中山大学软件学院 **2008** 级软件工程专业（2009 春季学期）

《操作系统》期末考试试卷（A）

(考试形式：闭　卷　　考试时间：2 小时)

警示

《中山大学授予学士学位工作细则》第六条

考试作弊不授予学士学位

方向：_____　　姓名：_____　　学号：_____

一、Explain following terms (Please select and answer ONE of the following two groups, 15 pts）

1. Virtual Machine, Dead Lock, Critical, Internal Fragmentation,

   FCB (File Control Block)

2. Caching, Race condition, Busy waiting, Working sets, Inode

二、Short Answer（Please select and answer FIVE of the following questions，25pts）

1. Why should we distinguish between kernel mode and user mode? When the CPU is running operating system code, which mode is the processor in?
2. What problems do caches cause in the computer systems?
3. How is the control of CPU transferred in a system call, and what's the difference between system call and general procedure call?
4. Please describe the five states of process and the possible conversion between them.
5. How the MMU with a base register and a limit register translate a logical address into a physical address and protect the operating system from user processes?
6. Please describe the difference among short-term, medium-term, and long-term scheduling.
7. What actions are taken by the operating systems when a page fault occurs?
8. What are the benefits to users by manipulating external devices as files?
9. Why open operation must be done before a file is read or written in a user process?
10. Please describe the thrashing, and explain the cause of thrashing

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三、There is a system with 150 storage units. The storage units were allocated to P1 ~ P3 as the

following table at T0. Show how the Banker's Algorithm works to decide whether the system is in a safe state or in an unsafe state.

(1)The 4th process P_4 arrived , maximum needs is 60 storage units, current allocation is 25 units. **(5 pts)**

(2)The 4th process P_4 arrived , maximum needs is 60 storage units, current allocation is 35 units. **(5 pts)**

If the system is in a safe state, please give a possible safe sequence; Otherwise, please explain.

Process	Max	Allocation
P_1	70	25
P_2	60	40
P_3	60	45

四、Consider a file in a UNIX file system. There are 15 pointers of disk blocks in a file's inode. The first 12 of these pointers are the direct block pointers, and the next 3 pointers point to the indirect blocks (a single indirect block, a double indirect block and a triple indirect block). Each indirect block contain 256 block number at most. Consider a file currently consisting of 10000 data blocks, and the inode of the file is already in memory.

(1) How many blocks does **the largest files** in this file system occupy under this method (the block of the inode of the file is excluded)? **(5 pts)**

(2) How many blocks does this file occupies (the block of the inode of the file is excluded)? **(5 pts)**

(3) How many blocks are read from the disk by the file system for a user's request to read the block at the end of the file?**(5 pts)**

五、**Please select and answer ONE of the following two questions，15 pts**

1、Supposed a computer system supports a 32-bits logical address and the CPU has a MMU with three-level hierarchical paging hardware, and an operating system with paging divided logical address space into pages of page size of 4 KB and use an outer page table of 1024 entries.

(1)How many pages at most are there in the page table of a process? **(5 pts)**

(2)Which and how many bits of the logical address are used for the index of the outer page table? **(5 pts)**

(3)If a logical address is 0001 0001 0011 0011 0011 0010 0010 0010, then the MMU use which entries in the outer page table to map this logical address to the corresponding physical address? **(5 pts)**

2、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 block 4,7,5,8 (as the following shows) .

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

(1)The size of virtual address space? **(3 pts)**

(2)The size of the page? **(5 pts)**

(3)Logical address is 5000(decimal), what's the corresponding physical address?**(7 pts)**

六、**Please select and answer ONE of the following two questions，20 pts**

1、**The k-Readers-Writers Problem.** A file is to be shared among several concurrent processes. Some of these processes(i.e. the Readers) may want only read the content of the shared file, whereas others (i.e. the Writers) may want to update the shared file. The file can be read simultaneously by **at most *k* processes** when no other process is updating it, and only one process can update at one time when no Readers are reading at this time.

(1) Please write a program to coordinate the Readers and the Writers to avoid race condition happening in these concurrent processes. **(10 pts)**

(2) Explain why readers or writers may be starved in your solution. **(5 pts)**

(3) Please write a new solution, such that if a writer is waiting to write, no new readers can start reading. **(5 pts)**

2、Consider a system that uses page-based memory mapping, and one-level page table. Assume that the page table always in main memory.

(1) To improve effective access time, we use MMU which will cost 20ns whether hit or not. Assume that per memory access takes 200 ns, 85% of the accesses are in the TLB of MMU, what is the effective memory access time? **(5 pts)**

(2) Now the access address sequence of a process is: 10, 11, 104, 170, 73, 309, 185, 245, 246, 434, 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 **(3 pts)**, and use the **FIFO** scheduling algorithm respectively, and **LRU** scheduling algorithm, to calculate how many page faults occur for the algorithms. Write down the number of eliminative page after page fault, and calculate their page fault rate (The first reference causes a page fault to the operating system, you need to write down the **computational procedure**) **(12 pts).**