

《操作系统》期末考试试题 (A)

考 试 注 意 事 项	一、学生参加考试须带学生证或学院证明，未带者不准进入考场。学生必须按照监考教师指定座位就坐。 二、书本、参考资料、书包等物品一律放到考场指定位置。 三、学生不得另行携带、使用稿纸，要遵守《北京邮电大学考场规则》，有考场违纪或作弊行为者，按相应规定严肃处理。 四、学生必须将答题内容做在试题答卷上，做在草稿纸上一律无效。 五、学生的姓名、班级、学号、班内序号等信息由教材中心统一印制。 六、第 1 题须用英文应答，中文答对得一半分。								
	考试 课程	操作系统		考试时间		2010 年 1 月 12 日			
	题号	一	二	三	四	五	六	七	八
	满分	10	10	20	10	20	15	15	
	得分								
	阅卷 教师								

1. FILL IN BLANKS (10 points)

1.5. A memory-mapped file is a file whose storage space (i.e., disk block) is mapped into/associated with a part of process's virtual address space/virtual memory, and we can treat file I/O as routine memory access.

1.6. The disk free-space list is implemented as a bitmap. If the size of the free space is 1280 blocks, and each block is of 512 bytes, then C bytes are needed to store the bitmap.

A. 128

C. 512

D. 8192

1.8 The file system consists of two distinct parts: a collection of files and a directory structure (or directory), which organizes and provides information about all files in the system.

1.9 The file system itself is generally composed of many different levels, including the logical file system, the file-organization module, the physical file system, and the I/O control.

2. CHOICE ( 10 points )

2.1 Here are some statements about memory management,

i) With respect to dynamic address relocation, logical addresses and physical addresses are the same in compile-time and execution time address-binding schemes

ii) Virtual memory management is designed according to the locality feature of programs. T

iii) The scheme of fixed-sized partitions may introduce internal and external fragmentation, while segmentation may only result in external fragmentation,

but may introduce internal fragmentation F

iv) A process is in thrashing if it is spending more time paging than executing; or if the frames allocated to the process is not enough, the page in the process may be replaced that will be needed again right away,

固定分区 无外部碎片仅有内部  
碎片

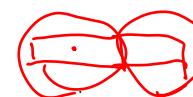
段式：外部碎片..

so the process is busy in swapping pages in and out.

, the incorrect descriptions are C:

- A. i), ii)
- B. ii), iv)
- C. i), iii)
- D. iii), iv)

一级间接寻址可使用



2.2 Consider a machine in which all memory-reference instructions have two memory address, and one-level indirect addressing is allowed, if an instruction is assumed to be stored in only one frame, then the minimum number of frames per process is B.

- A. two
- B. three
- C. four
- D. five

直接一块，最多可有n块，间接寻址。

2.3 With respect to the following page replacement algorithms, which one has the lowest page-fault rate?

- A. FIFO page replacement
- B. LRU approximation page replacement
- C. LRU page replacement
- D. optimal page replacement

2.4 某计算机采用 two-level paging 的分页存储管理方式，按字节编制，页大小为  $2^{10}$  bytes，页表项大小为 2 字节，逻辑地址结构为

页目编号/outer page	页号/inner page	页内偏移量/offset
-----------------	---------------	--------------

逻辑地址空间大小为  $2^{10}$  pages，则表示整个逻辑地址空间的页目录表中包含表项的个数至少是 (B)

A: 64

B: 128

C: 256

D: 512

页  $2^{10}$  bytes

页表项 2 byte

$$2^{10}/2 = 2^9 \text{ 个目录项}$$

每一页  $2^9$  个目录项

整本书  $2^{10}$  页，对应  $2^{10}$  个目录项

需要  $2^{10}$  存储目录项

2.5 下列命令组合情况，一次访存过程中，不可能发生的是 (D)

- A. TLB 未命中，Cache 未命中，Page 未命中
- B. TLB 未命中，Cache 命中，Page 命中
- C. TLB 命中，Cache 未命中，Page 命中
- D. TLB 命中，Cache 命中，Page 未命中

D

2.4 Which allocation scheme works best for the file system implemented on the device that can only be accessed sequentially, such as the tape drive? A

- A Contiguous allocation      B linked allocation  
C index allocation      D none of them

连续分配 适合块可顺序访问的 磁带

system uses 512-byte physical blocks. Each file has a directory entry giving the file name, the location of the first block, the length of file and the last block position. Assuming that:

- 1) the last physical block read is 200
- 2) block 200 and the directory entry are already in main memory

For the linked allocation algorithm, how many physical blocks must be read to access the specific block 400 (including the reading of block 400 itself)?

- A. 1      C. 400      B. 600

### 3 ESSAY QUESTIONS (20 points)

请苏烦

$$100 \times 10^{-6} \times 0.97 + 0.03 \times (0.5 \times 8 + 0.5 \times 20)$$

- 3.1 In a demand-paging system, it takes  $100 \times 10^{-6}$  ms to satisfy a memory request if the page is in memory. If the page is not in memory, the request takes 8ms if a free frame is available or the page to be swapped out has not been modified, and it takes 20 ms if the page to be swapped out has been modified.

What is the effective access time if the page fault rate is 3%, and 50% of the time the page to be replaced has been modified?

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

1) If a memory reference takes 400 time unit, how long does it take to access an instruction or data in a page that has been paged into memory? 先查页表再找数据 800

2) If we add TLB (translation look-aside buffers), and 70 percent of all page-table entries can be found in the TLB, what is the effective memory access time?

Assuming that page-table entry in the associative registers takes 30 time unit, if the entry is there)

Answers

a.  $400 \times 2 = 800$

b.  $0.7 \times (400 + 30) + 0.3 \times (30 + 400 + 400)$

$0.7 \times (400 + 30) + 0.3 \times (30 + 400 + 400)$

- 3.2 Consider a system in which a directory can store up to 64 disk block addresses.

For the file no larger than 64 blocks, these 64 addresses serve as the file's index table. For the file larger than 64 blocks, the addresses point to indirect blocks which in turn point to 1024 file blocks each. A block is of 2048 bytes.

What's the largest size of a file in the system?

Answers:

$64 \times 1024 \times 2048$

$64 \times 1024 \times 2048$  B

没问题，是对的 ✓

- 3.2 设文件的索引节点中有 16 个地址项，其中 8 个地址项为直接地址索引，4 个地址项是一级间接地址索引，4 个地址项是二级间接地址索引。每个地址项大小为 4 字节，可指向磁盘数据块或存储下一级地址的磁盘索引块。

若磁盘索引块和磁盘数据块大小均为 1024 字节，则可表示的单个文件的最大长度是多少？

要求写出计算过程。

每个地址项 4 字节

每个索引块 1024 字节

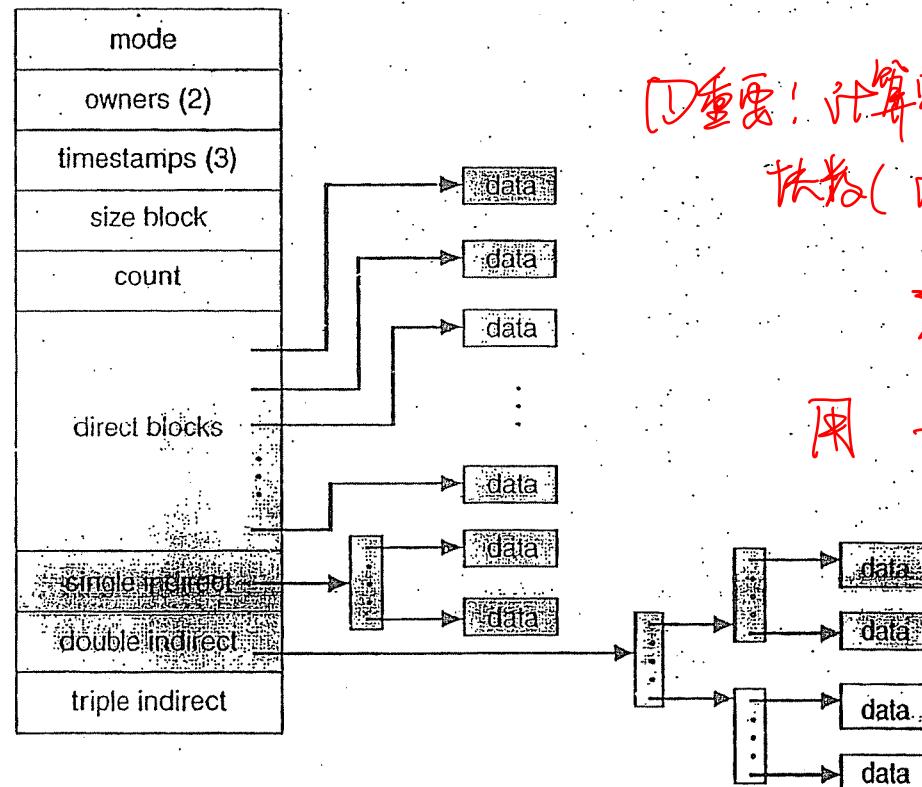
其中有 1024/4

= 256 个地址

$(8 + 4 \times 256 + 4 \times 256 \times 256) \times 1024$

[重要！计算索引块可索引到的块数（计算每块引中的地址数）]

