Rate = 35.6%
    Kickouts = 289058809; Dirty kickouts = 133542361; Transfers = 289059329
    VC Hit count = 547676

  L1 cache cost (Icache $200) + (Dcache $200) = $400
  L2 cache cost = $100;  Memory cost = $75  Total cost = $575
```

```
-------------------------------------------------------------------------
      libquantum.L1-2way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 2 : block size = 32
    Icache size = 8192 : ways = 2 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    138315739242;  Total refs = 16506492546
  Inst refs = 12487578510;  Data refs = 4018914036

  Number of reference types:  [Percentage]
    Reads  =  3526260463    [21.4%]
    Writes =   492653573    [ 3.0%]
    Inst.  = 12487578510    [75.7%]
    Total  = 16506492546

  Total cycles for activities:  [Percentage]
    Reads  =107914515978    [78.0%]
    Writes =  1290829516    [ 0.9%]
    Inst.  = 29110393748    [21.0%]
    Total  =138315739242

  CPI = 11.1
  Ideal: Exec. Time = 28994071056; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 35948584560; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 16621376882  Miss Count = 12171
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 7184; Dirty kickouts = 0; Transfers = 7448
    VC Hit count = 4723

  Memory Level:  L1d
    Hit Count = 6262734512  Miss Count = 576882485
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 576837953; Dirty kickouts = 237725652; Transfers = 576838217
    VC Hit count = 44268

  Memory Level:  L2
    Hit Count = 525009154  Miss Count = 289562163
    Total Requests = 814571317
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 289159022; Dirty kickouts = 133544022; Transfers = 289159542
    VC Hit count = 402621

  L1 cache cost (Icache $400) + (Dcache $400) = $800
  L2 cache cost = $100;  Memory cost = $75  Total cost = $975
```

```
--------------------------------------------------------------------------
      libquantum.L1-8way       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 8 : block size = 32
    Icache size = 8192 : ways = 8 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    138319542285;  Total refs = 16506492546
  Inst refs = 12487578510;  Data refs = 4018914036

  Number of reference types:  [Percentage]
    Reads  =  3526260463    [21.4%]
    Writes =   492653573    [ 3.0%]
    Inst.  = 12487578510    [75.7%]
    Total  = 16506492546

  Total cycles for activities:  [Percentage]
    Reads  =107920187547    [78.0%]
    Writes =  1289268611    [ 0.9%]
    Inst.  = 29110086127    [21.0%]
    Total  =138319542285

  CPI = 11.1
  Ideal: Exec. Time = 28994071056; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 35948584560; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 16621382623  Miss Count = 6430
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 5749; Dirty kickouts = 0; Transfers = 6013
    VC Hit count = 417

  Memory Level:  L1d
    Hit Count = 6262778716  Miss Count = 576838281
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 576837849; Dirty kickouts = 237725332; Transfers = 576838113
    VC Hit count = 168

  Memory Level:  L2
    Hit Count = 525022709  Miss Count = 289546749
    Total Requests = 814569458
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 289191880; Dirty kickouts = 133533715; Transfers = 289192400
    VC Hit count = 354349

  L1 cache cost (Icache $800) + (Dcache $800) = $1600
  L2 cache cost = $100;  Memory cost = $75  Total cost = $1775
```

```
--------------------------------------------------------------------------------
      libquantum.L1-small       Simulation Results
--------------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 1 : block size = 32
    Icache size = 4096 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    138278154943;  Total refs = 16506492546
  Inst refs = 12487578510;  Data refs = 4018914036

  Number of reference types:  [Percentage]
    Reads  =  3526260463    [21.4%]
    Writes =   492653573    [ 3.0%]
    Inst.  = 12487578510    [75.7%]
    Total  = 16506492546

  Total cycles for activities:  [Percentage]
    Reads  =107888959367    [78.0%]
    Writes =  1272785168    [ 0.9%]
    Inst.  = 29116410408    [21.1%]
    Total  =138278154943

  CPI = 11.1
  Ideal: Exec. Time = 28994071056; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 35948584560; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 16621282284  Miss Count = 106769
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 31651; Dirty kickouts = 0; Transfers = 31787
    VC Hit count = 74982

  Memory Level:  L1d
    Hit Count = 6246339741  Miss Count = 593277256
    Total Requests = 6839616997
    Hit Rate = 91.3%   Miss Rate = 8.7%
    Kickouts = 576863753; Dirty kickouts = 237729680; Transfers = 576863889
    VC Hit count = 16413367

  Memory Level:  L2
    Hit Count = 525338563  Miss Count = 289286793
    Total Requests = 814625356
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 288874864; Dirty kickouts = 133534663; Transfers = 288875384
    VC Hit count = 411409

  L1 cache cost (Icache $100) + (Dcache $100) = $200
  L2 cache cost = $100;  Memory cost = $75  Total cost = $375
```

```
-------------------------------------------------------------------------
      libquantum.L1-small-4way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 4 : block size = 32
    Icache size = 4096 : ways = 4 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    138279697471;  Total refs = 16506492546
  Inst refs = 12487578510;  Data refs = 4018914036

  Number of reference types:  [Percentage]
    Reads  =  3526260463    [21.4%]
    Writes =   492653573    [ 3.0%]
    Inst.  = 12487578510    [75.7%]
    Total  = 16506492546

  Total cycles for activities:  [Percentage]
    Reads  =107876228024    [78.0%]
    Writes =  1290156787    [ 0.9%]
    Inst.  = 29113312660    [21.1%]
    Total  =138279697471

  CPI = 11.1
  Ideal: Exec. Time = 28994071056; CPI =  2.3
  Ideal mis-aligned: Exec. Time = 35948584560; CPI =  2.9

  Memory Level:  L1i
    Hit Count = 16621364736  Miss Count = 24317
    Total Requests = 16621389053
    Hit Rate = 100.0%   Miss Rate =  0.0%
    Kickouts = 18519; Dirty kickouts = 0; Transfers = 18655
    VC Hit count = 5662

