|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm & tracefile | Memsize | | | |
| **RAND** | 50 | 100 | 150 | 200 |
| simpleloop | Hit count: 7583  Miss count: 2977  Clean evictions: 235  Dirty evictions: 2692  Total references : 10560  Hit rate: 71.8087  Miss rate: 28.1913 | Hit count: 7805  Miss count: 2755  Clean evictions: 51  Dirty evictions: 2604  Total references : 10560  Hit rate: 73.9110  Miss rate: 26.0890 | Hit count: 7843  Miss count: 2717  Clean evictions: 22  Dirty evictions: 2545  Total references : 10560  Hit rate: 74.2708  Miss rate: 25.7292 | Hit count: 7854  Miss count: 2706  Clean evictions: 18  Dirty evictions: 2488  Total references : 10560  Hit rate: 74.3750  Miss rate: 25.6250 |
| Matmul | Hit count: 1972586  Miss count: 995558  Clean evictions: 956334  Dirty evictions: 39174  Total references : 2968144  Hit rate: 66.4586  Miss rate: 33.5414 | Hit count: 2643917  Miss count: 324227  Clean evictions: 316545  Dirty evictions: 7582  Total references : 2968144  Hit rate: 89.0764  Miss rate: 10.9236 | Hit count: 2871866  Miss count: 96278  Clean evictions: 93792  Dirty evictions: 2336  Total references : 2968144  Hit rate: 96.7563  Miss rate: 3.2437 | Hit count: 2911656  Miss count: 56488  Clean evictions: 54639  Dirty evictions: 1649  Total references : 2968144  Hit rate: 98.0969  Miss rate: 1.9031 |
| Blocked | Hit count: 2516614  Miss count: 8402  Clean evictions: 5832  Dirty evictions: 2520  Total references : 2525016  Hit rate: 99.6672  Miss rate: 0.3328 | Hit count: 2519783  Miss count: 5233  Clean evictions: 3423  Dirty evictions: 1710  Total references : 2525016  Hit rate: 99.7928  Miss rate: 0.2072 | Hit count: 2520592  Miss count: 4424  Clean evictions: 2800  Dirty evictions: 1474  Total references : 2525016  Hit rate: 99.8248  Miss rate: 0.1752 | Hit count: 2521155  Miss count: 3861  Clean evictions: 2342  Dirty evictions: 1319  Total references : 2525016  Hit rate: 99.8471  Miss rate: 0.1529 |
| My\_trace\_generator | Hit count: 16087  Miss count: 313  Clean evictions: 126  Dirty evictions: 137  Total references : 16400  Hit rate: 98.0915  Miss rate: 1.9085 | Hit count: 16256  Miss count: 144  Clean evictions: 3  Dirty evictions: 41  Total references : 16400  Hit rate: 99.1220  Miss rate: 0.8780 | Hit count: 16274  Miss count: 126  Clean evictions: 0  Dirty evictions: 0  Total references : 16400  Hit rate: 99.2317  Miss rate: 0.7683 | Hit count: 16274  Miss count: 126  Clean evictions: 0  Dirty evictions: 0  Total references : 16400  Hit rate: 99.2317  Miss rate: 0.7683 |
| **FIFO** | 50 | 100 | 150 | 200 |
| simpleloop | Hit count: 7591  Miss count: 2969  Clean evictions: 206  Dirty evictions: 2713  Total references : 10560  Hit rate: 71.8845  Miss rate: 28.1155 | Hit count: 7806  Miss count: 2754  Clean evictions: 44  Dirty evictions: 2610  Total references : 10560  Hit rate: 73.9205  Miss rate: 26.0795 | Hit count: 7846  Miss count: 2714  Clean evictions: 16  Dirty evictions: 2548  Total references : 10560  Hit rate: 74.2992  Miss rate: 25.7008 | Hit count: 7854  Miss count: 2706  Clean evictions: 12  Dirty evictions: 2494  Total references : 10560  Hit rate: 74.3750  Miss rate: 25.6250 |