索引块大小、地址大小、



段页式

4. (14 points) Consider segmentation with paging system with  $2^{36}$  bytes of physical memory. The logical address space consists of up to 16 segments. Each segment can be up to  $2^{12}$  pages, and page size of 1024 bytes,

逻辑地址空间  $2^{10}$  页，需要 2<sup>10</sup> 个页表项，即 1024 项。

- (1) how many bits in the logical address space specify the segment number? 4
- (2) how many bits in the logical address specify the page number? 12
- (3) how many bits in the logical address specify the offset within the page? 10
- (4) what is the size of a frame? 1024 Bytes
- (5) how many bits in the physical address specify the frame number? 26
- (6) how many bits in the physical address specify the frame offset? 10
- (7) how many entries are in the page table (how long is the page table)?

$$2^{36} / 2^{10} = 2^{26}$$

页表

5. In a demand-paging system, 逻辑地址空间和物理地址空间均为 512KB，并按字节编址，页的大小为 2KB。若某进程的逻辑地址空间为 6 Page。OS 采用固定分配局部置换策略为此进程分配 5 个 Frame，如下所示：

Page number	Frame number	Loading time	Valid bit
0	6	150	1
1	4	260	1
2	3	220	1
3	10	190	1
4	7	245	1

当该进程执行到时刻 260 时，要访问逻辑地址为 32AB H(16 进制, hexadecimal)的数据，请回答下列问题：

- (1) 该逻辑地址对应的页号是多少？
- (2) 若采用 FIFO 置换算法，该逻辑地址对应的物理地址是多少？要求给出计算过程。
- (3) 若采用 LRU 置换算法，该逻辑地址对应的物理地址是多少？要求给出计算过程。

每个段 2<sup>12</sup> 页

每个页表指向一个页表 2<sup>12</sup> 页

每个分段一张页表，页表中 2<sup>12</sup> 个目录

若给出页面大小和页表项大小，  
即可计算每页可放目录条目

步

解答：32AB (H) = 0011 0010 1010 1011 (2 进制, binary)

- (1) 页大小为 2K，所以页内偏移地址为 11 位，于是前 5 位是页号，所以该逻辑地址对应的页号为 6

2<sup>36</sup> 比特

反面图：1024+0 4+0

16 页

每段 2<sup>12</sup> 页

北京邮电大学 2009—2010 学年第一学期

《操作系统》期末考试试题 (A)

考试注意事项	一、学生参加考试须带学生证或学院证明，未带者不准进入考场。学生必须按照监考教师指定座位就坐。 二、书本、参考资料、书包等物品一律放到考场指定位置。 三、学生不得另行携带、使用稿纸。要遵守《北京邮电大学考场规则》，有考场违纪或作弊行为者，按相应规定严肃处理。 四、学生必须将答题内容做在试题答卷上，做在草稿纸上一律无效。 五、学生的姓名、班级、学号、班内序号等信息由教材中心统一印制。 六、第 1 题须用英文应答，中文答对得一半分。									
考试课程	操作系统			考试时间		2010 年 1 月 12 日				
题号	一	二	三	四	五	六	七	八	九	总分
满分	10	10	20	6	5	9	10	14	16	
得分										
阅卷教师										

1. FILL IN BLANKS (10 points)

1.1 When a computer is powered on, the procedure of starting the computer by loading the OS kernel is known as boot the system.

1.2 Each process is represented in the operating system by a \_\_\_\_\_.

1.3 A software-generated interrupt caused either by an error or by specific requests from user programs that an operating-system service be performed is called a \_\_\_\_\_.

1.4 Switching the CPU to another process requires performing a state save of the

current process and a state restore of a different process. This task is known as \_\_\_\_\_.

1.5 The interval from the time of submission of a process to the time of its completion is called the \_\_\_\_\_ time.

1.6 For  $n$  concurrent processes that mutually exclusively use some resources, the code segmentations; in which the processes access the resources, are called \_\_\_\_\_.

1.7 Address binding of instructions and data to memory addresses can happen at three different stages, that is, compile time, load time, and \_\_\_\_\_.

1.8 The file system is generally composed of many different levels, including the logical file system, the \_\_\_\_\_, the physical file system, and the I/O control.

1.9 A deadlock situation can arise if the following four conditions hold simultaneously in a system: Mutual exclusion, Hold and wait, No preemption and \_\_\_\_\_.

1.10 A \_\_\_\_\_ controller can bypass the CPU to transfer data directly between I/O device and memory.

2. CHOICE (10 points)

2.1 Which operating system allows interaction between users and processes? C

A. Batch mode OS

B. Multi-programming batch OS

C. Time-shared OS

用户和进程之间交互

2 分时系统

D. None of the above

A.  $n, -m + n$       B.  $m, -n + m$       C.  $m, -n$       D.  $n, -m$

2.2 When a child process is created by its parent process, which of the following is possible in terms of the execution or address space of the child process? D

- A The child process runs concurrently with the parent
- B The child process has a new program loaded into it
- C The child process is a duplicate of the parent
- D All of the above 复制

above all

2.3 A process is the unit of work in a system, and is defined as D.

- A a program
- B a job
- C a program code
- D a program in execution

进程 书上的定义

2.4 Which storage device has the fastest access speed? D

- A magnetic disk
- B cache
- C main memory
- D register

最快、寄存器

2.5 Which one of the following scheduling algorithms is not fit the long-term scheduling? C

- A FCFS
- B SJF
- C RR
- D Priority

2.6 There are  $n$  processes concurrently executing in the system with  $m$  instances of resource A ( $n > m > 0$ ), and these processes should mutual exclusively use these instances.

互斥

A semaphore S is designed to synchronize these processes. The value of S can be changed from \_\_\_\_\_ (maximum) to B (minimum).

最大到等待

3

2.7 Here are some statements about memory management,

i) With respect to dynamic address relocation, logical addresses and physical addresses are the same in compile-time and load-time address-binding schemes

ii) Virtual memory can be implemented via segmentation 分段.

iii) Paging does not result in external fragmentation, but may introduce internal fragmentation

iv) Virtual memory management is designed according to the locality feature of programs

The correct descriptions are D:

- A i, ii)
- B ii, iv)
- C i, iii)
- D iii, iv)

正确

2.8 Consider a machine in which all memory-reference instructions have only one memory address, and one-level direct addressing is allowed. If an instruction is assumed to be stored in one frame, then the minimum number of frames needed by per process is B.

- A one
- B two
- C three
- D four

题目不理解啊

2.9 Which allocation scheme works best for the file system implemented on the device that can only be accessed sequentially, such as the tape drive? A

- A Contiguous allocation
- B linked allocation
- C index allocation
- D none of above 连续分配

2.10 Which one of the following items is a tertiary storage device? B

- A main memory
- B tape
- C registers
- D cache

4

tertiary 第三级

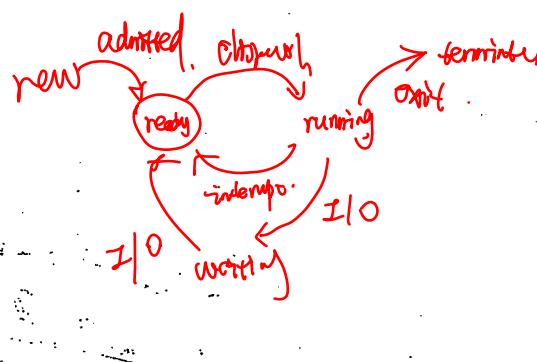
6 学五复印店

三级存储设备(光盘或磁带)

### 3 ESSAY QUESTIONS (20 points)

3.1 For each of the following transitions between process states, indicate whether the transition is possible, and why? (8 points)

- (a) running->ready ✓
- (b) running->waiting ✓ I/O
- (c) waiting->running ✗ → ready
- (d) running->terminated ✓



3.2 (6 points) Consider a system in which a directory can store up to 32 disk block addresses. For the file no larger than 32 blocks, these 32 disk block addresses serve as the file's index table. For the file larger than 32 blocks, the addresses point to indirect blocks which in turn point to 512 file blocks each. A block is of 2048 bytes.

What's the largest size of a file in the system?

32 \* 512 indirect blocks

$32 \times 512 \times 2048$  bytes

3.3 (6 points) In a demand-paging system, there are  $m$  frames available for each process in the system, and all frames are initially empty. For a given page-reference string, its length is  $p$ , and there are  $n$  ( $n > m > 0$ ) different pages in it.