  Memory Level:  L1d
    Hit Count = 6262759871  Miss Count = 576857126
    Total Requests = 6839616997
    Hit Rate = 91.6%   Miss Rate = 8.4%
    Kickouts = 576855191; Dirty kickouts = 237726434; Transfers = 576855327
    VC Hit count = 1799

  Memory Level:  L2
    Hit Count = 525322638  Miss Count = 289277778
    Total Requests = 814600416
    Hit Rate = 64.5%   Miss Rate = 35.5%
    Kickouts = 288971961; Dirty kickouts = 133542197; Transfers = 288972481
    VC Hit count = 305297

  L1 cache cost (Icache $300) + (Dcache $300) = $600
  L2 cache cost = $100;  Memory cost = $75  Total cost = $775
```

```
-------------------------------------------------------------------------
      omnetpp.All-2way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 2 : block size = 32
    Icache size = 8192 : ways = 2 : block size = 32
    L2-cache size = 32768 : ways = 2 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    97670412128;  Total refs = 10000000913
  Inst refs = 6748282688;  Data refs = 3251718225

  Number of reference types:  [Percentage]
    Reads  =  2012001894    [20.1%]
    Writes =  1239716331    [12.4%]
    Inst.  =  6748282688    [67.5%]
    Total  = 10000000913

  Total cycles for activities:  [Percentage]
    Reads  = 42652194785    [43.7%]
    Writes =  9028294283    [ 9.2%]
    Inst.  = 45989923060    [47.1%]
    Total  = 97670412128

  CPI = 14.5
  Ideal: Exec. Time = 16748283601; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 24145878430; CPI =  3.6

  Memory Level:  L1i
    Hit Count = 11118904476  Miss Count = 340257755
    Total Requests = 11459162231
    Hit Rate = 97.0%   Miss Rate =  3.0%
    Kickouts = 303109003; Dirty kickouts = 0; Transfers = 303109267
    VC Hit count = 37148488

  Memory Level:  L1d
    Hit Count = 5674968538  Miss Count = 263464973
    Total Requests = 5938433511
    Hit Rate = 95.6%   Miss Rate = 4.4%
    Kickouts = 241917926; Dirty kickouts = 97041173; Transfers = 241918190
    VC Hit count = 21546783

  Memory Level:  L2
    Hit Count = 393553105  Miss Count = 248515525
    Total Requests = 642068630
    Hit Rate = 61.3%   Miss Rate = 38.7%
    Kickouts = 234813094; Dirty kickouts = 56618242; Transfers = 234813614
    VC Hit count = 13701911

  L1 cache cost (Icache $400) + (Dcache $400) = $800
  L2 cache cost = $200;  Memory cost = $75  Total cost = $1075
```

```
-------------------------------------------------------------------------
      omnetpp.All-4way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 4 : block size = 32
    Icache size = 8192 : ways = 4 : block size = 32
    L2-cache size = 32768 : ways = 4 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    85553398132;  Total refs = 10000000913
  Inst refs = 6748282688;  Data refs = 3251718225

  Number of reference types:  [Percentage]
    Reads  =  2012001894    [20.1%]
    Writes =  1239716331    [12.4%]
    Inst.  =  6748282688    [67.5%]
    Total  = 10000000913

  Total cycles for activities:  [Percentage]
    Reads  = 37922183737    [44.3%]
    Writes =  8521351154    [10.0%]
    Inst.  = 39109863241    [45.7%]
    Total  = 85553398132

  CPI = 12.7
  Ideal: Exec. Time = 16748283601; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 24145878430; CPI =  3.6

  Memory Level:  L1i
    Hit Count = 11172290683  Miss Count = 286871548
    Total Requests = 11459162231
    Hit Rate = 97.5%   Miss Rate =  2.5%
    Kickouts = 226955754; Dirty kickouts = 0; Transfers = 226956018
    VC Hit count = 59915530

  Memory Level:  L1d
    Hit Count = 5715811077  Miss Count = 222622434
    Total Requests = 5938433511
    Hit Rate = 96.3%   Miss Rate = 3.7%
    Kickouts = 208418189; Dirty kickouts = 82285844; Transfers = 208418453
    VC Hit count = 14203981

  Memory Level:  L2
    Hit Count = 314561433  Miss Count = 203098882
    Total Requests = 517660315
    Hit Rate = 60.8%   Miss Rate = 39.2%
    Kickouts = 196001208; Dirty kickouts = 50512428; Transfers = 196001728
    VC Hit count = 7097154

  L1 cache cost (Icache $600) + (Dcache $600) = $1200
  L2 cache cost = $300;  Memory cost = $75  Total cost = $1575
```

```
-------------------------------------------------------------------------
      omnetpp.All-FA       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 256 : block size = 32
    Icache size = 8192 : ways = 256 : block size = 32
    L2-cache size = 32768 : ways = 512 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    77007111629;  Total refs = 10000000913
  Inst refs = 6748282688;  Data refs = 3251718225

  Number of reference types:  [Percentage]
    Reads  =  2012001894    [20.1%]
    Writes =  1239716331    [12.4%]
    Inst.  =  6748282688    [67.5%]
    Total  = 10000000913

  Total cycles for activities:  [Percentage]
    Reads  = 33449862713    [43.4%]
    Writes =  8144959406    [10.6%]
    Inst.  = 35412289510    [46.0%]
    Total  = 77007111629

  CPI = 11.4
  Ideal: Exec. Time = 16748283601; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 24145878430; CPI =  3.6

  Memory Level:  L1i
    Hit Count = 11254252558  Miss Count = 204909673
    Total Requests = 11459162231
    Hit Rate = 98.2%   Miss Rate =  1.8%
    Kickouts = 189929492; Dirty kickouts = 0; Transfers = 189929756
    VC Hit count = 14979917

  Memory Level:  L1d
    Hit Count = 5757558159  Miss Count = 180875352
    Total Requests = 5938433511
    Hit Rate = 97.0%   Miss Rate = 3.0%
    Kickouts = 179068432; Dirty kickouts = 73717066; Transfers = 179068696
    VC Hit count = 1806656

