课堂测试题目（内存管理）

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Contiguous Allocation

- Given five memory partitions of 100 KB, 500 KB, 200 KB, 300 KB, and 600 KB (in order), how would each of the first-fit, best-fit, and worst-fit algorithms place processes of 212 KB, 417 KB, 112 KB, and 426 KB (in order)? Which algorithm makes the most efficient use of memory?

Sol:

由上图知，best-fit算法的内存利用率最高。

Consider a paging system with the page table stored in memory.

a. If a memory reference takes 200 nanoseconds, how long does a paged memory reference take?

b. If we add associative registers, and 75 percent of all page-table references are found in the associative registers, what is the effective memory reference time? (Assume that finding a page-table entry in the associative registers takes zero time, if the entry is there.)

Sol:

a. 400ns: 访问位于内存的页表需要200ns, 访问内存中的数据需要200ns

b. 0.75 * 200 + 0.25 * 400 = 250ns

A system have a demand-page storage management schemes, 20-bits logic address, the low-order 11 bits of a logical address for the page address, and the high-order 9 bits of a logical address for the page number. The logical page 0,1,2,3 of a four-page manager were loaded in frame 4,7,5,8 (as the following table shows) .

Page number	0	1	2	3
Frame number	4	7	5	8

(1) The size of virtual address space?

(2) The size of the page?

(3) Logical address is 5000 (decimal), what's the corresponding physical address (decimal)?

Sol:

（1）虚拟地址空间是2^{20} = 1MB；

（2）系统的页面大小为2^{11} = 2KB；

（3）逻辑地址5000 分解成页号 P 和页内偏移量 W 为：P=2，W=904，所以对应的物理地址为5 × 2KB + 904 = 11144。

- Consider the following page reference string:

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

How many page faults would occur for the following replacement algorithms, assuming two or three frames? All frames are initially empty.

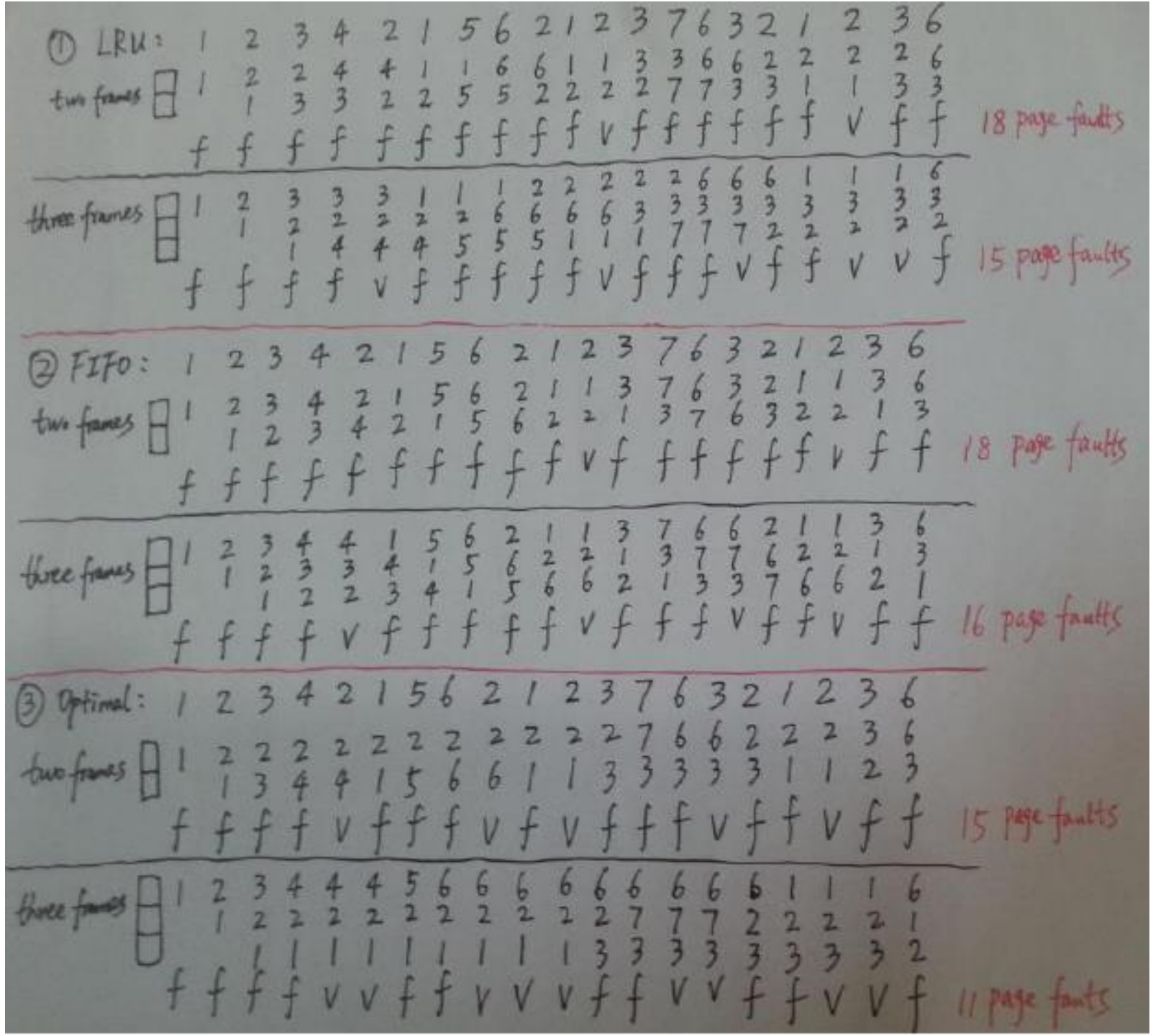
（1）LRU replacement

（2）FIFO replacement

（3）Optimal replacement

Sol:

Number of frames	LRU	FIFO	Optimal
2	18	18	15
3	15	16	11


① LRU:
1 2 3 4 2 1 5 6 2 1 2 3 7 6 3 2 1 2 3 6
two frames
f f f f f f f f f f v f f f f f f v f f
18 page faults
three frames
f f f f v f f f f f v f f f v f f v v f
15 page faults
② FIFO:
1 2 3 4 2 1 5 6 2 1 2 3 7 6 3 2 1 2 3 6
two frames
f f f f f f f f f f v f f f f f f v f f
18 page faults
three frames
f f f f v f f f f f v f f f v f f v f f
16 page faults
③ Optimal:
1 2 3 4 2 1 5 6 2 1 2 3 7 6 3 2 1 2 3 6
two frames
f f f f v f f f v f v f f f v f f v f f
15 page faults
three frames
f f f f v v f f v v v f f v v f f v v f
11 page faults

Consider a system that uses page-based memory mapping, and one-level page table. Now the access address sequence of a process is: 11, 104, 73, 309, 185, 245, 458, 364, the page size is 100 bytes and this process memory space size is 300 bytes.

Please give the **page reference string** of this address sequence, and use the FIFO scheduling algorithm and LRU scheduling algorithm, to calculate how many page faults occur for the algorithms. Write down the number of page faults, and calculate their page fault rate.

Sol:

页面的走向是：0、1、0、3、1、2、4、3。

FIFO 共产生5 次缺页，依次是0、1、3、2、4，缺页中断率是：

（5÷8）× 100% = 62.5%

LRU共产生6 次缺页，依次是0、1、3、2、4、3，缺页中断率是：

（6÷8）× 100% = 75%