Bài tập1 virtual memory

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1. A computer with a 32-bit address uses a two-level page table. Virtual addresses are split into a 9-bit top-level page table field, an 11-bit second-level page table field, and an offset. How large are the pages and how many are there in the address space?

top-level	second-level	offset
9	11	

Tổng = 32

Offset = 32 – 11 – 9 = 12 bits

Page size = 2^12 B = 4 KB

Total number of pages possible = 2^9 x 2^11 = 2^20

Kích thước trang = 2^n (n số offset)

Số trang tối đa = 2 ^ số page number

2. For each of the following decimal virtual addresses, compute the virtual page number and offset for a 4-KB page and for an 8 KB page: 20000, 32768, 60000.

4 KB = 4096 B

=20000 CHIA LẤY NGUYÊN cho 4096 ***= 20000 CHIA LẤY DƯ cho 4096***

	Page number	Offset
20000	4	3616
32768	8	0
60000	14	2656

Mấy cái sau tính tương tự

3. A machine has 48-bit virtual addresses and 32-bit physical addresses. Pages are 8 KB. How many entries are needed for the page table?

Pages are 8 KB = 2^13 B *(1KB = 2^10B)*

Number of entries for page table: $\frac{2^{48}}{2^{13}} = 2^{35}$

Number of entries for inverted page table: $\frac{2^{32}}{2^{13}} = 2^{19}$

entries for PAGE TABLE = total VIRTUAL memory size / size of single page

entries for INVERTED PAGE TABLE = total PHYSICAL memory size / size of single page

Size of page table = số entries của PAGE TABLE x kích thước mỗi entry

4. If FIFO page replacement is used with four-page frames and eight pages, how many page faults will occur with the reference string 0172327103 if the four frames are initially empty? Now repeat this problem for LRU.

FIFO: 6 page faults **(lỗi trang => trang chưa đc nạp lên => chỉ thay ở những cái mới chưa có trong cột)**

0	0	0	0	**3**	3	3	3	3	3
	1	1	1	1	1	1	1	**0**	0
		7	7	7	7	7	7	7	7
			2	2	2	2	2	2	2
*	*	*	*	*				*	

LRU: 7 page faults

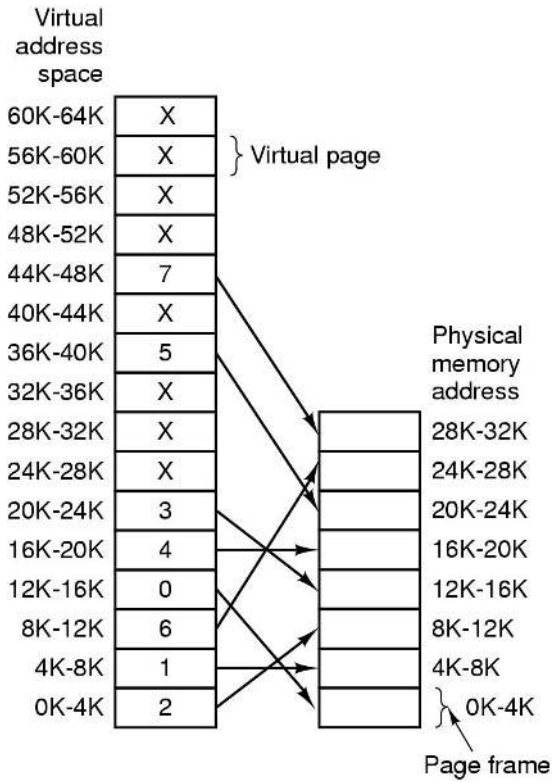
0	0	0	0	**3**	3	3	3	**0**	0
	1	1	1	1	1	1	1	1	1
		7	7	7	7	7	7	7	7
			2	2	2	2	2	2	**3**
*	*	*	*	*				*	*

Consider a system in which the memory has the following hole sizes in the following memory order:
1KB, 4 KB, 15 KB, 20 KB, 4 KB, 7 KB, 18 KB, 12 KB, 15 KB, 9 KB

You are given successive requests for program segments in the following order:
10 KB, 5 KB, 3 KB, 2 KB, 19 KB, 9 KB, 24 KB, 10 KB.

For each of the following algorithms, show how the holes get filled for each of the above requests. If a particular request cannot be satisfied, you can skip it (but do mention which ones cannot be satisfied):

10 KB: 1, 4, 5, 20, 4, 7, 18, 12, 15, 9 5 KB: 1, 4, 20, 4, 7, 18, 12, 15, 9 3 KB: 1, 1, 20, 4, 7, 18, 12, 15, 9 2 KB: 1, 1, 18, 4, 7, 18, 12, 15, 9 19 KB: Can't fit 9 KB: 1, 1, 9, 4, 7, 18, 12, 15, 9 24 KB: Can't fit 10 KB: 1, 1, 9, 4, 7, 8, 12, 15, 9	10 KB: 1, 4, 15, 20, 4, 7, 18, 2, 15, 9 5 KB: 1, 4, 15, 20, 4, 2, 18, 2, 15, 9 3 KB: 1, 1, 15, 20, 4, 2, 18, 2, 15, 9 2 KB: 1, 1, 15, 20, 4, 18, 2, 15, 9 19 KB: 1, 1, 15, 1, 4, 18, 2, 15, 9 9 KB: 1, 1, 15, 1, 4, 18, 2, 15 24 KB: Can't fit 10 KB: 1, 1, 5, 1, 4, 18, 2, 15	10 KB: 1, 4, 15, 10, 4, 7, 18, 12, 15, 9 5 KB: 1, 4, 15, 10, 4, 7, 13, 12, 15, 9 3 KB: 1, 4, 12, 10, 4, 7, 13, 12, 15, 9 2 KB: 1, 4, 12, 10, 4, 7, 13, 12, 13, 9 19 KB: Can't fit 9 KB: 1, 4, 12, 10, 4, 7, 4, 12, 13, 9 24 KB: Can't fit 10 KB: 1, 4, 12, 10, 4, 7, 4, 12, 3, 9
First fit	Best fit	Worst fit



Consider the page table of the figure. Give the physical address corresponding to each of the following virtual addresses:

(a) 29: Physical address: 8K + 29 = 8221
(b) 4100: Physical address: 4K + (4100 – 4K) = 4100
(c) 8300: Physical address: 24K + (8300 – 8K) =24

Consider a machine such as the DEC Alpha 21064 which has 64 bit registers and manipulates 64-bit addresses. If the page size is 8KB, how many bits of virtual page number are there? If the page table used for translation from virtual to physical addresses were 8 bytes per entry, how much memory is required for the page table and is this amount of memory feasible?

Page size = 8 KB = 2^13 B Offset = 13 bits
Bits for virtual page number = (64 – 13) = 51
# of page table entries = 2^51
=> Size of page table = 2^51 * 8 B =2^54 B = 2^2

Virtual Address (bits)	Page Size	# of Page Frames	# of Virtual Pages	Offset Length (bits)	Addressable Physical Memory
16	256 B = 2^8	2^2	2^8	8	2^10 = 1 KB
32	1 MB = 2^20	2^4	2^12	20	2^24 = 16 MB
32	1 KB = 2^10	2^8	2^22	10	2^18 = 256 KB
64	16 KB = 2^14	2^20	2^50	14	2^34 = 16 GB
64	8 MB = 2^23	2^16	2^41	23	2^39 = 512 GB