| Matmul | Hit count: 1840871  Miss count: 1127273  Clean evictions: 1083235  Dirty evictions: 43988  Total references : 2968144  Hit rate: 62.0209  Miss rate: 37.9791 | Hit count: 1884597  Miss count: 1083547  Clean evictions: 1061226  Dirty evictions: 22221  Total references : 2968144  Hit rate: 63.4941  Miss rate: 36.5059 | Hit count: 2933734  Miss count: 34410  Clean evictions: 32946  Dirty evictions: 1314  Total references : 2968144  Hit rate: 98.8407  Miss rate: 1.1593 | Hit count: 2934256  Miss count: 33888  Clean evictions: 32435  Dirty evictions: 1253  Total references : 2968144  Hit rate: 98.8583  Miss rate: 1.1417 |
| Blocked | Hit count: 2518547  Miss count: 6469  Clean evictions: 4164  Dirty evictions: 2255  Total references : 2525016  Hit rate: 99.7438  Miss rate: 0.2562 | Hit count: 2520658  Miss count: 4358  Clean evictions: 2777  Dirty evictions: 1481  Total references : 2525016  Hit rate: 99.8274  Miss rate: 0.1726 | Hit count: 2520753  Miss count: 4263  Clean evictions: 2687  Dirty evictions: 1426  Total references : 2525016  Hit rate: 99.8312  Miss rate: 0.1688 | Hit count: 2521824  Miss count: 3192  Clean evictions: 1893  Dirty evictions: 1099  Total references : 2525016  Hit rate: 99.8736  Miss rate: 0.1264 |
| My\_trace\_generator | Hit count: 16119  Miss count: 281  Clean evictions: 87  Dirty evictions: 144  Total references : 16400  Hit rate: 98.2866  Miss rate: 1.7134 | Hit count: 16254  Miss count: 146  Clean evictions: 0  Dirty evictions: 46  Total references : 16400  Hit rate: 99.1098  Miss rate: 0.8902 | Hit count: 16274  Miss count: 126  Clean evictions: 0  Dirty evictions: 0  Total references : 16400  Hit rate: 99.2317  Miss rate: 0.7683 | Hit count: 16274  Miss count: 126  Clean evictions: 0  Dirty evictions: 0  Total references : 16400  Hit rate: 99.2317  Miss rate: 0.7683 |
| **LRU** | 50 | 100 | 150 | 200 |
| simpleloop | Hit count: 7775  Miss count: 2785  Clean evictions: 94  Dirty evictions: 2641  Total references : 10560  Hit rate: 73.6269  Miss rate: 26.3731 | Hit count: 7877  Miss count: 2683  Clean evictions: 1  Dirty evictions: 2582  Total references : 10560  Hit rate: 74.5928  Miss rate: 25.4072 | Hit count: 7880  Miss count: 2680  Clean evictions: 0  Dirty evictions: 2530  Total references : 10560  Hit rate: 74.6212  Miss rate: 25.3788 | Hit count: 7880  Miss count: 2680  Clean evictions: 0  Dirty evictions: 2480  Total references : 10560  Hit rate: 74.6212  Miss rate: 25.3788 |
| Matmul | Hit count: 1926916  Miss count: 1041228  Clean evictions: 1040073  Dirty evictions: 1105  Total references : 2968144  Hit rate: 64.9199  Miss rate: 35.0801 | Hit count: 1961692  Miss count: 1006452  Clean evictions: 1005272  Dirty evictions: 1080  Total references : 2968144  Hit rate: 66.0915  Miss rate: 33.9085 | Hit count: 2935260  Miss count: 32884  Clean evictions: 31656  Dirty evictions: 1078  Total references : 2968144  Hit rate: 98.8921  Miss rate: 1.1079 | Hit count: 2935272  Miss count: 32872  Clean evictions: 31594  Dirty evictions: 1078  Total references : 2968144  Hit rate: 98.8925  Miss rate: 1.1075 |
