1. Data structure: a struct containing the following elements: a addr\_t array of length 128 to store tags, a Boolean array of length 128 to store valid bit, a Boolean array of length 128 to store dirty bit, and a int array of length 128 to store the lru\_counter. Length chosen to be 128 for different set associativity requirements.
2. Plot of miss rate vs. line size for each trace (32, 64, 128, 256, 512)
3. After comparing output of multiple trace files. It is determined that lowest miss rate is achieved with maximum associativity and maximum line size. In other words, line size = 512, associativity = 8.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | overall  miss  rate | write miss rate | read miss rate | writeback traffic | memory access | bytes refered | main memory |
| random64k | 0.00048828 | N/A | 0.00048828 | 0 | 65536 | 134217728 | 134152192 |
| bubble | 0.00104803 | 0.0009415 | 0.00106036 | 812544 | 3392512 | 3237039616 | 3233647104 |
| merge | 0.00113461 | 0.000905 | 0.00117438 | 1189888 | 4460544 | 3931356160 | 3926895616 |
| stream1M | 0.0078125 | N/A | 0.0078125 | 0 | 1048576 | 134217728 | 133169152 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | line size | accesses | hits | misses | miss rate | wb | write misses | writes | read misses | reads | write miss rate | read miss rate | wb traffic |
| random | 32 | 262144 | 260096 | 2048 | 0.0078125 | 0 | 0 | 0 | 2048 | 262144 | #DIV/0! | 0.0078125 | 0 |
|  | 64 | 262144 | 261120 | 1024 | 0.0039063 | 0 | 0 | 0 | 1024 | 262144 | #DIV/0! | 0.00390625 | 0 |
|  | 128 | 262144 | 261632 | 512 | 0.0019531 | 0 | 0 | 0 | 512 | 262144 | #DIV/0! | 0.00195313 | 0 |
|  | 256 | 262144 | 261888 | 256 | 0.0009766 | 0 | 0 | 0 | 256 | 262144 | #DIV/0! | 0.00097656 | 0 |
|  | 512 | 262144 | 262016 | 128 | 0.0004883 | 0 | 0 | 0 | 128 | 262144 | #DIV/0! | 0.00048828 | 0 |
|  | overall | 1310720 | 1306752 | 3968 | 0.0030273 | 0 | 0 | 0 | 3968 | 1310720 | #DIV/0! | 0.00302734 |  |
| bubble | 32 | 6322343 | 6302726 | 19617 | 0.0031028 | 6545 | 6140 | 656333 | 13477 | 5666010 | 0.009355007 | 0.00237857 | 209440 |
|  | 64 | 6322343 | 6309889 | 12454 | 0.0019698 | 3935 | 3235 | 656333 | 9219 | 5666010 | 0.0049289 | 0.00162707 | 251840 |
|  | 128 | 6322343 | 6313038 | 9305 | 0.0014718 | 2609 | 1755 | 656333 | 7550 | 5666010 | 0.002673948 | 0.00133251 | 333952 |
|  | 256 | 6322343 | 6314653 | 7690 | 0.0012163 | 1955 | 1018 | 656333 | 6672 | 5666010 | 0.001551042 | 0.00117755 | 500480 |
|  | 512 | 6322343 | 6314802 | 7541 | 0.0011928 | 1705 | 628 | 656333 | 6913 | 5666010 | 0.000956831 | 0.00122008 | 872960 |
|  | overall | 31611715 | 31555108 | 56607 | 0.0017907 | 16749 | 12776 | 3281665 | 43831 | 28330050 | 0.003893146 | 0.00154716 |  |
| merge | 32 | 7678430 | 7648727 | 29703 | 0.0038684 | 12571 | 10538 | 1133678 | 19165 | 6544752 | 0.009295408 | 0.0029283 | 402272 |
|  | 64 | 7678430 | 7660054 | 18376 | 0.0023932 | 7285 | 5529 | 1133678 | 12847 | 6544752 | 0.004877046 | 0.00196295 | 466240 |
|  | 128 | 7678430 | 7665234 | 13196 | 0.0017186 | 4576 | 2998 | 1133678 | 10198 | 6544752 | 0.00264449 | 0.0015582 | 585728 |
|  | 256 | 7678430 | 7668099 | 10331 | 0.0013455 | 3122 | 1718 | 1133678 | 8613 | 6544752 | 0.001515421 | 0.00131602 | 799232 |
|  | 512 | 7678430 | 7668811 | 9619 | 0.0012527 | 2489 | 1050 | 1133678 | 8569 | 6544752 | 0.000926189 | 0.00130929 | 1274368 |
|  | overall | 38392150 | 38310925 | 81225 | 0.0021157 | 30043 | 21833 | 5668390 | 59392 | 32723760 | 0.003851711 | 0.00181495 |  |
| stream | 32 | 262144 | 229376 | 32768 | 0.125 | 0 | 0 | 0 | 32768 | 262144 | #DIV/0! | 0.125 | 0 |
|  | 64 | 262144 | 245760 | 16384 | 0.0625 | 0 | 0 | 0 | 16384 | 262144 | #DIV/0! | 0.0625 | 0 |
|  | 128 | 262144 | 253952 | 8192 | 0.03125 | 0 | 0 | 0 | 8192 | 262144 | #DIV/0! | 0.03125 | 0 |
|  | 256 | 262144 | 258048 | 4096 | 0.015625 | 0 | 0 | 0 | 4096 | 262144 | #DIV/0! | 0.015625 | 0 |
|  | 512 | 262144 | 260096 | 2048 | 0.0078125 | 0 | 0 | 0 | 2048 | 262144 | #DIV/0! | 0.0078125 | 0 |
|  | overall | 1310720 | 1247232 | 63488 | 0.0484375 | 0 | 0 | 0 | 63488 | 1310720 | #DIV/0! | 0.0484375 |  |