  Memory Level:  L2
    Hit Count = 273601625  Miss Count = 169113893
    Total Requests = 442715518
    Hit Rate = 61.8%   Miss Rate = 38.2%
    Kickouts = 167226327; Dirty kickouts = 46041346; Transfers = 167226847
    VC Hit count = 1887046

  L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
  L2 cache cost = $1000;  Memory cost = $75  Total cost = $4675
```

```
---------------------------------------------------------------------
      omnetpp.All-small       Simulation Results
---------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 1 : block size = 32
    Icache size = 4096 : ways = 1 : block size = 32
    L2-cache size = 16384 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    195788892557;  Total refs = 10000000913
  Inst refs = 6748282688;  Data refs = 3251718225

  Number of reference types:  [Percentage]
    Reads  =  2012001894    [20.1%]
    Writes =  1239716331    [12.4%]
    Inst.  =  6748282688    [67.5%]
    Total  = 10000000913

  Total cycles for activities:  [Percentage]
    Reads  = 82618782936    [42.2%]
    Writes = 14942804433    [ 7.6%]
    Inst.  = 98227305188    [50.2%]
    Total  =195788892557

  CPI = 29.0
  Ideal: Exec. Time = 16748283601; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 24145878430; CPI =  3.6

  Memory Level:  L1i
    Hit Count = 10787088688  Miss Count = 672073543
    Total Requests = 11459162231
    Hit Rate = 94.1%   Miss Rate =  5.9%
    Kickouts = 632913461; Dirty kickouts = 0; Transfers = 632913597
    VC Hit count = 39159946

  Memory Level:  L1d
    Hit Count = 5430872993  Miss Count = 507560518
    Total Requests = 5938433511
    Hit Rate = 91.5%   Miss Rate = 8.5%
    Kickouts = 428758067; Dirty kickouts = 181205877; Transfers = 428758203
    VC Hit count = 78802315

  Memory Level:  L2
    Hit Count = 619689730  Miss Count = 623187947
    Total Requests = 1242877677
    Hit Rate = 49.9%   Miss Rate = 50.1%
    Kickouts = 594658876; Dirty kickouts = 124401558; Transfers = 594659140
    VC Hit count = 28528807

  L1 cache cost (Icache $100) + (Dcache $100) = $200
  L2 cache cost = $50;  Memory cost = $75  Total cost = $325
```

```
---------------------------------------------------------------------------
      omnetpp.default       Simulation Results
---------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 1 : block size = 32
    Icache size = 8192 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    120981145371;  Total refs = 10000000913
  Inst refs = 6748282688;  Data refs = 3251718225

  Number of reference types:  [Percentage]
    Reads  =  2012001894    [20.1%]
    Writes =  1239716331    [12.4%]
    Inst.  =  6748282688    [67.5%]
    Total  = 10000000913

  Total cycles for activities:  [Percentage]
    Reads  = 51828382023    [42.8%]
    Writes = 10214008258    [ 8.4%]
    Inst.  = 58938755090    [48.7%]
    Total  =120981145371

  CPI = 17.9
  Ideal: Exec. Time = 16748283601; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 24145878430; CPI =  3.6

  Memory Level:  L1i
    Hit Count = 11001944170  Miss Count = 457218061
    Total Requests = 11459162231
    Hit Rate = 96.0%   Miss Rate =  4.0%
    Kickouts = 411462916; Dirty kickouts = 0; Transfers = 411463180
    VC Hit count = 45754881

  Memory Level:  L1d
    Hit Count = 5568268231  Miss Count = 370165280
    Total Requests = 5938433511
    Hit Rate = 93.8%   Miss Rate = 6.2%
    Kickouts = 310498771; Dirty kickouts = 135067550; Transfers = 310499035
    VC Hit count = 59666245

  Memory Level:  L2
    Hit Count = 524507109  Miss Count = 332522656
    Total Requests = 857029765
    Hit Rate = 61.2%   Miss Rate = 38.8%
    Kickouts = 312030542; Dirty kickouts = 69556847; Transfers = 312031062
    VC Hit count = 20491594

  L1 cache cost (Icache $200) + (Dcache $200) = $400
  L2 cache cost = $100;  Memory cost = $75  Total cost = $575
```

```
------------------------------------------------------------------------
      omnetpp.L1-2way       Simulation Results
------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 2 : block size = 32
    Icache size = 8192 : ways = 2 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    104823212948;  Total refs = 10000000913
  Inst refs = 6748282688;  Data refs = 3251718225

  Number of reference types:  [Percentage]
    Reads  =  2012001894    [20.1%]
    Writes =  1239716331    [12.4%]
    Inst.  =  6748282688    [67.5%]
    Total  = 10000000913

  Total cycles for activities:  [Percentage]
    Reads  = 45242835315    [43.2%]
    Writes =  9447722683    [ 9.0%]
    Inst.  = 50132654950    [47.8%]
    Total  =104823212948

  CPI = 15.5
  Ideal: Exec. Time = 16748283601; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 24145878430; CPI =  3.6

  Memory Level:  L1i
    Hit Count = 11118904476  Miss Count = 340257755
    Total Requests = 11459162231
    Hit Rate = 97.0%   Miss Rate =  3.0%
    Kickouts = 303109003; Dirty kickouts = 0; Transfers = 303109267
    VC Hit count = 37148488

  Memory Level:  L1d
    Hit Count = 5674968538  Miss Count = 263464973
    Total Requests = 5938433511
    Hit Rate = 95.6%   Miss Rate = 4.4%
    Kickouts = 241917926; Dirty kickouts = 97041173; Transfers = 241918190
    VC Hit count = 21546783

  Memory Level:  L2
    Hit Count = 363380347  Miss Count = 278688283
    Total Requests = 642068630
    Hit Rate = 56.6%   Miss Rate = 43.4%
    Kickouts = 268295016; Dirty kickouts = 61197838; Transfers = 268295536
    VC Hit count = 10392747

  L1 cache cost (Icache $400) + (Dcache $400) = $800
  L2 cache cost = $100;  Memory cost = $75  Total cost = $975
```

```
--------------------------------------------------------------------------
      omnetpp.L1-8way       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 8 : block size = 32
    Icache size = 8192 : ways = 8 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    90288143876;  Total refs = 10000000913
  Inst refs = 6748282688;  Data refs = 3251718225