If OS takes FIFO page replacement algorithm to handle page faults, what is the minimal number of page faults? And why?

What is the maximum number of page faults? And why?

4. (6 points) On a simple paging system with  $2^{34}$  bytes of physical memory,  $2^{11}$  pages of logical address space, and page size of 2048 bytes,  $2^{11}$

- (1) how many bits are there in a logical address?  $2^{11} + 1 = 2^11 + 1 = 2^12$
- (2) how many bits in the logical address specify the page number?  $11$
- (3) how many bits in the logical address specify the offset within the page?  $11$
- (4) how many bytes are there in a frame?  $2048$
- (5) how many bits in the physical address specify the frame number?  $2^{34} / 2048$
- (6) how many entries are there in the page table?  $2^{34} / 2^{11} = 2^{23}$

页表中

$2^{11}$  页

页式

0 ~ 99

5. (5 points) Disk requests come into the disk driver for cylinders 10, 22, 20, 2, 40, 6, and 38, in that order. Assume that the disk has 100 cylinders. A seek takes 1 msec per cylinder moved. Compute the average seek time for the request sequence given above for

1) First-come, First-served

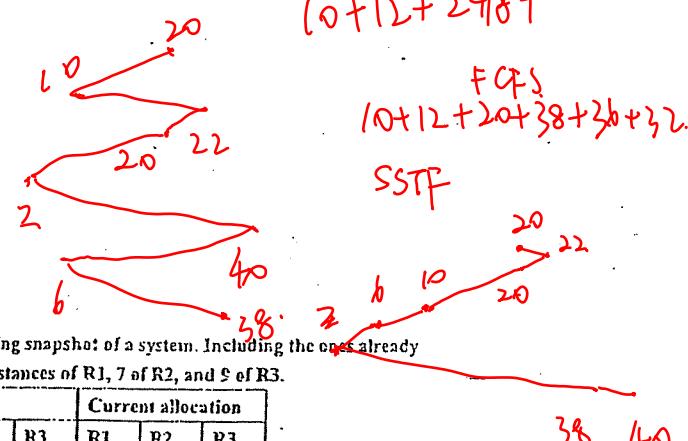
2) Shortest Seek Time First (SSTF)

In all the cases, the arm is initially at cylinder 20.

解:

(10 22 20 2 40 6 38)

(10 + 12 + 2 + 8 +



6. (9 points) Given the following snapshot of a system. Including the ones already allocated, the system has 6 instances of R1, 7 of R2, and 9 of R3.

Process	Max need			Current allocation		
	R1	R2	R3	R1	R2	R3
A	3	2	1	1	1	0
B	0	2	3	0	0	3
C	4	4	4	2	4	2
D	1	1	6	1	0	4

Determine whether or not the system is in a safe state, and why?

解:

6. 7. ? work = [2, 2, 0]

$$\text{Need} = \begin{bmatrix} A \\ B \\ C \\ D \end{bmatrix} = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 2 & 0 \\ 2 & 0 & 2 \\ 0 & 1 & 2 \end{bmatrix}$$

找 B.

work = [2, 2, 0]

A.

[3, 3, 3]

C.

8 [5, 4, 5]

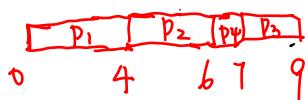
[6, 4, 9]

7. (10 points) In a system, there are 4 concurrent processes P<sub>1</sub>, P<sub>2</sub>, P<sub>3</sub> and P<sub>4</sub>. Their arrival times, CPU burst times, and priority numbers are given in the following table. (A smaller priority number implies a higher priority).

Process	Arrival Time	CPU Burst Time	Priority Number
P <sub>1</sub>	0	4	3
P <sub>2</sub>	2	2	2
P <sub>3</sub>	3	2	1
P <sub>4</sub>	5	1	2

- (1) Suppose that nonpreemptive SJF scheduling is employed,
- Draw a Gantt chart illustrating the execution of these processes
  - Calculate the average turnaround time of this set of processes.
- (2) Suppose that preemptive priority scheduling is employed,
- Draw a Gantt chart illustrating the execution of these processes
  - Calculate the average waiting time of this set of processes.

解: 非抢占式最短 SJF.



P<sub>1</sub>: 4

P<sub>2</sub>: 4

P<sub>3</sub>: 6

P<sub>4</sub>: 2.

5  
2.0  
1

② 抢占式优先级



8.(14 points) There is a coop (笼子) that can hold only one tiger or two pigs. If one pig is already kept in it, another pig is allowed to be in it, but a tiger is not; if one tiger is in the coop, other tigers or pigs are not permitted to be in it.

A tiger-hunter will hunt a tiger at a time and need to put the tiger into the coop; a pig-hunter will hunt a pig at a time and need to put the pig into the coop.

Then the feeder (饲养员) will take out the tiger from the coop and send it to a park. The kitchener (厨师) will take out one pig from the coop at a time, and then send it to a restaurant.

The process structures for the tiger-hunter, the pig-hunter, the feeder, and the kitchener are shown as follows.

<b>tiger-hunter:</b> while(true){ Catch a tiger; (1) Put the tiger into the coop; (2)	<b>feeder:</b> while(true){ Take the tiger from the coop; Send the tiger to the park; (3)
<b>pig-hunter:</b> while(true){ Catch a pig; (5) Put the pig into the coop; (6)	<b>kitchener:</b> while(true){ Take a pig from the coop; Send the pig to restaurant; (7)

Please design semaphores and *wait* and *signal* operations on the semaphores to synchronize the above-mentioned processes.

It is required that:

- 1) definitions and initial values of the semaphores should be given, and
- 2) appropriate code sections should be described for the blanks marked by numbers from (1) to (8).

*pig-room=2*

*pignum*

*coop      tiger*

*wait(coop)*

放入老虎

*Signal(tiger)*

*Wait(tiger)*

放出老虎

*Signal(coop)*

*coop=1*

*wait(pig-room)*

*pignum++*

*if(pignum==2) wait(coop)*

*Signal(pig)*

*Wait(pig)*

*pignum--* (bif)

*if(pignum==0)*

*Signal(coop)*

*Signal(pig-room)*

两个一个信号量

*pig-room*

用于表示当前还有

多少留给猪肉的空间。



《操作系统》期末考试试题 (A)

1. FILL IN BLANKS (10 points)

1.1 A trap is a software-generated interrupt caused either by an error or by a specific request from a user program that an operating-system services be performed.

1.2 A signal is used in Unix systems to notify a process that a particular event has occurred.

1.3 To manage the process executing, OS records the state and other information (e.g. the priority) of the process in PCB.

1.4 The scheduling criteria include CPU utilization, throughput, turnaround time, waiting time, and response time

1.5 For  $n$  concurrent processes that mutually exclusively use some resources, the code segmentations, in which the processes access the resources, are called critical section

1.6 The virtual memory swapping scheme enables users to run programs that are larger than actual physical memory, this allows the execution of a process that is not completely in memory.

1.7 The FIFO page replacement algorithm associates with each page the time when that page was brought into memory. When a page must be replaced, the oldest page is chosen.

1.8 The file system resides permanently on secondary storage which is designed to hold a large amount of data permanently.

1.9 The file system itself is generally composed of many different levels, including the logical file system, the file-organization module, the

and the I/O control.

1.10 The kernel's I/O subsystem provides numerous services. Among these are I/O scheduling, \_\_\_\_\_, caching, spooling, device reservation, and error handling, and name translation.

2. CHOICE ( 10 points )

2.1 \_\_\_\_\_ operating systems have well defined, fixed time constraints. Processing must be done within the defined constraints, or the system will fail.

- A. Multimedia     B. Real-time    C. Clustered    D. Network

2.2 Which one of the following OS is implemented based on microkernel structure? \_\_\_\_\_

- A. Ms-DOS     B. UNIX     C. Mach    D. Linux

2.3 Considering  $m$  processes, which mutually exclusively use the resource type A of  $n$  instances ( $m > n$ ). A semaphore S is designed to synchronize these processes. The maximum and minimal values are \_\_\_\_\_ respectively.

- A.  $n, -m + n$     B.  $m, -m + n$     C.  $m, n$     D.  $n, -m$

2.4 Here are some statements about processes and threads,

i) The thread is the basic unit of memory allocation for program execution in computer systems.

ii) For process state transitions, the migration from waiting to running is impossible.

iii) When CPU switch from process to process, the contents of CPU registers are not saved in PCB.

iv) An I/O-bound process spends more of its time doing I/O operation than it spends doing computation.