| Blocked | Hit count: 2519783  Miss count: 5233  Clean evictions: 2802  Dirty evictions: 2381  Total references : 2525016  Hit rate: 99.7928  Miss rate: 0.2072 | Hit count: 2521184  Miss count: 3832  Clean evictions: 2648  Dirty evictions: 1084  Total references : 2525016  Hit rate: 99.8482  Miss rate: 0.1518 | Hit count: 2521192  Miss count: 3824  Clean evictions: 2612  Dirty evictions: 1062  Total references : 2525016  Hit rate: 99.8486  Miss rate: 0.1514 | Hit count: 2521316  Miss count: 3700  Clean evictions: 2438  Dirty evictions: 1062  Total references : 2525016  Hit rate: 99.8535  Miss rate: 0.1465 |
| My\_trace\_generator | Hit count: 16197  Miss count: 203  Clean evictions: 46  Dirty evictions: 107  Total references : 16400  Hit rate: 98.7622  Miss rate: 1.2378 | Hit count: 16272  Miss count: 128  Clean evictions: 0  Dirty evictions: 28  Total references : 16400  Hit rate: 99.2195  Miss rate: 0.7805 | Hit count: 16274  Miss count: 126  Clean evictions: 0  Dirty evictions: 0  Total references : 16400  Hit rate: 99.2317  Miss rate: 0.7683 | Hit count: 16274  Miss count: 126  Clean evictions: 0  Dirty evictions: 0  Total references : 16400  Hit rate: 99.2317  Miss rate: 0.7683 |
| **CLOCK** | 50 | 100 | 150 | 200 |
| simpleloop | Hit count: 7761  Miss count: 2799  Clean evictions: 109  Dirty evictions: 2640  Total references : 10560  Hit rate: 73.4943  Miss rate: 26.5057 | Hit count: 7876  Miss count: 2684  Clean evictions: 2  Dirty evictions: 2582  Total references : 10560  Hit rate: 74.5833  Miss rate: 25.4167 | Hit count: 7879  Miss count: 2681  Clean evictions: 0  Dirty evictions: 2531  Total references : 10560  Hit rate: 74.6117  Miss rate: 25.3883 | Hit count: 7879  Miss count: 2681  Clean evictions: 0  Dirty evictions: 2481  Total references : 10560  Hit rate: 74.6117  Miss rate: 25.3883 |
| Matmul | Hit count: 1926905  Miss count: 1041239  Clean evictions: 1040084  Dirty evictions: 1105  Total references : 2968144  Hit rate: 64.9195  Miss rate: 35.0805 | Hit count: 1966416  Miss count: 1001728  Clean evictions: 1000549  Dirty evictions: 1079  Total references : 2968144  Hit rate: 66.2507  Miss rate: 33.7493 | Hit count: 2933568  Miss count: 34576  Clean evictions: 33348  Dirty evictions: 1078  Total references : 2968144  Hit rate: 98.8351  Miss rate: 1.1649 | Hit count: 2935260  Miss count: 32884  Clean evictions: 31607  Dirty evictions: 1077  Total references : 2968144  Hit rate: 98.8921  Miss rate: 1.1079 |
| Blocked | Hit count: 2519280  Miss count: 5736  Clean evictions: 3268  Dirty evictions: 2418  Total references : 2525016  Hit rate: 99.7728  Miss rate: 0.2272 | Hit count: 2520657  Miss count: 4359  Clean evictions: 2653  Dirty evictions: 1606  Total references : 2525016  Hit rate: 99.8274  Miss rate: 0.1726 | Hit count: 2521192  Miss count: 3824  Clean evictions: 2613  Dirty evictions: 1061  Total references : 2525016  Hit rate: 99.8486  Miss rate: 0.1514 | Hit count: 2521777  Miss count: 3239  Clean evictions: 1977  Dirty evictions: 1062  Total references : 2525016  Hit rate: 99.8717  Miss rate: 0.1283 |
