

Assignment8

Please write your student number and name in the assignment when submit it.

1. Consider the following page reference string:

7, 2, 3, 1, 2, 5, 3, 4, 6, 7, 7, 1, 0, 5, 4, 6, 2, 3, 0, 1.

Assuming demand paging with *three* frames, how many page faults would occur for the following replacement algorithms? Assuming demand paging with *four* frames, how many page faults would occur for the following replacement algorithms? Note: all frames are initially empty.

- LRU replacement
- FIFO replacement
- Optimal replacement

2. The following page table is for a system with 16-bit virtual and physical addresses and with 4,096-byte pages. The reference bit is set to 1 when the page has been referenced. A dash for a page frame indicates the page is not in memory. All numbers are provided in decimal.

Page	Page Frame	Reference Bit
0	9	0
1	1	0
2	14	0
3	10	0
4	–	0
5	13	0
6	8	0
7	15	0
8	–	0
9	0	0
10	5	0
11	4	0
12	–	0
13	–	0
14	3	0
15	2	0

Convert the following virtual addresses (in hexadecimal) to the equivalent physical addresses. You may provide answers in either hexadecimal or decimal.

- 0xE12C
- 0x3A9D
- 0xA9D9
- 0x7001
- 0xACA1

3. Assume we have a demand-paged memory. The page table is held in registers. It takes

8 milliseconds to service a page fault if an empty page is available or the replaced page is not modified, and 20 milliseconds if the replaced page is modified. Memory access time is 100 nanoseconds.

Assume that the page to be replaced is modified 70 percent of the time. What is the maximum acceptable page-fault rate for an effective access time of no more than 200 nanoseconds?

4. A page-replacement algorithm should minimize the number of page faults. We can achieve this minimization by distributing heavily used pages evenly over all of memory, rather than having them compete for a small number of page frames. We can associate with each page frame a counter of the number of pages associated with that frame. Then, to replace a page, we can search for the page frame with the smallest counter.

a. Define a page-replacement algorithm using this basic idea. Specifically address these problems:

- i. What the initial value of the counters is
- ii. When counters are increased
- iii. When counters are decreased
- iv. How the page to be replaced is selected

b. How many page faults occur for your algorithm for the following reference string, for four page frames?

1, 2, 3, 4, 5, 3, 4, 1, 6, 7, 8, 7, 8, 9, 7, 8, 9, 5, 4, 5, 4, 2.

c. What is the minimum number of page faults for an optimal page replacement strategy for the reference string in part b with four page frames?