  Number of reference types:  [Percentage]
    Reads  =  2012001894    [20.1%]
    Writes =  1239716331    [12.4%]
    Inst.  =  6748282688    [67.5%]
    Total  = 10000000913

  Total cycles for activities:  [Percentage]
    Reads  = 39029613281    [43.2%]
    Writes =  9106978991    [10.1%]
    Inst.  = 42151551604    [46.7%]
    Total  = 90288143876

  CPI = 13.4
  Ideal: Exec. Time = 16748283601; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 24145878430; CPI =  3.6

  Memory Level:  L1i
    Hit Count = 11196293866  Miss Count = 262868365
    Total Requests = 11459162231
    Hit Rate = 97.7%   Miss Rate =  2.3%
    Kickouts = 208082061; Dirty kickouts = 0; Transfers = 208082325
    VC Hit count = 54786040

  Memory Level:  L1d
    Hit Count = 5739490068  Miss Count = 198943443
    Total Requests = 5938433511
    Hit Rate = 96.6%   Miss Rate = 3.4%
    Kickouts = 191470956; Dirty kickouts = 77179796; Transfers = 191471220
    VC Hit count = 7472223

  Memory Level:  L2
    Hit Count = 247986832  Miss Count = 228746509
    Total Requests = 476733341
    Hit Rate = 52.0%   Miss Rate = 48.0%
    Kickouts = 224780583; Dirty kickouts = 53243647; Transfers = 224781103
    VC Hit count = 3965406

  L1 cache cost (Icache $800) + (Dcache $800) = $1600
  L2 cache cost = $100;  Memory cost = $75  Total cost = $1775
```

```
-------------------------------------------------------------------------
      omnetpp.L1-small       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 1 : block size = 32
    Icache size = 4096 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    144593654457;  Total refs = 10000000913
  Inst refs = 6748282688;  Data refs = 3251718225

  Number of reference types:  [Percentage]
    Reads  =  2012001894    [20.1%]
    Writes =  1239716331    [12.4%]
    Inst.  =  6748282688    [67.5%]
    Total  = 10000000913

  Total cycles for activities:  [Percentage]
    Reads  = 60414485056    [41.8%]
    Writes = 11333834553    [ 7.8%]
    Inst.  = 72845334848    [50.4%]
    Total  =144593654457

  CPI = 21.4
  Ideal: Exec. Time = 16748283601; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 24145878430; CPI =  3.6

  Memory Level:  L1i
    Hit Count = 10787088688  Miss Count = 672073543
    Total Requests = 11459162231
    Hit Rate = 94.1%   Miss Rate =  5.9%
    Kickouts = 632913461; Dirty kickouts = 0; Transfers = 632913597
    VC Hit count = 39159946

  Memory Level:  L1d
    Hit Count = 5430872993  Miss Count = 507560518
    Total Requests = 5938433511
    Hit Rate = 91.5%   Miss Rate = 8.5%
    Kickouts = 428758067; Dirty kickouts = 181205877; Transfers = 428758203
    VC Hit count = 78802315

  Memory Level:  L2
    Hit Count = 845952798  Miss Count = 396924879
    Total Requests = 1242877677
    Hit Rate = 68.1%   Miss Rate = 31.9%
    Kickouts = 370421868; Dirty kickouts = 76790491; Transfers = 370422388
    VC Hit count = 26502491

  L1 cache cost (Icache $100) + (Dcache $100) = $200
  L2 cache cost = $100;  Memory cost = $75  Total cost = $375
```

```
---------------------------------------------------------------------------
      omnetpp.L1-small-4way       Simulation Results
---------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 4 : block size = 32
    Icache size = 4096 : ways = 4 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    135840464412;  Total refs = 10000000913
  Inst refs = 6748282688;  Data refs = 3251718225

  Number of reference types:  [Percentage]
    Reads  =  2012001894    [20.1%]
    Writes =  1239716331    [12.4%]
    Inst.  =  6748282688    [67.5%]
    Total  = 10000000913

  Total cycles for activities:  [Percentage]
    Reads  = 54385528500    [40.0%]
    Writes = 10394812197    [ 7.7%]
    Inst.  = 71060123715    [52.3%]
    Total  =135840464412

  CPI = 20.1
  Ideal: Exec. Time = 16748283601; CPI =  2.5
  Ideal mis-aligned: Exec. Time = 24145878430; CPI =  3.6

  Memory Level:  L1i
    Hit Count = 10796713031  Miss Count = 662449200
    Total Requests = 11459162231
    Hit Rate = 94.2%   Miss Rate =  5.8%
    Kickouts = 625743756; Dirty kickouts = 0; Transfers = 625743892
    VC Hit count = 36705308

  Memory Level:  L1d
    Hit Count = 5576768211  Miss Count = 361665300
    Total Requests = 5938433511
    Hit Rate = 93.9%   Miss Rate = 6.1%
    Kickouts = 335244705; Dirty kickouts = 127146836; Transfers = 335244841
    VC Hit count = 26420459

  Memory Level:  L2
    Hit Count = 718947978  Miss Count = 369187591
    Total Requests = 1088135569
    Hit Rate = 66.1%   Miss Rate = 33.9%
    Kickouts = 354196103; Dirty kickouts = 70863375; Transfers = 354196623
    VC Hit count = 14990968

  L1 cache cost (Icache $300) + (Dcache $300) = $600
  L2 cache cost = $100;  Memory cost = $75  Total cost = $775
```

```
-------------------------------------------------------------------------
      sjeng.All-2way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 2 : block size = 32
    Icache size = 8192 : ways = 2 : block size = 32
    L2-cache size = 32768 : ways = 2 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    95029042658;  Total refs = 17300001933
  Inst refs = 12741056222;  Data refs = 4558945711

  Number of reference types:  [Percentage]
    Reads  =  3299993836    [19.1%]
    Writes =  1258951875    [ 7.3%]
    Inst.  = 12741056222    [73.6%]
    Total  = 17300001933