, the correct descriptions are B:

- A. i), ii)      B. ii), iv)
- C. i), iii)      D. iii), iv)

2.5 With respect to the following descriptions about CPU scheduling,

- i) the Round Robin scheduling is fit for the interactive systems.
- ii) with respect to the throughput for a given set of processes, SJF is optimal. 吞吐量
- iii) the preemptive priority algorithm is starvation-free, guaranteeing that no process waits indefinitely for service.
- iv) medium-term scheduling is responsible for process swapping. 中期调度负责进程换出.

, the wrong statements are \_\_\_\_\_

- A. i), ii)      B. iii), iv)
- C. i), iv)      D. ii), iii)

2.6 Considering the following statements,

- i) the Banker Algorithm is used for deadlock prevention, applicable to the systems with multiple instances of each resources.
- ii) the monitor is the high-level construct for process synchronization, and is characterized by shared variables and a set of programmer-defined operations on the shared variables. ✓
- iii) the current value of a counting semaphore S is -3, then there are 3 process waiting in the queue relevant to S. ✓
- iv) denying the mutual-exclusion condition is a good choice for deadlock prevention. 死锁预防.

, the correct descriptions are \_\_\_\_\_:

- A. i), ii), iv)      B. ii), iii), iv)
- C. ii), iii)      D. i), iii)

2.7 There are many solutions to satisfy a request of size n from a list of free holes. One way is b. It allocates the first hole that is big enough.

Searching can start either at the beginning of the set of holes or where the previous search ended.

- A. best fit      B. worst fit      C. last fit      D. first fit

2.8 Which of the following structures is in memory C.

- A. The boot control block
- B. The per file FCB
- C. The system open-file table
- D. The directory structure per file system 系统打开文件表.

2.9 Which of the following operations does not deal with the data block of a file? \_\_\_\_\_

- A. read      B. write      C. close      D. delete

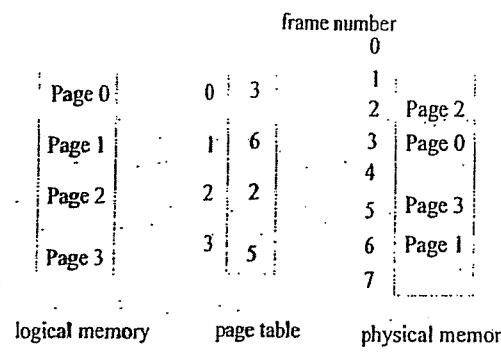
2.10 I/O Buffering is used for the following reason except \_\_\_\_\_

- A. cope with a speed mismatch between the producer and consumer of a data stream.
- B. adapt between devices that have different data-transfer size.
- C. support copy semantics for application I/O.
- D. improve the transfer rate of I/O devices.

### 3 ESSAY QUESTIONS (20 points)

3.1 List the five basic functions of OS. (5 points)

3.2 Consider the following page table: (5 points)



The page size is 1024 bytes. What are the physical addresses for the following logical addresses?

(1) 230      (2) 4094

~~1024x3+230      1024x5+4094 (4094-3072)~~

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

a. If a memory reference takes 500 time unit, how long does it take to access an instruction or data in a page that has been paged into memory?

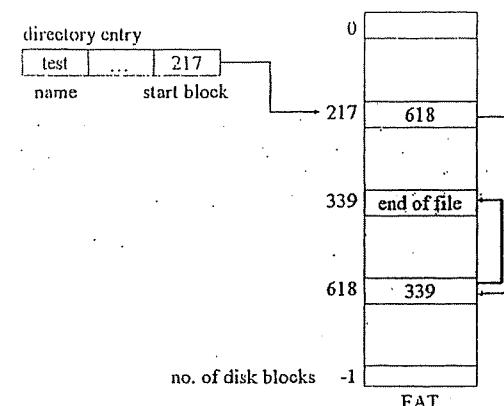
b. If we add TLB (*translation look-aside buffers*), and 70 percent of all page-table entries can be found in the TLB, what is the effective memory access time?

(Assume that finding a page-table entry in the associative registers takes 20 time unit, if the entry is there.)      (5 points)

3.4 According to the following figure, answer the following questions:

(1) How many blocks are there in the file test?

(2) How to access the 100<sup>th</sup> byte in block 2 (A logical block number is an index relative to the beginning of the file, so the first logical block is block 0)?      (5 points)



4. Consider the following page-reference string:

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

How many page faults would occur for the LRU replacement algorithm, assuming that there are four frames available for each process in the system, and all frames are initially empty.      (10 Points)

5. In a computer system, the users submit to the system their computational tasks as jobs, and all these jobs are then stored as the standby jobs on the disk.

The job scheduler selects standby jobs on the disk, creates new processes in memory for them, and then starts executing these processes. Each job's ID is the same as that of the process created for it, for example,  $J_i$  and  $P_i$ .

When the number of concurrent processes in memory is lower than three, the job scheduler takes the FCFS algorithm to select a standby job on the disk to create a new process. Otherwise, the processes should wait in the disk.

For the processes in memory, the process scheduler takes the non-preemptive priority-based algorithm to select a process and allocates the CPU to it.

It is assumed the system costs resulting from job and process scheduling are omitted.

Consider the following set of Jobs  $J_1, J_2, J_3, J_4$  and  $J_5$ . For  $1 \leq i \leq 5$ , the arrival time of each  $J_i$ , the length of the CPU burst time of each process  $P_i$ , and the priority number for each  $J_i/P_i$  are given as below, and a smaller priority number implies a higher priority.

Job	Arrival Time (minute)	Burst Time	Priority Number
$J_1$	14:00	40	4
$J_2$	14:20	30.01	2
$J_3$	14:30	50.01	3
$J_4$	14:50	20.01	5
$J_5$	15:05	10.01	5

(1) Illustrate the execution of each job/process by charts.

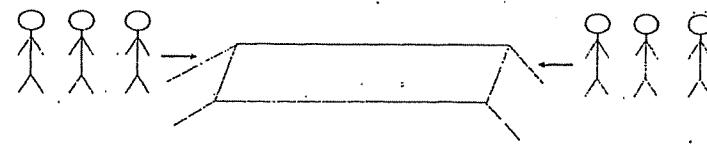
(2) What is the turnaround time of each job?

(3) What is the waiting time of each job?

Note: The waiting time of a job includes the time it waits on the disk and that it waits in memory. (20 Points)

6. As illustrated in the figure, on two sides of a one-plank bridge(独木桥), there are two groups of soldiers that are composed of  $m$  and  $n$  people respectively need to cross the bridge, but the narrow bridge allows only one group of the soldiers in the same direction to cross at the same time.

One group of the soldiers is permitted to cross as long as there are no people on the bridge. Once one group of the soldiers begins walking on the bridge, the other group should be waiting to start crossing until all members of the first group have passed the bridge.



Please design two semaphore-based processes to describe the crossing actions of the soldiers in the two groups. It is required

(1) to define the semaphores and variables needed, explain their roles?, and give their initial values; and

(2) to illustrate the structures of processes for the soldiers in each group.

(15 Points)

7. Consider the following snapshot of a system

	Allocation			Max			Need			Available		
	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>
P <sub>1</sub>	1	0	0	3	2	2	2	2	2	2	1	2
P <sub>2</sub>	4	1	1	6	1	3	2	0	2			
P <sub>3</sub>	2	1	1	3	1	4	1	0	3			
P <sub>4</sub>	0	0	2	4	2	2	4	0	2			

(1) Fill in the contents of the matrix *Need* for each process in the space above.

(2) Is the system in a safe state? If it is safe, give the safe sequence.

(3) If both P<sub>1</sub> and P<sub>2</sub> make resource requests of <1, 0, 1>, how should we grant the requests while keeping the system in a safe state? (15 Points)

## 《操作系统原理》期末考试试题 A

考 试	一、学生参加考试须带学生证或学院证明，未带者不准进入考场。学生必须按照监考教师指定座位就坐。								
注 意 事 项	二、书本、参考资料、书包等与考试无关的东西一律放到考场指定位置。								
	三、学生不得另行携带、使用稿纸，要遵守《北京邮电大学考场规则》，有考场违纪或作弊行为者，按相应规定严肃处理。								
	四、学生必须将答题内容写在试卷上，做在草稿纸上一律无效。								
	五、第 1 题须用英文应答，中文答对得一半分。								
题号	一	二	三	四	五	六	七	八	总分
满分	10	13	27	12	16	12	10		100
得分									
阅卷 教师									

## 1. FILL IN BLANKS (1 \* 10 points)

- (1) A time-shared computer system uses \_\_\_\_\_ scheduling scheme and multiprogramming to provide each user with a small portion of CPU time.
- (2) To prevent users from performing illegal I/O, we define all I/O instruction to be \_\_\_\_\_ instructions, which can be executed only in monitor mode.
- (3) Considering OS interfaces, an application program can utilize \_\_\_\_\_ to acquire services provided by OS.
- (4) In operating systems, \_\_\_\_\_ is the basic unit of resource-allocation for programs executing in computer systems.
- (5) If a system can deal with 3 real-time processes, 5 interactive processes and 2 batch processes in 400ms, then the throughput of this system is \_\_\_\_\_.
- (6) \_\_\_\_\_ is a high-level language construct for process synchronization, and is characterized by shared variables and a set of programmer-defined operations on the shared variables.

