

COMP 304 Project 3: Virtual Memory Manager

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In this project, we have implemented a virtual memory manager that translates logical addresses to physical addresses. The program reads from a file containing logical addresses and translates to the physical address. At the end, it prints logical addresses, physical addresses, values, hit rates and page faults.

Part1)

In the first part, we assumed that our logical memory size and physical memory size are equal. We implemented TLB and page table into the given startup code. The replacement policy of TLB is FIFO. We have used 10 bits for page number and 10 bits for offset, 20 bits in total for addresses.

Part2)

In the second part, we have decreased page frames to 256 from 1024. Also we have implemented another replacement policy LRU which replaces the least frequently used page.

Part 1:

```
Virtual address: 916271 Physical address: 208640 Value: -53
Virtual address: 753029 Physical address: 99584 Value: 0
Virtual address: 677480 Physical address: 157696 Value: 0
Virtual address: 476995 Physical address: 213760 Value: -48
Virtual address: 415260 Physical address: 138240 Value: 0
Virtual address: 88876 Physical address: 207872 Value: 0
Virtual address: 589991 Physical address: 42752 Value: 41
Virtual address: 136203 Physical address: 2816 Value: 2
Virtual address: 81677 Physical address: 199936 Value: 0
Virtual address: 316760 Physical address: 88064 Value: 0
Virtual address: 203705 Physical address: 243968 Value: 0
Virtual address: 73847 Physical address: 30464 Value: 29
Virtual address: 723514 Physical address: 145920 Value: 28
Virtual address: 570463 Physical address: 24320 Value: 23
Virtual address: 462398 Physical address: 146944 Value: 28
Virtual address: 643337 Physical address: 67040 Value: 0
Virtual address: 260397 Physical address: 77056 Value: 0
Virtual address: 752292 Physical address: 173056 Value: 0
Virtual address: 584076 Physical address: 101376 Value: 0
Virtual address: 486173 Physical address: 204032 Value: 0
Virtual address: 49238 Physical address: 22016 Value: 28
Virtual address: 164309 Physical address: 120064 Value: 0
Virtual address: 575213 Physical address: 191744 Value: 0
Virtual address: 921457 Physical address: 225536 Value: 0
Virtual address: 98518 Physical address: 54784 Value: 28
Virtual address: 452120 Physical address: 137216 Value: 0
Virtual address: 825620 Physical address: 70656 Value: 0
Virtual address: 614356 Physical address: 250880 Value: 0
Virtual address: 998853 Physical address: 115968 Value: 0
Virtual address: 72230 Physical address: 140800 Value: 28
Virtual address: 625910 Physical address: 62976 Value: 28
Virtual address: 1003500 Physical address: 257024 Value: 0
Virtual address: 873601 Physical address: 33024 Value: 0
Virtual address: 516620 Physical address: 134144 Value: 0
Virtual address: 542687 Physical address: 253696 Value: -9
Virtual address: 120720 Physical address: 233472 Value: 0
Virtual address: 84183 Physical address: 55040 Value: 53
Virtual address: 579119 Physical address: 143184 Value: -117
Virtual address: 402096 Physical address: 176128 Value: 0
Virtual address: 453684 Physical address: 13312 Value: 0
Virtual address: 387498 Physical address: 109056 Value: 28
Virtual address: 30789 Physical address: 17664 Value: 0
Virtual address: 66531 Physical address: 254720 Value: -8
Virtual address: 928668 Physical address: 236544 Value: 0
Virtual address: 900457 Physical address: 92416 Value: 0
Virtual address: 796446 Physical address: 204288 Value: 28
Virtual address: 414541 Physical address: 216320 Value: 0
Virtual address: 65714 Physical address: 45568 Value: 28
Virtual address: 667527 Physical address: 231168 Value: -31
Virtual address: 347755 Physical address: 158464 Value: -102
Number of Translated Addresses = 1000
Page Faults = 421
Page Fault Rate = 0.421
TLB Hits = 164
TLB Hit Rate = 0.164
```