  Total cycles for activities:  [Percentage]
    Reads  = 20486721843    [21.6%]
    Writes = 13316370331    [14.0%]
    Inst.  = 61225950484    [64.4%]
    Total  = 95029042658

  CPI = 7.5
  Ideal: Exec. Time = 30041058155; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 40161444400; CPI =  3.2

  Memory Level:  L1i
    Hit Count = 21334634694  Miss Count = 380922410
    Total Requests = 21715557104
    Hit Rate = 98.2%   Miss Rate =  1.8%
    Kickouts = 358005322; Dirty kickouts = 0; Transfers = 358005586
    VC Hit count = 22916824

  Memory Level:  L1d
    Hit Count = 5498545462  Miss Count = 206285612
    Total Requests = 5704831074
    Hit Rate = 96.4%   Miss Rate = 3.6%
    Kickouts = 175673830; Dirty kickouts = 83889252; Transfers = 175674094
    VC Hit count = 30611518

  Memory Level:  L2
    Hit Count = 450372832  Miss Count = 167196100
    Total Requests = 617568932
    Hit Rate = 72.9%   Miss Rate = 27.1%
    Kickouts = 156243019; Dirty kickouts = 39959234; Transfers = 156243539
    VC Hit count = 10952561

  L1 cache cost (Icache $400) + (Dcache $400) = $800
  L2 cache cost = $200;  Memory cost = $75  Total cost = $1075
```

```
-------------------------------------------------------------------------
      sjeng.All-4way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 4 : block size = 32
    Icache size = 8192 : ways = 4 : block size = 32
    L2-cache size = 32768 : ways = 4 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    87293550795;  Total refs = 17300001933
  Inst refs = 12741056222;  Data refs = 4558945711

  Number of reference types:  [Percentage]
    Reads  =  3299993836    [19.1%]
    Writes =  1258951875    [ 7.3%]
    Inst.  = 12741056222    [73.6%]
    Total  = 17300001933

  Total cycles for activities:  [Percentage]
    Reads  = 18299325841    [21.0%]
    Writes = 12041669340    [13.8%]
    Inst.  = 56952555614    [65.2%]
    Total  = 87293550795

  CPI = 6.9
  Ideal: Exec. Time = 30041058155; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 40161444400; CPI =  3.2

  Memory Level:  L1i
    Hit Count = 21340884702  Miss Count = 374672402
    Total Requests = 21715557104
    Hit Rate = 98.3%   Miss Rate =  1.7%
    Kickouts = 362363343; Dirty kickouts = 0; Transfers = 362363607
    VC Hit count = 12308795

  Memory Level:  L1d
    Hit Count = 5540978435  Miss Count = 163852639
    Total Requests = 5704831074
    Hit Rate = 97.1%   Miss Rate = 2.9%
    Kickouts = 149960858; Dirty kickouts = 73387309; Transfers = 149961122
    VC Hit count = 13891517

  Memory Level:  L2
    Hit Count = 450952387  Miss Count = 134759651
    Total Requests = 585712038
    Hit Rate = 77.0%   Miss Rate = 23.0%
    Kickouts = 124826824; Dirty kickouts = 35428477; Transfers = 124827344
    VC Hit count = 9932307

  L1 cache cost (Icache $600) + (Dcache $600) = $1200
  L2 cache cost = $300;  Memory cost = $75  Total cost = $1575
```

```
--------------------------------------------------------------------------
      sjeng.All-FA       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 256 : block size = 32
    Icache size = 8192 : ways = 256 : block size = 32
    L2-cache size = 32768 : ways = 512 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    77103508917;  Total refs = 17300001933
  Inst refs = 12741056222;  Data refs = 4558945711

  Number of reference types:  [Percentage]
    Reads  =  3299993836    [19.1%]
    Writes =  1258951875    [ 7.3%]
    Inst.  = 12741056222    [73.6%]
    Total  = 17300001933

  Total cycles for activities:  [Percentage]
    Reads  = 13790677927    [17.9%]
    Writes = 10508262236    [13.6%]
    Inst.  = 52804568754    [68.5%]
    Total  = 77103508917

  CPI = 6.1
  Ideal: Exec. Time = 30041058155; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 40161444400; CPI =  3.2

  Memory Level:  L1i
    Hit Count = 21292857690  Miss Count = 422699414
    Total Requests = 21715557104
    Hit Rate = 98.1%   Miss Rate =  1.9%
    Kickouts = 409046754; Dirty kickouts = 0; Transfers = 409047018
    VC Hit count = 13652396

  Memory Level:  L1d
    Hit Count = 5588462471  Miss Count = 116368603
    Total Requests = 5704831074
    Hit Rate = 98.0%   Miss Rate = 2.0%
    Kickouts = 111721718; Dirty kickouts = 62636980; Transfers = 111721982
    VC Hit count = 4646621

  Memory Level:  L2
    Hit Count = 500077372  Miss Count = 83328608
    Total Requests = 583405980
    Hit Rate = 85.7%   Miss Rate = 14.3%
    Kickouts = 80455641; Dirty kickouts = 26401300; Transfers = 80456161
    VC Hit count = 2872447

  L1 cache cost (Icache $1800) + (Dcache $1800) = $3600
  L2 cache cost = $1000;  Memory cost = $75  Total cost = $4675
```

```
-------------------------------------------------------------------------
      sjeng.All-small       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 1 : block size = 32
    Icache size = 4096 : ways = 1 : block size = 32
    L2-cache size = 16384 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    169275345018;  Total refs = 17300001933
  Inst refs = 12741056222;  Data refs = 4558945711

  Number of reference types:  [Percentage]
    Reads  =  3299993836    [19.1%]
    Writes =  1258951875    [ 7.3%]
    Inst.  = 12741056222    [73.6%]
    Total  = 17300001933

  Total cycles for activities:  [Percentage]
    Reads  = 49538588785    [29.3%]
    Writes = 19932476206    [11.8%]
    Inst.  = 99804280027    [59.0%]
    Total  =169275345018

  CPI = 13.3
  Ideal: Exec. Time = 30041058155; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 40161444400; CPI =  3.2