(7) With respect to deadlocks, a system is \_\_\_\_\_ if the system can allocate resources to each process (up to its maximum) in some order and still avoid a deadlock.

(8) On a paging system with  $2^{32}$  bytes of physical memory,  $2^{11}$  1024-byte pages of logical address space, \_\_\_\_\_ bits in the physical address specify the frame number.

(9) The file system consists of two distinct parts: a collection of files and a \_\_\_\_\_, which organizes and provides information about all files in the system.

(10) Considering file access methods and file disk space allocation, \_\_\_\_\_ access is adapt to the files of linked allocation

## 2. CHOICE (1 \* 13 points)

(1) Which one is not the main task of an operating system? \_\_\_\_\_

- A. Process management      B. Language translation  
C. File management      D. memory management

(2) Which of the following system has strict time constraint? \_\_\_\_\_

- A. batch system      B. time-sharing system  
C. real-time system      D. interactive system

(3) A starvation-free job-scheduling policy guarantees that no job waits indefinitely for service. Which of the following job-scheduling policies is starvation free? \_\_\_\_\_

- A. Round Robin      B. Priority  
C. Shortest Job First      D. None of the above

(4) In operating systems, the semaphore stands for instances of resource, it is a integer variable relevant to a queue, its value can only be changed by operation WAIT and SIGNAL. If a semaphore S is initialized to 5, now its value is 2, how many processes is or are waiting in the queue relevant to S. \_\_\_\_\_

- A. 3      B. 2      C. 1      D. 0

(5) The Banker Algorithm is used for \_\_\_\_\_

- A. deadlock avoidance      B. deadlock prevention  
C. deadlock detection      D. deadlock recovery

- (6) With respect to binding of instructions and data to memory addresses, if address binding is done at \_\_\_\_\_, the hardware MMU is needed  
 A. Coding time    B. compile time    C. load time    D. execution time
- (7) Considering the following memory management schemes, \_\_\_\_\_ will maximize memory utilization.  
 A. fixed-sized partitions (MVT)    B. paging    C. segmentation
- (8) Consider a machine in which all memory-reference instructions have only one memory address, and one-level indirect addressing is allowed, if an instruction is assumed to be stored in one frame, then the minimum number of frames per process is  
 A. one    B. two    C. three    D. four
- (9) The file system itself is generally composed of several different levels. In these levels, the \_\_\_\_\_ manages metadata and is responsible for protection and security.  
 A. logical file system    B. file-organization module  
 C. basic file system    D. I/O control
- (10) Which allocation scheme would work best for a file system implemented on a device (e.g. a tape drive) that can only be accessed sequentially? \_\_\_\_\_  
 A. linked allocation    B. contiguous allocation  
 C. index allocation    D. none of them
- (11) The disk free-space list is implemented as a bitmap. If the size of the disk space is 128 blocks, and each block is of 512 bytes, then \_\_\_\_\_ bytes are needed to store the bitmap.  
 A. 128    B. 512    C. 16    D. 8192
- (12) With respect to disk I/O operations, the \_\_\_\_\_ executes I/O instructions to control the disk controller to access data on disks  
 A. file system    B. kernel I/O subsystem  
 C. application process    D. driver
- (13) The following characteristics except \_\_\_\_\_ are correct for disks.  
 A. secondary storage    B. read-write devices  
 C. random-access devices    D. character-stream devices

### 3. ESSAY QUESTIONS (27 points)

3.1 (6 points) Explain the following terms

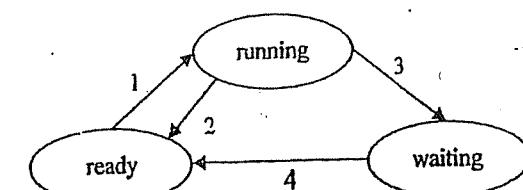
(1) deadlock (3 points)



(2) demand paging (3 points)



3.2 (6 points) In a multiprogramming system, consider the following diagram of process state transitions,



- 1) Is it possible that the transition 2 of a process can cause the transition 1 for a process? If yes, give an example; If not, why? (3 points)
- 2) Is it possible that the transition 4 of a process can cause the transition 1 for a process? If yes, give an example; If not, why? (3 points)

# 文件系统

3.3 (4 points) In a paging system, the page table is stored in main memory, and the active page entries are also held in high-speed associate memory TLB (translation look-aside buffer). If it takes 100 nanoseconds to search the TLB, and 180 nanoseconds to search page table in main memory. What must the TLB hit ratio be to achieve an effective access time (EAT) of 150ns?

3.4 (6 points) In the file system on a disk with physical block sizes of 512 bytes, a file is made up of 128-byte logical records, and each logical record cannot be separately stored in two different blocks. The disk space of the file is organized on the basis of indexed allocation, and a block address is stored in 4 bytes. Suppose that 2-level index blocks is used to manage the data blocks of the file, answer the following questions:

- 1) What is the largest size of the file? (3 points)
- 2) Given 2000, the number of a logical record in the file, how to find out the physical address of the record 2000 in accordance with the 2-level index blocks (3 points)

3.5 (5 points) A file is made up of 128-byte fix-sized logical records and stored on the disk in the unit of the block that is of 1024 bytes. The size of the file is 10240 bytes. Physical I/O operations transfer data on the disk into an OS buffer in main memory, in terms of 1024-byte block. If a process issues *read* requests to read the file's records in the sequential access manner, what is the percentage of the *read* requests that will result in I/O operations?

4. (12 points) Considering a real-time system, in which there are 4 real-time processes  $P_1, P_2, P_3$  and  $P_4$  that are aimed to react to 4 critical environmental events  $e_1, e_2, e_3$  and  $e_4$  in time respectively.

The arrival time of each event  $e_i, 1 \leq i \leq 4$ , (that is, the arrival time of the process  $P_i$ ), the length of the CPU burst time of each process  $P_i$ , and the deadline for each event  $e_i$  are given below. Here, the deadline for  $e_i$  is defined as the absolute time point before which the process  $P_i$  must be completed.

The priority for each event  $e_i$  (also for  $P_i$ ) is also given, and a smaller priority number implies a higher priority.

Events	Process	Arrival Time	Burst Time	Priorities	Deadline
$e_1$	$P_1$	0.00	4.00	3	7.00
$e_2$	$P_2$	3.00	2.00	1	5.50
$e_3$	$P_3$	4.00	2.00	4	12.01
$e_4$	$P_4$	6.00	4.00	2	11.00

(1) Suppose that priority-based preemptive scheduling is employed, (6 points)

a) Draw a Gantt chart illustrating the execution of these processes.

b) What are the average waiting time and the average turnaround time

Which event will be treated with in time, that is, the process reacting to this event will be completed before its deadline?

- (2) Suppose that FCFS scheduling is employed. (6 points)
- Draw a Gantt chart illustrating the execution of these processes
  - What are the average waiting time and the average turnaround time
  - Which event will be treated with in time?

5. (16 points) Here is a plate that can contain 3 fruits. The father puts apples and the mother puts oranges into the plate. The daughter takes apples and the son takes oranges from the plate to eat. The father, mother, daughter and son are permitted only to operate on the plate in a mutually exclusive mode, and only one apple or one orange can be put into or taken from the plate each time.

Please design four semaphore-based processes for the father, mother, daughter and son to correctly operate on the plate.

Requirements:

- Define the semaphores used to synchronize the processes, describe simply the role of each semaphore, and give their initial values. (4 points)
- Illustrate the structures of processes for the father, mother, daughter and son. (12 points)

$$\langle P_1, P_2, P_0, P_3, P_4 \rangle$$

$$+ 112$$

$$+ 211$$

$$+ 323$$

$$(4, 3, 6)$$

$$323$$

$$+ 011$$

$$(334)$$

$$+ 100$$

$$439$$

$$+ 002$$

$$436$$

6. (12 points) Considering a system with five processes  $P_0$  through  $P_4$  and three resource types A, B and C. Resource type A has 4 instances, B has 3 instances and C has 6 instances. Suppose that, at time  $T_0$ , we have the following resource-allocation state,

	<u>Allocation</u>	<u>Request</u>	<u>Available</u>
	A B C	A B C	A B C
$P_0$	1 0 0	2 3 2	1 1 2
$P_1$	2 1 1	1 0 2	
$P_2$	0 1 1	1 0 3	
$P_3$	0 0 2	4 2 0	
$P_4$	0 0 0	1 0 6	

$P_0 \rightarrow 242$

Answer following questions by means of the deadlock-detection algorithm

(1) Is the system in a deadlocked state? and why? (6 points)

(2) If  $P_0$  requests one additional instance of type B; what is the Request Matrix?