Part 2 with usage of FIFO:

```
Virtual address: 677480 Physical address: 157696 Value: 0
Virtual address: 476995 Physical address: 213760 Value: -48
Virtual address: 415260 Physical address: 138240 Value: 0
Virtual address: 88876 Physical address: 207872 Value: 0
Virtual address: 589991 Physical address: 42752 Value: 41
Virtual address: 136203 Physical address: 2816 Value: 2
Virtual address: 81677 Physical address: 199936 Value: 0
Virtual address: 316760 Physical address: 88064 Value: 0
Virtual address: 203705 Physical address: 243968 Value: 0
Virtual address: 73847 Physical address: 30464 Value: 29
Virtual address: 723514 Physical address: 145920 Value: 28
Virtual address: 570463 Physical address: 24320 Value: 23
Virtual address: 462398 Physical address: 146944 Value: 28
Virtual address: 643337 Physical address: 67040 Value: 0
Virtual address: 260397 Physical address: 77056 Value: 0
Virtual address: 752292 Physical address: 173056 Value: 0
Virtual address: 584076 Physical address: 101376 Value: 0
Virtual address: 486173 Physical address: 204032 Value: 0
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Virtual address: 575213 Physical address: 191744 Value: 0
Virtual address: 921457 Physical address: 225536 Value: 0
Virtual address: 98518 Physical address: 54784 Value: 28
Virtual address: 452120 Physical address: 137216 Value: 0
Virtual address: 825620 Physical address: 70656 Value: 0
Virtual address: 614356 Physical address: 250880 Value: 0
Virtual address: 998853 Physical address: 115968 Value: 0
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Virtual address: 625910 Physical address: 62976 Value: 28
Virtual address: 1003500 Physical address: 257024 Value: 0
Virtual address: 873601 Physical address: 33024 Value: 0
Virtual address: 516620 Physical address: 134144 Value: 0
Virtual address: 542687 Physical address: 253696 Value: -9
Virtual address: 120720 Physical address: 233472 Value: 0
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Virtual address: 579119 Physical address: 143184 Value: -117
Virtual address: 402096 Physical address: 176128 Value: 0
Virtual address: 453684 Physical address: 13312 Value: 0
Virtual address: 387498 Physical address: 109056 Value: 28
Virtual address: 30789 Physical address: 17664 Value: 0
Virtual address: 66531 Physical address: 254720 Value: -8
Virtual address: 928668 Physical address: 236544 Value: 0
Virtual address: 900457 Physical address: 92416 Value: 0
Virtual address: 796446 Physical address: 204288 Value: 28
Virtual address: 414541 Physical address: 216320 Value: 0
Virtual address: 65714 Physical address: 45568 Value: 28
Virtual address: 667527 Physical address: 231168 Value: -31
Virtual address: 347755 Physical address: 158464 Value: -102
Number of Translated Addresses = 1000
Page Faults = 422
Page Fault Rate = 0.422
TLB Hits = 156
TLB Hit Rate = 0.156
```

Part 2 with usage of LRU:

```
Virtual address: 677480 Physical address: 157696 Value: 0
Virtual address: 476995 Physical address: 213760 Value: -48
Virtual address: 415260 Physical address: 138240 Value: 0
Virtual address: 88876 Physical address: 207872 Value: 0
Virtual address: 589991 Physical address: 42752 Value: 41
Virtual address: 136203 Physical address: 2816 Value: 2
Virtual address: 81677 Physical address: 199936 Value: 0
Virtual address: 316760 Physical address: 88064 Value: 0
Virtual address: 203705 Physical address: 243968 Value: 0
Virtual address: 73847 Physical address: 30464 Value: 29
Virtual address: 723514 Physical address: 145920 Value: 28
Virtual address: 570463 Physical address: 24320 Value: 23
Virtual address: 462398 Physical address: 146944 Value: 28
Virtual address: 643337 Physical address: 67840 Value: 0
Virtual address: 260397 Physical address: 77056 Value: 0
Virtual address: 752292 Physical address: 173056 Value: 0
Virtual address: 584076 Physical address: 101376 Value: 0
Virtual address: 486173 Physical address: 204032 Value: 0
Virtual address: 49238 Physical address: 22016 Value: 28
Virtual address: 164309 Physical address: 120064 Value: 0
Virtual address: 575213 Physical address: 191744 Value: 0
Virtual address: 921457 Physical address: 225536 Value: 0
Virtual address: 98518 Physical address: 54784 Value: 28
Virtual address: 452120 Physical address: 137216 Value: 0
Virtual address: 825620 Physical address: 70656 Value: 0
Virtual address: 614356 Physical address: 250880 Value: 0
Virtual address: 998853 Physical address: 115968 Value: 0
Virtual address: 72230 Physical address: 140800 Value: 28
Virtual address: 625910 Physical address: 62976 Value: 28
Virtual address: 1003500 Physical address: 257024 Value: 0
Virtual address: 873601 Physical address: 33024 Value: 0
Virtual address: 516620 Physical address: 134144 Value: 0
Virtual address: 542687 Physical address: 253696 Value: -9
Virtual address: 120720 Physical address: 233472 Value: 0
Virtual address: 84183 Physical address: 55040 Value: 53
Virtual address: 579119 Physical address: 143104 Value: -117
Virtual address: 402096 Physical address: 176128 Value: 0
Virtual address: 453684 Physical address: 13312 Value: 0
Virtual address: 387498 Physical address: 109056 Value: 28
Virtual address: 30789 Physical address: 17664 Value: 0
Virtual address: 66531 Physical address: 254720 Value: -8
Virtual address: 928668 Physical address: 236544 Value: 0
Virtual address: 900457 Physical address: 92416 Value: 0
Virtual address: 796446 Physical address: 204288 Value: 28
Virtual address: 414541 Physical address: 216320 Value: 0
Virtual address: 65714 Physical address: 45568 Value: 28
Virtual address: 667527 Physical address: 231168 Value: -31
Virtual address: 347755 Physical address: 158464 Value: -102
Number of Translated Addresses = 1000
Page Faults = 422
Page Fault Rate = 0.422
TLB Hits = 157
TLB Hit Rate = 0.157
```