  Memory Level:  L1i
    Hit Count = 21080519103  Miss Count = 635038001
    Total Requests = 21715557104
    Hit Rate = 97.1%   Miss Rate =  2.9%
    Kickouts = 579198944; Dirty kickouts = 0; Transfers = 579199080
    VC Hit count = 55838921

  Memory Level:  L1d
    Hit Count = 5144935625  Miss Count = 559895449
    Total Requests = 5704831074
    Hit Rate = 90.2%   Miss Rate = 9.8%
    Kickouts = 387909946; Dirty kickouts = 147202554; Transfers = 387910082
    VC Hit count = 171985367

  Memory Level:  L2
    Hit Count = 657481388  Miss Count = 456830328
    Total Requests = 1114311716
    Hit Rate = 59.0%   Miss Rate = 41.0%
    Kickouts = 430071584; Dirty kickouts = 81872240; Transfers = 430071848
    VC Hit count = 26758480

  L1 cache cost (Icache $100) + (Dcache $100) = $200
  L2 cache cost = $50;  Memory cost = $75  Total cost = $325
```

```
-------------------------------------------------------------------------
      sjeng.default       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 1 : block size = 32
    Icache size = 8192 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    106335247059;  Total refs = 17300001933
  Inst refs = 12741056222;  Data refs = 4558945711

  Number of reference types:  [Percentage]
    Reads  =  3299993836    [19.1%]
    Writes =  1258951875    [ 7.3%]
    Inst.  = 12741056222    [73.6%]
    Total  = 17300001933

  Total cycles for activities:  [Percentage]
    Reads  = 25430426927    [23.9%]
    Writes = 13905815484    [13.1%]
    Inst.  = 66999004648    [63.0%]
    Total  =106335247059

  CPI = 8.3
  Ideal: Exec. Time = 30041058155; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 40161444400; CPI =  3.2

  Memory Level:  L1i
    Hit Count = 21310647762  Miss Count = 404909342
    Total Requests = 21715557104
    Hit Rate = 98.1%   Miss Rate =  1.9%
    Kickouts = 373687626; Dirty kickouts = 0; Transfers = 373687890
    VC Hit count = 31221452

  Memory Level:  L1d
    Hit Count = 5381411277  Miss Count = 323419797
    Total Requests = 5704831074
    Hit Rate = 94.3%   Miss Rate = 5.7%
    Kickouts = 227161103; Dirty kickouts = 99092298; Transfers = 227161367
    VC Hit count = 96258430

  Memory Level:  L2
    Hit Count = 485941759  Miss Count = 213999796
    Total Requests = 699941555
    Hit Rate = 69.4%   Miss Rate = 30.6%
    Kickouts = 198648199; Dirty kickouts = 44168570; Transfers = 198648719
    VC Hit count = 15351077

  L1 cache cost (Icache $200) + (Dcache $200) = $400
  L2 cache cost = $100;  Memory cost = $75  Total cost = $575
```

```
--------------------------------------------------------------------------
      sjeng.L1-2way       Simulation Results
--------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 2 : block size = 32
    Icache size = 8192 : ways = 2 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    100481092118;  Total refs = 17300001933
  Inst refs = 12741056222;  Data refs = 4558945711

  Number of reference types:  [Percentage]
    Reads  =  3299993836    [19.1%]
    Writes =  1258951875    [ 7.3%]
    Inst.  = 12741056222    [73.6%]
    Total  = 17300001933

  Total cycles for activities:  [Percentage]
    Reads  = 22463072463    [22.4%]
    Writes = 13384162211    [13.3%]
    Inst.  = 64633857444    [64.3%]
    Total  =100481092118

  CPI = 7.9
  Ideal: Exec. Time = 30041058155; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 40161444400; CPI =  3.2

  Memory Level:  L1i
    Hit Count = 21334634694  Miss Count = 380922410
    Total Requests = 21715557104
    Hit Rate = 98.2%   Miss Rate =  1.8%
    Kickouts = 358005322; Dirty kickouts = 0; Transfers = 358005586
    VC Hit count = 22916824

  Memory Level:  L1d
    Hit Count = 5498545462  Miss Count = 206285612
    Total Requests = 5704831074
    Hit Rate = 96.4%   Miss Rate = 3.6%
    Kickouts = 175673830; Dirty kickouts = 83889252; Transfers = 175674094
    VC Hit count = 30611518

  Memory Level:  L2
    Hit Count = 425560576  Miss Count = 192008356
    Total Requests = 617568932
    Hit Rate = 68.9%   Miss Rate = 31.1%
    Kickouts = 182812837; Dirty kickouts = 42300121; Transfers = 182813357
    VC Hit count = 9194999

  L1 cache cost (Icache $400) + (Dcache $400) = $800
  L2 cache cost = $100;  Memory cost = $75  Total cost = $975
```

```
-------------------------------------------------------------------------
      sjeng.L1-8way       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 8 : block size = 32
    Icache size = 8192 : ways = 8 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    94235208548;  Total refs = 17300001933
  Inst refs = 12741056222;  Data refs = 4558945711

  Number of reference types:  [Percentage]
    Reads  =  3299993836    [19.1%]
    Writes =  1258951875    [ 7.3%]
    Inst.  = 12741056222    [73.6%]
    Total  = 17300001933

  Total cycles for activities:  [Percentage]
    Reads  = 18521036838    [19.7%]
    Writes = 12244994665    [13.0%]
    Inst.  = 63469177045    [67.4%]
    Total  = 94235208548

  CPI = 7.4
  Ideal: Exec. Time = 30041058155; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 40161444400; CPI =  3.2

  Memory Level:  L1i
    Hit Count = 21328712269  Miss Count = 386844835
    Total Requests = 21715557104
    Hit Rate = 98.2%   Miss Rate =  1.8%
    Kickouts = 373949989; Dirty kickouts = 0; Transfers = 373950253
    VC Hit count = 12894582

  Memory Level:  L1d
    Hit Count = 5565356345  Miss Count = 139474729
    Total Requests = 5704831074
    Hit Rate = 97.6%   Miss Rate = 2.4%
    Kickouts = 127491962; Dirty kickouts = 65378544; Transfers = 127492226
    VC Hit count = 11982503