| My\_trace\_generator | Hit count: 16196  Miss count: 204  Clean evictions: 45  Dirty evictions: 109  Total references : 16400  Hit rate: 98.7561  Miss rate: 1.2439 | Hit count: 16268  Miss count: 132  Clean evictions: 0  Dirty evictions: 32  Total references : 16400  Hit rate: 99.1951  Miss rate: 0.8049 | Hit count: 16274  Miss count: 126  Clean evictions: 0  Dirty evictions: 0  Total references : 16400  Hit rate: 99.2317  Miss rate: 0.7683 | Hit count: 16274  Miss count: 126  Clean evictions: 0  Dirty evictions: 0  Total references : 16400  Hit rate: 99.2317  Miss rate: 0.7683 |
| **OPT** | 50 | 100 | 150 | 200 |
| simpleloop | Hit count: 6275  Miss count: 4285  Clean evictions: 1607  Dirty evictions: 2628  Total references : 10560  Hit rate: 59.4223  Miss rate: 40.5777 | Hit count: 7777  Miss count: 2783  Clean evictions: 142  Dirty evictions: 2541  Total references : 10560  Hit rate: 73.6458  Miss rate: 26.3542 | Hit count: 7922  Miss count: 2638  Clean evictions: 0  Dirty evictions: 2488  Total references : 10560  Hit rate: 75.0189  Miss rate: 24.9811 | Hit count: 7922  Miss count: 2638  Clean evictions: 0  Dirty evictions: 2438  Total references : 10560  Hit rate: 75.0189  Miss rate: 24.9811 |
| Matmul | Hit count: 745933  Miss count: 2222211  Clean evictions: 1831727  Dirty evictions: 390434  Total references : 2968144  Hit rate: 25.1313  Miss rate: 74.8687 | Hit count: 1137560  Miss count: 1830584  Clean evictions: 1440150  Dirty evictions: 390334  Total references : 2968144  Hit rate: 38.3256  Miss rate: 61.6744 | Hit count: 1267688  Miss count: 1700456  Clean evictions: 1341429  Dirty evictions: 358877  Total references : 2968144  Hit rate: 42.7098  Miss rate: 57.2902 | Hit count: 1382829  Miss count: 1585315  Clean evictions: 1232636  Dirty evictions: 352479  Total references : 2968144  Hit rate: 46.5890  Miss rate: 53.4110 |
| Blocked | Hit count: 635098  Miss count: 1889918  Clean evictions: 1555278  Dirty evictions: 334590  Total references : 2525016  Hit rate: 25.1522  Miss rate: 74.8478 | Hit count: 971302  Miss count: 1553714  Clean evictions: 1219126  Dirty evictions: 334488  Total references : 2525016  Hit rate: 38.4672  Miss rate: 61.5328 | Hit count: 1147126  Miss count: 1377890  Clean evictions: 1084910  Dirty evictions: 292830  Total references : 2525016  Hit rate: 45.4304  Miss rate: 54.5696 | Hit count: 1242982  Miss count: 1282034  Clean evictions: 996942  Dirty evictions: 284892  Total references : 2525016  Hit rate: 49.2267  Miss rate: 50.7733 |
| My\_trace\_generator | Hit count: 10183  Miss count: 6217  Clean evictions: 5988  Dirty evictions: 179  Total references : 16400  Hit rate: 62.0915  Miss rate: 37.9085 | Hit count: 12620  Miss count: 3780  Clean evictions: 3577  Dirty evictions: 103  Total references : 16400  Hit rate: 76.9512  Miss rate: 23.0488 | Hit count: 16274  Miss count: 126  Clean evictions: 0  Dirty evictions: 0  Total references : 16400  Hit rate: 99.2317  Miss rate: 0.7683 | Hit count: 16274  Miss count: 126  Clean evictions: 0  Dirty evictions: 0  Total references : 16400  Hit rate: 99.2317  Miss rate: 0.7683 |

