

INDIAN INSTITUTE OF TECHNOLOGY KANPUR



PROGRAMMING ASSIGNMENT - 1

Computer Architecture

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1 Results

1.1 Perlbench

1.1.1 MyPinTool Analysis Results

Total Instructions	: 208000000000
NOP Instructions	: 966201
Directed Call Instructions	: 12788598
Indirected Call Instructions	: 2827659
Return Instructions	: 15616257
Unconditional Branch Instructions	: 30532433
Conditional Branch Instructions	: 130018958
Logical Operation Instructions	: 100219552
Shift Instructions	: 4265342
Flag Operation Instructions	: 864918
Vector Instructions	: 0
Conditional Moves Instructions	: 0
MME, SSE Instructions	: 0
System Instructions	: 0
Floating Point Instructions	: 942346
Other Instructions	: 700791353
Load Instructions	: 356472727
Store Instructions	: 205979744
CPI	: 29.1225
Instruction Memory Map	: 91264
Data Memory Map	: 1019040
<hr/>	
Maximum Memory Bytes Touched	: 8
Average Bytes Touched	: 3.80897
Maximum Immediate Field	: 2147483647
Minimum Immediate Field	: -2147483648
Maximum Displacement Field	: 135918104
Minimum Displacement Field	: -1408

Table 1: Perlbench

1.1.2 Distributions

Distribution of instruction length:

0 : 0
1 : 117479272
2 : 256719867
3 : 274848256
4 : 52932522
5 : 78568083
6 : 185481754
7 : 33970206
8 : 28
9 : 0
10 : 12
11 : 0
12 : 0
13 : 0

Distribution of the number of operands:

0 : 966201
1 : 1072485
2 : 520653458
3 : 355058333
4 : 103365797
5 : 15617935
6 : 3265791
7 : 0
8 : 0
9 : 0

Distribution of number of register read operands:

0 : 10139370
1 : 260158504
2 : 537634326
3 : 179164713
4 : 7052675
5 : 2584621
6 : 3265791
7 : 0
8 : 0
9 : 0

Distribution of number of register write operands:

0 : 135902158
1 : 685061417
2 : 175767021
3 : 2389502
4 : 879902
5 : 0
6 : 0
7 : 0

Distribution of number of memory operands:

0 : 453460672

1 : 530841382

2 : 15531563

3 : 0

4 : 0

5 : 0

Distribution of number of read memory operands:

0 : 190856902

1 : 354636164

2 : 879879

3 : 0

4 : 0

5 : 0

Distribution of number of write memory operands:

0 : 340864359

1 : 205508586

2 : 0

3 : 0

4 : 0

1.2 Bzip2

1.2.1 MyPinTool Analysis Results

Total Instructions	: 302000000000
NOP Instructions	: 36514
Directed Call Instructions	: 791585
Indirected Call Instructions	: 13
Return Instructions	: 791594
Unconditional Branch Instructions	: 21299252
Conditional Branch Instructions	: 129923059
Logical Operation Instructions	: 71000850
Shift Instructions	: 61832109
Flag Operation Instructions	: 6130
Vector Instructions	: 0
Conditional Moves Instructions	: 0
MME, SSE Instructions	: 0
System Instructions	: 0
Floating Point Instructions	: 0
Other Instructions	: 714314809
Load Instructions	: 452705953
Store Instructions	: 231174231
CPI	: 35.194
Instruction Memory Map	: 24288
Data Memory Map	: 81190208
<hr/>	
Maximum Memory Bytes Touched	: 8
Average Bytes Touched	: 4.02652
Maximum Immediate Field	: 1431655766
Minimum Immediate Field	: -858993459
Maximum Displacement Field	: 135000192
Minimum Displacement Field	: -4848

Table 2: Bzip2

1.2.2 Distributions

Distribution of instruction length:

0 : 0
1 : 38611298
2 : 219201500
3 : 436966066
4 : 75326911
5 : 22047290
6 : 141357049
7 : 51341644
8 : 15085632
9 : 0
10 : 62610
11 : 0
12 : 0
13 : 0

Distribution of the number of operands:

0 : 36514
1 : 6147
2 : 597647599
3 : 382870338
4 : 2693810
5 : 14191384
6 : 2554208
7 : 0
8 : 0
9 : 0

Distribution of number of register read operands:

0 : 5189068
1 : 183351810
2 : 533608282
3 : 215105796
4 : 46791037
5 : 13399799
6 : 2554208
7 : 0
8 : 0
9 : 0

Distribution of number of register write operands:

0 : 132331509
1 : 712782228
2 : 152332038
3 : 2554225
4 : 0
5 : 0
6 : 0

Distribution of number of memory operands:

0 : 399852629
1 : 516406388
2 : 83736898
3 : 0
4 : 0
5 : 0

Distribution of number of read memory operands:

0 : 147437333
1 : 452705953
2 : 0
3 : 0
4 : 0

Distribution of number of write memory operands:

0 : 368969055
1 : 231174231
2 : 0
3 : 0
4 : 0

1.3 Gcc

1.3.1 MyPinTool Analysis Results

Total Instructions	: 108000000000
NOP Instructions	: 186115
Directed Call Instructions	: 4505668
Indirected Call Instructions	: 502878
Return Instructions	: 5008547
Unconditional Branch Instructions	: 4741774
Conditional Branch Instructions	: 133291642
Logical Operation Instructions	: 132076565
Shift Instructions	: 2328500
Flag Operation Instructions	: 185101
Vector Instructions	: 0
Conditional Moves Instructions	: 0
MME, SSE Instructions	: 0
System Instructions	: 0
Floating Point Instructions	: 5
Other Instructions	: 717104799
Load Instructions	: 136501493
Store Instructions	: 360744687
CPI	: 25.8622
Instruction Memory Map	: 94944
Data Memory Map	: 36378240
<hr/>	
Maximum Memory Bytes Touched	: 8
Average Bytes Touched	: 4.05548
Maximum Immediate Field	: 1073741823
Minimum Immediate Field	: -2147483587
Maximum Displacement Field	: 138634432
Minimum Displacement Field	: -1744

Table 3: Gcc

1.3.2 Distributions

Distribution of instruction length:

0 : 0
1 : 130012774
2 : 593488611
3 : 123502331
4 : 116411874
5 : 10736994
6 : 15139729
7 : 10650237
8 : 57450
9 : 0
10 : 0
11 : 0

Distribution of the number of operands:

0 : 186115
1 : 4598421
2 : 348357376
3 : 404003418
4 : 33483967
5 : 205115420
6 : 4255283
7 : 0
8 : 0
9 : 0

Distribution of number of register read operands:

0 : 2118108
1 : 168396402
2 : 471710282
3 : 61736723
4 : 91174848
5 : 200608354
6 : 4255283
7 : 0
8 : 0
9 : 0

Distribution of number of register write operands:

0 : 126049975
1 : 416305874
2 : 453245041
3 : 4399110
4 : 0
5 : 0
6 : 0

Distribution of number of memory operands:

0 : 519053334
1 : 464510343

2 : 16367917
3 : 0
4 : 0
5 : 0

Distribution of number of read memory operands:

0 : 344376770
1 : 136501490
2 : 0
3 : 0
4 : 0

Distribution of number of write memory operands:

0 : 120133573
1 : 360744687
2 : 0
3 : 0
4 : 0

1.4 Hammer

1.4.1 MyPinTool Analysis Results

Total Instructions	: 265000000000
NOP Instructions	: 34317
Directed Call Instructions	: 144622
Indirected Call Instructions	: 959
Return Instructions	: 145581
Unconditional Branch Instructions	: 205862
Conditional Branch Instructions	: 144361425
Logical Operation Instructions	: 1158703
Shift Instructions	: 294106
Flag Operation Instructions	: 5669
Vector Instructions	: 0
Conditional Moves Instructions	: 0
MME, SSE Instructions	: 0
System Instructions	: 0
Floating Point Instructions	: 40212
Other Instructions	: 853607581
Load Instructions	: 547670760
Store Instructions	: 75698746
CPI	: 32.1685
Instruction Memory Map	: 15616
Data Memory Map	: 2690112
<hr/>	
Maximum Memory Bytes Touched	: 8
Average Bytes Touched	: 3.99842
Maximum Immediate Field	: 2147483647
Minimum Immediate Field	: -987654321
Maximum Displacement Field	: 135294312
Minimum Displacement Field	: -580

Table 4: Hammer

1.4.2 Distributions

Distribution of instruction length:

0 : 0
1 : 25078459
2 : 302860551
3 : 296150903
4 : 270388804
5 : 24861234
6 : 68360214
7 : 416480
8 : 11883355
9 : 0
10 : 0
11 : 0

Distribution of the number of operands:

0 : 34887
1 : 3512
2 : 566126763
3 : 432938364
4 : 713115
5 : 159551
6 : 23808
7 : 0
8 : 0
9 : 0

Distribution of number of register read operands:

0 : 610947
1 : 75620185
2 : 562398803
3 : 281425779
4 : 79905549
5 : 14929
6 : 23808
7 : 0
8 : 0
9 : 0

Distribution of number of register write operands:

0 : 75149178
1 : 755279999
2 : 169547015
3 : 23808
4 : 0
5 : 0
6 : 0

Distribution of number of memory operands:

0 : 376808159
1 : 623024769

2 : 166109
3 : 0
4 : 0
5 : 0

Distribution of number of read memory operands:

0 : 75528001
1 : 547662877
2 : 0
3 : 0
4 : 0

Distribution of number of write memory operands:

0 : 547496768
1 : 75694110
2 : 0
3 : 0
4 : 0

1.5 Mcf

1.5.1 MyPinTool Analysis Results

Total Instructions	: 378000000000
NOP Instructions	: 1477639
Directed Call Instructions	: 12556341
Indirected Call Instructions	: 0
Return Instructions	: 12556341
Unconditional Branch Instructions	: 8314494
Conditional Branch Instructions	: 178242946
Logical Operation Instructions	: 75119537
Shift Instructions	: 3516411
Flag Operation Instructions	: 0
Vector Instructions	: 0
Conditional Moves Instructions	: 0
MME, SSE Instructions	: 0
System Instructions	: 0
Floating Point Instructions	: 0
Other Instructions	: 708216291
Load Instructions	: 415212613
Store Instructions	: 110040128
CPI	: 27.2626
Instruction Memory Map	: 2080
Data Memory Map	: 373532416
<hr/>	
Maximum Memory Bytes Touched	: 8
Average Bytes Touched	: 4.09699
Maximum Immediate Field	: 1374389535
Minimum Immediate Field	: -100000000
Maximum Displacement Field	: 134957120
Minimum Displacement Field	: -76

Table 5: Mcf

1.5.2 Distributions

Distribution of instruction length:

0 : 0
1 : 80626418
2 : 485393488
3 : 315526303
4 : 50531287
5 : 22076608
6 : 5249812
7 : 40596084
8 : 0
9 : 0
10 : 0

Distribution of the number of operands:

0 : 1477639
1 : 0
2 : 484784824
3 : 457346918
4 : 43834278
5 : 12556341
6 : 0
7 : 0
8 : 0

Distribution of number of register read operands:

0 : 3759877
1 : 148510529
2 : 677530812
3 : 170198782
4 : 0
5 : 0
6 : 0

Distribution of number of register write operands:

0 : 70906609
1 : 770283585
2 : 158771295
3 : 38511
4 : 0
5 : 0
6 : 0

Distribution of number of memory operands:

0 : 487182363
1 : 500382533
2 : 12435104
3 : 0
4 : 0
5 : 0

Distribution of number of read memory operands:

0 : 97605024
1 : 415212613
2 : 0
3 : 0
4 : 0

Distribution of number of write memory operands:

0 : 402777509
1 : 110040128
2 : 0
3 : 0
4 : 0

1.6 Omnetpp

1.6.1 MyPinTool Analysis Results

Total Instructions	: 44000000000
NOP Instructions	: 802403
Directed Call Instructions	: 21327723
Indirected Call Instructions	: 3689261
Return Instructions	: 25016980
Unconditional Branch Instructions	: 22189669
Conditional Branch Instructions	: 117335266
Logical Operation Instructions	: 60009441
Shift Instructions	: 7139690
Flag Operation Instructions	: 20159884
Vector Instructions	: 0
Conditional Moves Instructions	: 0
MME, SSE Instructions	: 0
System Instructions	: 0
Floating Point Instructions	: 96963573
Other Instructions	: 625366110
Load Instructions	: 371235106
Store Instructions	: 229791053
CPI	: 31.0513
Instruction Memory Map	: 28832
Data Memory Map	: 17734592
<hr/>	
Maximum Memory Bytes Touched	: 8
Average Bytes Touched	: 4.2431
Maximum Immediate Field	: 2147483647
Minimum Immediate Field	: -2092037281
Maximum Displacement Field	: 136090116
Minimum Displacement Field	: -104

Table 6: Omnetpp

1.6.2 Distributions

Distribution of instruction length:

0 : 0
1 : 154578785
2 : 308551276
3 : 382074521
4 : 34347870
5 : 45117282
6 : 48822868
7 : 26506977
8 : 0
9 : 0
10 : 421
11 : 0
12 : 0
13 : 0

Distribution of the number of operands:

0 : 802403
1 : 225880
2 : 518294361
3 : 281743949
4 : 172763912
5 : 25030575
6 : 1138920
7 : 0
8 : 0
9 : 0

Distribution of number of register read operands:

0 : 29000218
1 : 197518853
2 : 540431942
3 : 219765949
4 : 8457504
5 : 3686614
6 : 1138920
7 : 0
8 : 0
9 : 0

Distribution of number of register write operands:

0 : 165349954
1 : 665542455
2 : 167592657
3 : 376014
4 : 1138920
5 : 0
6 : 0
7 : 0

Distribution of number of memory operands:

0 : 449250176

1 : 542984691

2 : 7765133

3 : 0

4 : 0

5 : 0

Distribution of number of read memory operands:

0 : 212450764

1 : 337160140

2 : 1138920

3 : 0

4 : 0

5 : 0

Distribution of number of write memory operands:

0 : 331672847

1 : 219076977

2 : 0

3 : 0

4 : 0

1.7 Soplex

1.7.1 MyPinTool Analysis Results

Total Instructions	: 365000000000
NOP Instructions	: 7973
Directed Call Instructions	: 3194681
Indirected Call Instructions	: 126
Return Instructions	: 3194801
Unconditional Branch Instructions	: 12973382
Conditional Branch Instructions	: 103134881
Logical Operation Instructions	: 13878268
Shift Instructions	: 10421490
Flag Operation Instructions	: 23126123
Vector Instructions	: 0
Conditional Moves Instructions	: 0
MME, SSE Instructions	: 0
System Instructions	: 0
Floating Point Instructions	: 308051651
Other Instructions	: 522016624
Load Instructions	: 546825868
Store Instructions	: 100071739
CPI	: 33.3449
Instruction Memory Map	: 33664
Data Memory Map	: 182089440
<hr/>	
Maximum Memory Bytes Touched	: 8
Average Bytes Touched	: 5.51447
Maximum Immediate Field	: 2147483647
Minimum Immediate Field	: -1074790400
Maximum Displacement Field	: 135855532
Minimum Displacement Field	: -344

Table 7: Soplex

1.7.2 Distributions

Distribution of instruction length:

0 : 0
1 : 77371567
2 : 441847466
3 : 399365836
4 : 16290519
5 : 3265466
6 : 40374545
7 : 17547688
8 : 3936913
9 : 0
10 : 0
11 : 0

Distribution of the number of operands:

0 : 7973
1 : 16
2 : 413956206
3 : 395345517
4 : 187459263
5 : 3231025
6 : 0
7 : 0
8 : 0

Distribution of number of register read operands:

0 : 23329013
1 : 216167176
2 : 577713233
3 : 139318564
4 : 43435691
5 : 36323
6 : 0
7 : 0
8 : 0

Distribution of number of register write operands:

0 : 68995836
1 : 764813923
2 : 166190241
3 : 0
4 : 0
5 : 0

Distribution of number of memory operands:

0 : 530764622
1 : 439460866
2 : 29774512
3 : 0
4 : 0

5 : 0

Distribution of number of read memory operands:

0 : 52439920

1 : 416795458

2 : 0

3 : 0

4 : 0

Distribution of number of write memory operands:

0 : 387020946

1 : 82214432

2 : 0

3 : 0

4 : 0

1.8 Xalancbmk

1.8.1 MyPinTool Analysis Results

Total Instructions	: 1332000000000
NOP Instructions	: 22004030
Directed Call Instructions	: 13270504
Indirected Call Instructions	: 8947483
Return Instructions	: 22216380
Unconditional Branch Instructions	: 8619103
Conditional Branch Instructions	: 177691744
Logical Operation Instructions	: 37949055
Shift Instructions	: 5621524
Flag Operation Instructions	: 1675118
Vector Instructions	: 0
Conditional Moves Instructions	: 0
MME, SSE Instructions	: 0
System Instructions	: 0
Floating Point Instructions	: 7312904
Other Instructions	: 694215670
Load Instructions	: 367809103
Store Instructions	: 169267473
CPI	: 27.8534
Instruction Memory Map	: 74080
Data Memory Map	: 27004160
<hr/>	
Maximum Memory Bytes Touched	: 8
Average Bytes Touched	: 4.18111
Maximum Immediate Field	: 2147483647
Minimum Immediate Field	: -1431655765
Maximum Displacement Field	: 139657912
Minimum Displacement Field	: -1392

Table 8: Xalancbmk

1.8.2 Distributions

Distribution of instruction length:

0 : 0
1 : 145417765
2 : 320263712
3 : 446452165
4 : 31889603
5 : 24145364
6 : 23732591
7 : 7709391
8 : 262555
9 : 60557
10 : 66297
11 : 0
12 : 0
13 : 0

Distribution of the number of operands:

0 : 22004030
1 : 748201
2 : 423137817
3 : 412388500
4 : 102001452
5 : 24177451
6 : 15542549
7 : 0
8 : 0
9 : 0

Distribution of number of register read operands:

0 : 29469962
1 : 236655485
2 : 457873944
3 : 250424186
4 : 1205392
5 : 8828482
6 : 15542549
7 : 0
8 : 0
9 : 0

Distribution of number of register write operands:

0 : 113551821
1 : 685189745
2 : 185714378
3 : 15544056
4 : 0
5 : 0
6 : 0

Distribution of number of memory operands:

0 : 493002365
1 : 479448355
2 : 27072795
3 : 0
4 : 0
5 : 0

Distribution of number of read memory operands:

0 : 141052719
1 : 365468431
2 : 0
3 : 0
4 : 0

Distribution of number of write memory operands:

0 : 338395636
1 : 168125514
2 : 0
3 : 0
4 : 0