  Memory Level:  L2
    Hit Count = 397789393  Miss Count = 169031630
    Total Requests = 566821023
    Hit Rate = 70.2%   Miss Rate = 29.8%
    Kickouts = 163186395; Dirty kickouts = 36736083; Transfers = 163186915
    VC Hit count = 5844715

  L1 cache cost (Icache $800) + (Dcache $800) = $1600
  L2 cache cost = $100;  Memory cost = $75  Total cost = $1775
```

```
-------------------------------------------------------------------------
      sjeng.L1-small       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 1 : block size = 32
    Icache size = 4096 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    130091527498;  Total refs = 17300001933
  Inst refs = 12741056222;  Data refs = 4558945711

  Number of reference types:  [Percentage]
    Reads  =  3299993836    [19.1%]
    Writes =  1258951875    [ 7.3%]
    Inst.  = 12741056222    [73.6%]
    Total  = 17300001933

  Total cycles for activities:  [Percentage]
    Reads  = 35522149155    [27.3%]
    Writes = 15801533416    [12.1%]
    Inst.  = 78767844927    [60.5%]
    Total  =130091527498

  CPI = 10.2
  Ideal: Exec. Time = 30041058155; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 40161444400; CPI =  3.2

  Memory Level:  L1i
    Hit Count = 21080519103  Miss Count = 635038001
    Total Requests = 21715557104
    Hit Rate = 97.1%   Miss Rate =  2.9%
    Kickouts = 579198944; Dirty kickouts = 0; Transfers = 579199080
    VC Hit count = 55838921

  Memory Level:  L1d
    Hit Count = 5144935625  Miss Count = 559895449
    Total Requests = 5704831074
    Hit Rate = 90.2%   Miss Rate = 9.8%
    Kickouts = 387909946; Dirty kickouts = 147202554; Transfers = 387910082
    VC Hit count = 171985367

  Memory Level:  L2
    Hit Count = 838472506  Miss Count = 275839210
    Total Requests = 1114311716
    Hit Rate = 75.2%   Miss Rate = 24.8%
    Kickouts = 251053513; Dirty kickouts = 53257242; Transfers = 251054033
    VC Hit count = 24785177

  L1 cache cost (Icache $100) + (Dcache $100) = $200
  L2 cache cost = $100;  Memory cost = $75  Total cost = $375
```

```
--------------------------------------------------------------------------------
      sjeng.L1-small-4way       Simulation Results
--------------------------------------------------------------------------------

  Memory system:
    Dcache size = 4096 : ways = 4 : block size = 32
    Icache size = 4096 : ways = 4 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    124770147094;  Total refs = 17300001933
  Inst refs = 12741056222;  Data refs = 4558945711

  Number of reference types:  [Percentage]
    Reads  =  3299993836    [19.1%]
    Writes =  1258951875    [ 7.3%]
    Inst.  = 12741056222    [73.6%]
    Total  = 17300001933

  Total cycles for activities:  [Percentage]
    Reads  = 32975317005    [26.4%]
    Writes = 14466306170    [11.6%]
    Inst.  = 77328523919    [62.0%]
    Total  =124770147094

  CPI = 9.8
  Ideal: Exec. Time = 30041058155; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 40161444400; CPI =  3.2

  Memory Level:  L1i
    Hit Count = 21124519083  Miss Count = 591038021
    Total Requests = 21715557104
    Hit Rate = 97.3%   Miss Rate =  2.7%
    Kickouts = 549306198; Dirty kickouts = 0; Transfers = 549306334
    VC Hit count = 41731687

  Memory Level:  L1d
    Hit Count = 5401443669  Miss Count = 303387405
    Total Requests = 5704831074
    Hit Rate = 94.7%   Miss Rate = 5.3%
    Kickouts = 281169770; Dirty kickouts = 115258621; Transfers = 281169906
    VC Hit count = 22217499

  Memory Level:  L2
    Hit Count = 682080105  Miss Count = 263654756
    Total Requests = 945734861
    Hit Rate = 72.1%   Miss Rate = 27.9%
    Kickouts = 250847302; Dirty kickouts = 52469698; Transfers = 250847822
    VC Hit count = 12806934

  L1 cache cost (Icache $300) + (Dcache $300) = $600
  L2 cache cost = $100;  Memory cost = $75  Total cost = $775
```

```
-------------------------------------------------------------------------
      sjeng.default       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 1 : block size = 32
    Icache size = 8192 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 8 : chunktime = 15

  Execute time =    106335247059;  Total refs = 17300001933
  Inst refs = 12741056222;  Data refs = 4558945711

  Number of reference types:  [Percentage]
    Reads  =  3299993836    [19.1%]
    Writes =  1258951875    [ 7.3%]
    Inst.  = 12741056222    [73.6%]
    Total  = 17300001933

  Total cycles for activities:  [Percentage]
    Reads  = 25430426927    [23.9%]
    Writes = 13905815484    [13.1%]
    Inst.  = 66999004648    [63.0%]
    Total  =106335247059

  CPI = 8.3
  Ideal: Exec. Time = 30041058155; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 40161444400; CPI =  3.2

  Memory Level:  L1i
    Hit Count = 21310647762  Miss Count = 404909342
    Total Requests = 21715557104
    Hit Rate = 98.1%   Miss Rate =  1.9%
    Kickouts = 373687626; Dirty kickouts = 0; Transfers = 373687890
    VC Hit count = 31221452

  Memory Level:  L1d
    Hit Count = 5381411277  Miss Count = 323419797
    Total Requests = 5704831074
    Hit Rate = 94.3%   Miss Rate = 5.7%
    Kickouts = 227161103; Dirty kickouts = 99092298; Transfers = 227161367
    VC Hit count = 96258430

  Memory Level:  L2
    Hit Count = 485941759  Miss Count = 213999796
    Total Requests = 699941555
    Hit Rate = 69.4%   Miss Rate = 30.6%
    Kickouts = 198648199; Dirty kickouts = 44168570; Transfers = 198648719
    VC Hit count = 15351077