# A comparison of the various algorithms used:

**My OPT filr doesn’t work that great but it should so I will write this part as if OPT is the holy grail of paging algorithms as indicated in the textbook and class.**

OPT performs the best (most of the time) out of all other algorithms used because it just flat out cheats and knows what the system is going to reference next, refer to notes on Belady’s sequence to know why.

LRU and OPT (even more so) take longer than other algorithms to run, this is because of keeping track of data structures and doing more computations to update/reference them.

For some reasons (and on piazza this is the case with the results of others) the larger the trace file the better the hitrate. (Please go over this in class.)

When the memsize is increased (the size of the “cache”) the hitrate increases as well, this is due to having to swap files out less because we can just hold on to many more different pages all at once.

* This (like almost everything in the world) follows the law of diminishing returns, as the cache size becomes very large the hitrate starts to almost seem like it converges to 100 very slowly.
* This also implies that there will be less page evictions (regardless of whether they are dirty or not, depending on the algorithm e.g. rand doesn’t care)

# LRU and memsize correlation:

In general for cache’s as the memsize(aka cache size) increases the hit count will increase, this implies that the hit rate will increase. This is why the hitrate will almost always increase or at least stay the same as you increase the cache size. LRU will always try to remove pages that have not been used (i.e. dirty bit is not on). This is proved as the CLOCK algorithm being a good approximation for LRU (as seen in the textbook readings). As memsize increases LRU gets a bigger “window” to look back in time, more data implies a more sound hypothesis (I’m not going to include fancy statistics in this report). By having a bigger window to look back in time LRU can get a better idea of a page that isn’t really useful in the current task, therefore it is probably the best candidate for being evicted. A great piece of evidence for this is in the matmul trace. As soon as the memsize was increased from 100 to 150 the hitrate made almost a 33% raise!

LRU is great for evicting pages that are mostly improbably of being unused in the near future but it comes at a computation cost of either structure size of computation. You could use AVL trees to find the minimum quicker but this is trickier to implement and require more overhead. So an increase in cache size isn’t always the best way to increase computation speeds in such magnitudes as seen in the matmul trace file.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| LRU | 50 | 100 | 150 | 200 |
| simpleloop | Hit count: 7775  Miss count: 2785  Clean evictions: 94  Dirty evictions: 2641  Total references : 10560  Hit rate: 73.6269  Miss rate: 26.3731 | Hit count: 7877  Miss count: 2683  Clean evictions: 1  Dirty evictions: 2582  Total references : 10560  Hit rate: 74.5928  Miss rate: 25.4072 | Hit count: 7880  Miss count: 2680  Clean evictions: 0  Dirty evictions: 2530  Total references : 10560  Hit rate: 74.6212  Miss rate: 25.3788 | Hit count: 7880  Miss count: 2680  Clean evictions: 0  Dirty evictions: 2480  Total references : 10560  Hit rate: 74.6212  Miss rate: 25.3788 |
| Matmul | Hit count: 1926916  Miss count: 1041228  Clean evictions: 1040073  Dirty evictions: 1105  Total references : 2968144  Hit rate: 64.9199  Miss rate: 35.0801 | Hit count: 1961692  Miss count: 1006452  Clean evictions: 1005272  Dirty evictions: 1080  Total references : 2968144  Hit rate: 66.0915  Miss rate: 33.9085 | Hit count: 2935260  Miss count: 32884  Clean evictions: 31656  Dirty evictions: 1078  Total references : 2968144  Hit rate: 98.8921  Miss rate: 1.1079 | Hit count: 2935272  Miss count: 32872  Clean evictions: 31594  Dirty evictions: 1078  Total references : 2968144  Hit rate: 98.8925  Miss rate: 1.1075 |
| Blocked | Hit count: 2519783  Miss count: 5233  Clean evictions: 2802  Dirty evictions: 2381  Total references : 2525016  Hit rate: 99.7928  Miss rate: 0.2072 | Hit count: 2521184  Miss count: 3832  Clean evictions: 2648  Dirty evictions: 1084  Total references : 2525016  Hit rate: 99.8482  Miss rate: 0.1518 | Hit count: 2521192  Miss count: 3824  Clean evictions: 2612  Dirty evictions: 1062  Total references : 2525016  Hit rate: 99.8486  Miss rate: 0.1514 | Hit count: 2521316  Miss count: 3700  Clean evictions: 2438  Dirty evictions: 1062  Total references : 2525016  Hit rate: 99.8535  Miss rate: 0.1465 |
| My\_trace\_generator | Hit count: 16197  Miss count: 203  Clean evictions: 46  Dirty evictions: 107  Total references : 16400  Hit rate: 98.7622  Miss rate: 1.2378 | Hit count: 16272  Miss count: 128  Clean evictions: 0  Dirty evictions: 28  Total references : 16400  Hit rate: 99.2195  Miss rate: 0.7805 | Hit count: 16274  Miss count: 126  Clean evictions: 0  Dirty evictions: 0  Total references : 16400  Hit rate: 99.2317  Miss rate: 0.7683 | Hit count: 16274  Miss count: 126  Clean evictions: 0  Dirty evictions: 0  Total references : 16400  Hit rate: 99.2317  Miss rate: 0.7683 |