Is there a deadlock in the system? and why? (6 points)

死锁检测

(1) 没有死锁

$\langle P_1, P_2, P_0, P_3, P_4 \rangle$

(2)

(3, 3, 4)

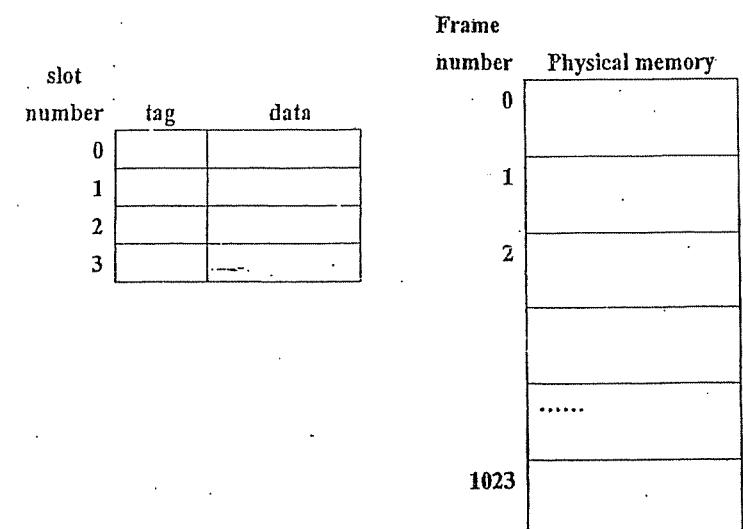
3 < 4

(2, 4, 2)

死锁.

7. (10 points) A cache is a region of faster memory that holds copies of data. Most systems have one or more high-speed data caches in the memory hierarchy. Information (e.g. the instruction or data) is normally kept in main memory. As it is used, it is copied into the cache. When a particular piece of information is needed, we first check whether it is in the cache. If it is, we use the information directly from the cache; if it is not, we use the information from the main memory, and put a copy in the cache under the assumption that we will need it again soon.

In a paging system, the main memory is divided into 1024 frames. Refer to the following figure. It is supposed that a cache in the system consists of 4 slots and each slot can hold only one frame. There is also a tag field in each slot to record the number of the frame kept in this slot.



When a frame is needed to be copied to the cache but there is no free slot to hold it, slot replacement occurs. The system uses the slot replacement algorithm to select a victim frame already in the cache and then replace the victim by this frame.

Assuming that all of 4 slots in the cache are free initially, and CPU references the memory according to the following sequence of memory frame numbers

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

(1) If FIFO replacement algorithm is used, illustrate the frame number kept in each cache slot successively, and give the cache hit ratio (5 points)

(2) If LRU replacement algorithm is used, illustrate the frame number kept in each cache slot successively, and give the cache hit ratio (5 points)

**Note:**

1. The scheme of slot replacement between the cache and the main memory is similar to that of page replacement between the main memory and the disk.
2. The cache hit ratio is defined as the percentage of times that the frames referenced by CPU can be found in the cache.

一填空

- |                       |                |
|-----------------------|----------------|
| (1) CPU               | (6) monitor 管程 |
| (2) kernel privileged | (7) soft safe  |
| (3)                   | (8) 11 22      |
| (4) file              | (9) FCB? 目录    |
| (5) 25                | (10) direct    |

二选择

- |         |        |        |
|---------|--------|--------|
| (1) B   | (6) D  | (11) C |
| (2) C   | (7) C? | (12) D |
| (3) A   | (8) B? | (13) D |
| (4) A D | (9) B? |        |
| (5) AD  | (10) B |        |

三问答

3.1 ① 当系统进程存在队列、忙于 wait、非抢占、被阻塞时。  
并且

② 直表长度小于直号范围，又插入需要的直号的信息时  
制表

3.2 “yes”，当一个进程被中断打断时，就进入  
ready

→ no.

P<sub>r</sub>

$$3.3 p \times 100\text{ns} + (1-p)(100\text{ns} + 180\text{s}) \leq 150\text{ns}$$

$$1-p \cdot 180\text{ns} \leq 50\text{ns}$$

$$p \cdot 18\text{ns} \geq 130\text{ns} \quad p \geq \frac{13}{18} \approx 70\%$$

$$3.4 v \left(\frac{512}{4}\right)^2 \cdot 512\text{B} = 128 \times 128 \times 512\text{B} = 64\text{MB} \quad 8\text{MB}$$

so a second-level index could access 512 records

$$\frac{512}{4} \times \frac{512}{128} = 128 \times 4 = 512 \text{ records}$$

so 2000 is in the 3rd first-level index  
115th second-level index  
the last record.

$$3.5 10240 / 128 = 80 \text{ records}$$

$$1024 / 128 = 8 \text{ records}$$

$$80 / 8 = 10 \text{ block}$$

$$so \frac{80}{128} = 12.5\% \text{ will result}$$

4. (1)	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	P <sub>5</sub>	over
	0 3 P <sub>1</sub>	5 P <sub>2</sub>	6 P <sub>3</sub>	10 P <sub>4</sub>	12 over	

Waiting time	2	0	6	0	2
turnaround time	6	2	8	4	5

all are treated in time

4. (2)	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	over
	0 4	5.5	7.5	11	

Waiting time	0	1	1.5	1.5	1
turnaround time	4	2.5	3.5	5	3.75

	Need	Request	safe
	A B C	AB C	(P <sub>1</sub> , P <sub>2</sub> , P <sub>0</sub> , P <sub>3</sub> , P <sub>4</sub> )
P <sub>0</sub>	1 3 2	P <sub>0</sub> 2 4 2	③ there is
P <sub>1</sub>		P <sub>1</sub> 1 0 2	
P <sub>2</sub>		P <sub>2</sub> 1 0 3	
P <sub>3</sub>		P <sub>3</sub> 4 2 0	
P <sub>4</sub>		P <sub>4</sub> 1 0 6	

7.	1 0 2 1 7 6 7 0 1 2 0 4 5 1 5
④ FIFO	1 1 1 1 6 6 6 6 5
	0 0 0 0 1 1 1 1
	2 2 2 2 0 0 0
	① 7 7 ② 7 ③ 7 4 4 ④
ratio = $\frac{6}{15} = 26\%$	

	1 0 2 1 7 6 7 0 1 2 0 4 5 1 5
⑤ LRU	1 1 1 1 1 1 1 1 5 5
	0 0 0 6 6 2 2 2 1
	2 2 2 0 0 0 0 0
	① 7 7 ② 7 ③ 7 ④ 4 4 4 ⑤
ratio $\frac{5}{15} = 33\%$	