  L1 cache cost (Icache $200) + (Dcache $200) = $400
  L2 cache cost = $100;  Memory cost = $75  Total cost = $575
```

```
-------------------------------------------------------------------------
      sjeng.default_16       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 1 : block size = 32
    Icache size = 8192 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 16 : chunktime = 15

  Execute time =    91766209719;  Total refs = 17300001933
  Inst refs = 12741056222;  Data refs = 4558945711

  Number of reference types:  [Percentage]
    Reads  =  3299993836    [19.1%]
    Writes =  1258951875    [ 7.3%]
    Inst.  = 12741056222    [73.6%]
    Total  = 17300001933

  Total cycles for activities:  [Percentage]
    Reads  = 20557356107    [22.4%]
    Writes = 11094109704    [12.1%]
    Inst.  = 60114743908    [65.5%]
    Total  = 91766209719

  CPI = 7.2
  Ideal: Exec. Time = 30041058155; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 40161444400; CPI =  3.2

  Memory Level:  L1i
    Hit Count = 21310647762  Miss Count = 404909342
    Total Requests = 21715557104
    Hit Rate = 98.1%   Miss Rate =  1.9%
    Kickouts = 373687626; Dirty kickouts = 0; Transfers = 373687890
    VC Hit count = 31221452

  Memory Level:  L1d
    Hit Count = 5381411277  Miss Count = 323419797
    Total Requests = 5704831074
    Hit Rate = 94.3%   Miss Rate = 5.7%
    Kickouts = 227161103; Dirty kickouts = 99092298; Transfers = 227161367
    VC Hit count = 96258430

  Memory Level:  L2
    Hit Count = 485941759  Miss Count = 213999796
    Total Requests = 699941555
    Hit Rate = 69.4%   Miss Rate = 30.6%
    Kickouts = 198648199; Dirty kickouts = 44168570; Transfers = 198648719
    VC Hit count = 15351077

  L1 cache cost (Icache $200) + (Dcache $200) = $400
  L2 cache cost = $100;  Memory cost = $175  Total cost = $675
```

```
-------------------------------------------------------------------------
      sjeng.default_32       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 1 : block size = 32
    Icache size = 8192 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 32 : chunktime = 15

  Execute time =    84481691049;  Total refs = 17300001933
  Inst refs = 12741056222;  Data refs = 4558945711

  Number of reference types:  [Percentage]
    Reads  =  3299993836    [19.1%]
    Writes =  1258951875    [ 7.3%]
    Inst.  = 12741056222    [73.6%]
    Total  = 17300001933

  Total cycles for activities:  [Percentage]
    Reads  = 18120820697    [21.4%]
    Writes =  9688256814    [11.5%]
    Inst.  = 56672613538    [67.1%]
    Total  = 84481691049

  CPI = 6.6
  Ideal: Exec. Time = 30041058155; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 40161444400; CPI =  3.2

  Memory Level:  L1i
    Hit Count = 21310647762  Miss Count = 404909342
    Total Requests = 21715557104
    Hit Rate = 98.1%   Miss Rate =  1.9%
    Kickouts = 373687626; Dirty kickouts = 0; Transfers = 373687890
    VC Hit count = 31221452

  Memory Level:  L1d
    Hit Count = 5381411277  Miss Count = 323419797
    Total Requests = 5704831074
    Hit Rate = 94.3%   Miss Rate = 5.7%
    Kickouts = 227161103; Dirty kickouts = 99092298; Transfers = 227161367
    VC Hit count = 96258430

  Memory Level:  L2
    Hit Count = 485941759  Miss Count = 213999796
    Total Requests = 699941555
    Hit Rate = 69.4%   Miss Rate = 30.6%
    Kickouts = 198648199; Dirty kickouts = 44168570; Transfers = 198648719
    VC Hit count = 15351077

  L1 cache cost (Icache $200) + (Dcache $200) = $400
  L2 cache cost = $100;  Memory cost = $275  Total cost = $775
```

```
-------------------------------------------------------------------------
      sjeng.default_64       Simulation Results
-------------------------------------------------------------------------

  Memory system:
    Dcache size = 8192 : ways = 1 : block size = 32
    Icache size = 8192 : ways = 1 : block size = 32
    L2-cache size = 32768 : ways = 1 : block size = 64
    Memory ready time = 50 : chunksize = 64 : chunktime = 15

  Execute time =    80839431714;  Total refs = 17300001933
  Inst refs = 12741056222;  Data refs = 4558945711

  Number of reference types:  [Percentage]
    Reads  =  3299993836    [19.1%]
    Writes =  1258951875    [ 7.3%]
    Inst.  = 12741056222    [73.6%]
    Total  = 17300001933

  Total cycles for activities:  [Percentage]
    Reads  = 16902552992    [20.9%]
    Writes =  8985330369    [11.1%]
    Inst.  = 54951548353    [68.0%]
    Total  = 80839431714

  CPI = 6.3
  Ideal: Exec. Time = 30041058155; CPI =  2.4
  Ideal mis-aligned: Exec. Time = 40161444400; CPI =  3.2

  Memory Level:  L1i
    Hit Count = 21310647762  Miss Count = 404909342
    Total Requests = 21715557104
    Hit Rate = 98.1%   Miss Rate =  1.9%
    Kickouts = 373687626; Dirty kickouts = 0; Transfers = 373687890
    VC Hit count = 31221452

  Memory Level:  L1d
    Hit Count = 5381411277  Miss Count = 323419797
    Total Requests = 5704831074
    Hit Rate = 94.3%   Miss Rate = 5.7%
    Kickouts = 227161103; Dirty kickouts = 99092298; Transfers = 227161367
    VC Hit count = 96258430

  Memory Level:  L2
    Hit Count = 485941759  Miss Count = 213999796
    Total Requests = 699941555
    Hit Rate = 69.4%   Miss Rate = 30.6%
    Kickouts = 198648199; Dirty kickouts = 44168570; Transfers = 198648719
    VC Hit count = 15351077

  L1 cache cost (Icache $200) + (Dcache $200) = $400
  L2 cache cost = $100;  Memory cost = $375  Total cost = $875
```