## 计算机操作系统期末考试题及答案

### 一、单项选择题（每题1分，共20分）

1. 操作系统的发展过程是( C )  
A、原始操作系统，管理程序，操作系统  
B、原始操作系统，操作系统，管理程序  
C、管理程序，原始操作系统，操作系统  
D、管理程序，操作系统，原始操作系统
  2. 用户程序中的输入、输出操作实际上是由( B )完成。  
A、程序设计语言      B、操作系统  
C、编译系统      D、标准库程序
  3. 进程调度的对象和任务分别是( C )。  
A、作业，从就绪队列中按一定的调度策略选择一个进程占用 CPU  
B、进程，从后备作业队列中按调度策略选择一个作业占用 CPU  
C、进程，从就绪队列中按一定的调度策略选择一个进程占用 CPU  
D、作业，从后备作业队列中调度策略选择一个作业占用 CPU
  4. 支持程序浮动的地址转换机制是( A、动态重定位 )  
A、动态重定位      B、段式地址转换  
C、页式地址转换      D、静态重定位
  5. 在可变分区存储管理中，最优适应分配算法要求对空闲区表项按( C )进行排列。  
A、地址从大到小      B、地址从小到大  
C、尺寸从小到大      D、尺寸从大到小
  6. 设计批处理多道系统时，首先要考虑的是( 系统效率和吞吐量 )。  
A、灵活性和可适应性      B、系统效率和吞吐量  
C、交互性和响应时间      D、实时性和可靠性
  7. 当进程因时间片用完而让出处理器时，该进程应转变为( C )状态。  
A、等待      B、就绪      C、运行      D、完成
  8. 文件的保密是指防止文件被( C )。  
A、篡改      B、破坏      C、窃取      D、删除
  9. 若系统中有五个并发进程涉及某个相同的变量 A，则变量 A 的相关临界区是由( C )  
临界区构成。  
A、2个      B、3个      C、4个      D、5个
  10. 按逻辑结构划分，文件主要有两类：( 记录式文件 ) 和流式文件。  
A、记录式文件      B、网状文件      C、索引文件      D、流式文件
  11. UNIX 中的文件系统采用( C、索引文件 )。  
A、网状文件      B、记录式文件      C、索引文件      D、流式文件
  12. 文件系统的主要目的是( C )。  
A、实现对文件的按名存取      B、实现虚拟存储器  
C、提高外围设备的输入输出速度      D、用于存储系统文档
  13. 文件系统中用( C )管理文件。  
A、堆栈结构      B、指针      C、页表      D、目录
  14. 为了允许不同用户的文件具有相同的文件名，通常在文件系统中采用( C )。  
A、重名翻译      B、多级目录      C、约定      D、文件名
  15. 在多进程的并发系统中，肯定不会因竞争( C )而产生死锁。  
A、打印机      B、磁带机      C、CPU      D、磁盘
  16. 一种既有利于短小作业又兼顾到长作业的作业调度算法是( C )。  
A、先来先服务      B、轮转  
C、最高响应比优先      D、均衡调度
  17. 两个进程合作完成一个任务。在并发执行中，一个进程要等待其合作伙伴发来消息，或者建立某个条件后再向前执行，这种制约性合作关系被称为进程的( C )。  
A、互斥      B、同步      C、调度      D、伙伴
  18. 当每类资源只有一个个体时，下列说法中不正确的是( C )。  
A、有环必死锁      B、死锁必有环  
C、有环不一定死锁      D、被锁者一定全在环中
  19. 数据文件存放在存储介质上时，采用的逻辑组织形式是与( C )有关的。  
A、文件逻辑结构      B、存储介质特性  
C、主存储器管理方式      D、分配外设方式
  20. 在单处理器的多进程系统中，进程什么时候占用处理器和能占用多长时间，取决于( C )。  
A、进程相应的程序段的长度      B、进程自身和进程调度策略  
C、进程总共需要运行时间多少      D、进程完成什么功能
- ### 二、填空题（每空 2 分，共 20 分）
1. 若信号量 S 的初值定义为 10，则在 S 上调用了 16 次 P 操作和 15 次 V 操作后 S 的值应为( 9 )。

2. 进程调度的方式通常有（抢占）和（非抢占）两种方式。
3. 每个索引文件都必须有一张（索引结点）表，其中的地址登记项用来指出文件在外存上的位置信息。
4. 在一请求分页系统中，假如一个作业的页面走向为：4、3、2、1、4、3、5、4、3、2、1、5，当分配给该作业的物理块数为4时（开始时没有装入页面），采用 LRU 页面淘汰算法将产生（8）次缺页中断。
5. 信号量被广泛用于三个目的是（同步）、（互斥）和描述前趋关系。
6. 程序并发执行时的特征是（间断性）、（失去了封闭性）、（不可再现性）和独立性。

### 三、判断题（每题1分，共10分）

- (T)1. 文件系统中分配存储空间的基本单位不是记录。
- (F)2. 具有多道功能的操作系统一定是多用户操作系统。
- (T)3. 虚拟存储器是由操作系统提供的一个假想的特大存储器，它并不是实际的内存，其大小可比内存空间大得多。
- (T)4. 批处理系统的（主要优点）是系统的吞吐量大、资源利用率高、系统的开销较小。
- (F)5. 文件系统中源程序是有结构的记录式文件。
- (F)6. 即使在多道程序环境下，普通用户也能设计用内存物理地址直接访问内存的程序。
- (F)7. 顺序文件适合建立在顺序存储设备上，而不适合建立在磁盘上。
- (T)8. SPOOLing 系统实现设备管理的虚拟技术，即：将独占设备改造为共享设备。它由专门负责 I/O 的常驻内存进程以及输入、输出井组成。
- (F)9. 系统调用是操作系统与外界程序之间的接口，它属于核心程序。在层次结构设计中，它最靠近硬件。
- (F)10. 若系统中存在一个循环等待的进程集合，则必定会死锁。

### 四、程序与算法（共10分）

设有一缓冲池 P，P 中含有 20 个可用缓冲区，一个输入进程将外部数据读入 P，另有一个输出进程将 P 中数据取出并输出。若讲程每次操作均以一个缓冲区为单位，试用记录型信号量写出两个进程的同步算法，要求写出信号量的初值。

解：

```
semaphore mutex=1;
semaphore empty=20;
semaphore full=0;
int in,out = 0;
item p [20];
```

```
void Producer(){
    while(true){
        producer an item in nextp;
        wait(empty);
        wait(mutex);
        p[in] := nextp;
        in := (in+1) mod 20;
        signal(mutex);
        signal(full);
    }
}

void Consumer(){
    while(true){
        wait(full);
        wait(mutex);
        nextc := p[out];
        out := (out+1) mod 20;
        signal(mutex);
        signal(empty);
    }
}
```

### 五、问答题（共16分）

某系统有 A、B、C、D 四类资源可供五个进程 P1、P2、P3、P4、P5 共享。系统对这四类资源的拥有量为：A 类 3 个、B 类 14 个、C 类 12 个、D 类 12 个。进程对资源的需求和分配情况如下：

进程	已占有资源				最大需求数			
	A	B	C	D	A	B	C	D
P1	0	0	1	2	0	0	1	2
P2	1	0	0	0	1	7	5	0
P3	1	3	5	4	2	3	5	6

P4	0 6 3 2	0 6 5 2
P5	0 0 1 4	0 6 5 6

按银行家算法回答下列问题：

- (1) 现在系统中的各类资源还剩余多少？(4分)
- (2) 现在系统是否处于安全状态？为什么？(6分)
- (3) 如果现在进程 P2 提出需要 A 类资源 0 个、B 类资源 4 个、C 类资源 2 个和 D 类资源 0 个，系统能否去满足它的请求？请说明原因。(6)

(1) A: 1; B: 5; C: 2; D: 0

(2) need 矩阵为：P1 0 0 0 0

P2 0 7 5 0

P3 1 0 0 2

P4 0 0 2 0

P5 0 6 4 2

存在安全序列，如 P1, P3, P4, P5, P2，所以安全

(3) 能，因为试探分配后，可用资源为 1, 1, 0, 0。可找到安全序列，所以可分配。

#### 六、计算题（第 1 题 6 分；第 2 题 10 分；第 3 题 8 分；共 24 分）

- 1、某虚拟存储器的用户编程空间共 32 个页面，每页为 1KB，内存为 16KB。假定某时刻一用户页表中已调入内存的页面的页号和物理块号的对照表如下：

页号	物理块号
0	5
1	10
2	4
3	7

则逻辑地址 0A5D (H) 所对应的物理地址是什么？(6 分)

0A5D (H) =0000 1010 0101 1101

2 号页对应 4 号块，所以物理地址是 0001 0010 0101 1101  
即 125D (H)。

- 2、设有三道作业，它们的提交时间及执行时间由下表给出：

作业号	提交时间	执行时间
1	8.5	2.0

2	9.2	1.6
3	9.4	0.5

试计算在单道程序环境下，采用先来先服务调度算法和最短作业优先调度算法时的平均周转时间（时间单位：小时，以十进制进行计算；要求写出计算过程）(10 分)

FCFS: 作业号 提交时间 执行时间 开始时间 完成时间 周转时间

1 8.5 2.0 8.5 10.5 2.0

2 9.2 1.6 10.5 12.1 2.9

3 9.4 0.5 12.1 12.6 3.2

平均周转时间=(2.0+2.9+3.2)/3=2.7(小时)

SJF: 作业号 提交时间 执行时间 开始时间 完成时间 周转时间

1 8.5 2.0 8.5 10.5 2.0

2 9.2 1.6 11.0 12.6 3.4

3 9.4 0.5 10.5 11.0 1.6

平均周转时间=(2.0+3.4+1.6)/3=2.3(小时)

- 3、假定当前磁头位于 100 号磁道，进程对磁道的请求序列为 55, 58, 39, 18, 90, 160, 150, 38, 180。当采用先来先服务和最短寻道时间优先算法时，总的移动的磁道数分别是多少？（请给出寻道次序和每步移动磁道数）(8 分)

FCFS: 服务序列依次为：55, 58, 39, 18, 90, 160, 150, 38, 180

移动的磁道数分别是： 45, 3, 19, 21, 72, 70, 10, 112, 142

总的移动的磁道数是：494

SSTF: 服务序列依次为：90, 58, 55, 39, 38, 18, 150, 160, 180

移动的磁道数分别是： 10, 32, 3, 16, 1, 20, 132, 10, 20

总的移动的磁道数是：244

2007-2008 学年第一学期考试试卷 B

《操作系统》

注意事项：

1. 请考生按要求在试卷装订线内填写姓名、学号和年级专业。
2. 请仔细阅读各种题目的回答要求，在规定的位置填写答案。

3. 不要在试卷上乱写乱画，不要在装订线内填写无关的内容。

4. 满分 100 分，考试时间为 120 分钟。

题号	一	二	三	四	五	总分	统分人
得分							

得 分	
评分人	

一、 填空题(每空 1 分,共 10 分)

1. 按信息交换方式不同，通道可分为三类\_\_\_\_\_、数组多路通道、选择通道。

2. Linux 中，1#进程是由\_\_\_\_\_建立的。

3. 作业控制方式有\_\_\_\_\_方式和\_\_\_\_\_方式两种。

4. 文件的逻辑结构分为\_\_\_\_\_的无结构文件和\_\_\_\_\_的有结构文件两种。

5. 解决死锁问题可以采用的方式中，采用死锁避免策略，如\_\_\_\_\_算法虽然保守，但可以保证系统时时处于安全状态。

6. 一作业 8: 00 到达系统，估计运行时间为 1 小时，若 10: 00 开始执行该作业，其响应比是\_\_\_\_\_。

7. 设有 8 页的逻辑空间，每页有 1024 字节，它们被映射到 32 块物理存储区中。那么，逻辑地址的有效位是\_\_\_\_\_位，物理地址至少是\_\_\_\_\_位。

得 分	
评分人	

二、 单选题(每题 2 分,共 20 分)

1. 操作系统的基本功能不包括( )。

- A、处理器管理 B、存储管理 C、用户管理 D、设备管理

2. 中央处理器处于目态时，执行( )将产生“非法操作”事件。

- A、特权指令 B、非特权指令 C、用户程序 D、访管指令

3. 一个作业被调度进入内存后其进程被调度进入 CPU 运行，在执行一段指令后，进程请求打印输出，此间该进程的状态变化是( )。

- A、运行态—就绪态—等待态 B、等待态—就绪态—运行态  
C、就绪态—运行态—等待态 D、就绪态—等待态—运行态

4. 在单处理器系统中，如果同时存在有 10 个进程，则处于就绪队列中的进程最多为( )个。

- A、1 B、8 C、9 D、10

5. 操作系统为用户提供按名存取的功能，在以下目录结构中，不能解决文件重名问题是( )。

- A、一级目录结构 B、二级目录结构  
C、树形目录结构 D、以上三个答案都不对

6. 在磁盘文件的物理结构中，( )既适合顺序存取，又方便随机存取。

- A、顺序结构 B、链式结构 C、索引结构 D、文件的目录结构

7. Windows 内核使用( )个优先级表示线程要求执行的紧迫性。

- A、16 B、30 C、32 D、5

8. 现有 3 个作业同时到达，每个作业的计算时间都是 1 小时，它们在单处理机上按单道方式运行，则平均周转时间为( )。

A、1小时

B、2小时

C、3小时

D、6小时

3. 什么是分页？什么是分段？二者主要有何区别？

9. 通过硬件和软件的功能扩充，把原来独占的设备改造成若干用户共享的设备，这种设备称为（ ）。

A、存储设备 B、系统设备 C、虚拟设备 D、并行设备

10. 对磁盘而言，输入输出操作的信息传送单位为（ ）。

A、字符 B、字 C、块 D、文件

4. 外设和内存之间常用的数据传送控制方式有哪4种？

得 分	
评分人	

三、简答题。(每题5分,共20分)

1. 在操作系统中，P操作和V操作各自的动作是如何定义的？

得 分	
评分人	

四、计算题(每题10分,共30分)

2. 二级目录和多级目录的好处是什么？符号文件目录表和基本文件目录表是二级目录吗？

1. 若在一个单道批处理系统中4个作业(J1, J2, J3, J4)，估计它们的提交时刻和需要运行的时间如下表所示。试用SJF算法计算各作业进入主存的时间和它们的平均周转时间。

作业名	提交时刻	运行时间(小时)
J1	10: 00	2
J2	10: 30	1
J3	10: 50	1.5
J4	11: 20	0.5

2. 一个请求分页系统中，若系统分配给一个作业的物理块数为 2 块，且作业的页面走向为 2, 3, 2, 1, 5, 2, 4, 5, 3, 2, 5, 2。试用 FIFO 和 LRU 两种算法分别计算出程序访问过程中所发生的缺页次数，并计算它们各自的缺页率。（假设初始作业装入时已经依次装入了页号为 1 和 2 的两个页面）

(2) 用电梯调度算法，列出响应的次序。

3. 假定某移动磁盘上，处理了访问 56 号柱面的请求后，现在正在 70 号柱面上读信息，目前有下面的请求访问磁盘柱面的序列：73,68,100,120,60,108,8, 50。请写出：

(1) 用最短查找时间优先算法，列出响应的次序。

得 分	
评分人	

五、综合分析题（每题 10 分，共 20 分）

1、设系统中有五个并发进程 (P1, P2, P3, P4, P5) 共享系统中的三类资源 (R1, R2, R3)，它们的资源总数量分别为 (16, 5, 19)，在 T0 时刻系统状态如下图所示，系统采用银行家算法实施死锁避免策略。

进程	最大资源需求量			已分配资源数量		
	R1	R2	R3	R1	R2	R3
P1	5	5	9	2	1	2
P2	5	3	6	4	0	2
P3	4	0	11	4	0	5
P4	4	2	5	2	0	4
P5	3	2	4	3	1	4

问题 1：判断在 T0 时刻是否处于安全状态，为什么？

问题 2：在 T0 时刻若进程 P2 提出 (1, 0, 1) 的资源请求，是否实施分配？为什么？

2、有一只最多能装 2 只兔子的铁笼子，猎人仅能向笼子中放入兔子（每次只能放入 1 只），若笼子是满的，则猎人必须等待；饭店老板仅能从笼子中取兔子（每次只能取出 1 只），若笼子是空的则他也必须等待。假设初始时笼子是空的。定义信号量并初始化，使用 P、V 操作模拟猎人和饭店老板进程之间的同步与互斥。

注意事项：

1. 请考生按要求在试卷装订线内填写姓名、学号和年级专业。
2. 请仔细阅读各种题目的回答要求，在规定的位置填写答案。
3. 不要在试卷上乱写乱画，不要在装订线内填写无关的内容。
4. 满分 100 分，考试时间为 120 分钟。

题 号	一	二	三	四	五	总 分	统分人
得 分							

得 分	
评分人	

一、填空题(每空 1 分,共 10 分。)

- 1、字节多路通道
- 2、0#进程
- 3、脱机方式 联机方式
- 4、字符流 记录式
- 5、银行家算法
- 6、3
- 7、13 15

得 分	
评分人	

二、单选题(每题 2 分,共 20 分。)

- 1、C 2、A 3、C 4、C 5、A 6、C 7、C 8、B 9、C 10、C

得 分	
评分人	

### 三、简答题(每题 5 分,共 20 分。)

1.

P 操作:

- ① P 操作一次, 信号量 S-1
- ② 如果  $S \geq 0$  表示有资源, 当前进程可执行
- ③ 如果  $S < 0$  无资源, 则当前进程进入队列的队尾等待, 等另一进程执行 V (S) 操作后释放资源。此时,  $|S|$  绝对值表示等待资源进程的个数要求

V 操作:

- ① V 操作一次, 信号量 S+1
- ② 如果  $S > 0$  (有资源, 告诉其它进程可以继续)
- ③ 如果  $S \leq 0$  (等待队列中另一进程释放资源后才能执行)

2.

二级目录和多级目录的好处是:

1、层次清楚

2、解决重名问题

3、提高检索目录的速度

符号文件目录表和基本文件目录表不是二级目录, 而是实现文件共享的方法。

3.

分页: 把程序中的逻辑地址分成大小相等的许多页, 把主存储器进行分块, 块的大小与页的大小一致。块是进行主存空间分配的物理单位。这样, 就可把作业信息按页存放到块中。

分段: 作业的地址空间被划分为若干个段, 每个段是一组完整的逻辑信息, 每个段都有自己的段号, 都是从零开始编址的一段连续的地址空间, 各段长度是不等的。

区别: (1) 段是信息的逻辑单位, 它是根据用户的需要划分的, 因此段对用户是可见的; 页是信息的物理单位, 是为了管理主存的方便而划分的, 对用户是透明的。

(2) 页的大小固定不变, 由系统决定。段的大小是不固定的, 它由其完成的功能决定。

(3) 段式向用户提供的是二维地址空间, 页式向用户提供的一维地址空间, 其页号和页内偏移是机器硬件的功能。

(4) 由于段是信息的逻辑单位, 因此便于存贮保护和信息的共享, 页的保护和共享受到限制。

4.

外设和内存之间常用的数据传送控制方式有:

- (1) 程序直接控制方式(CPU 直接询问方式)
- (2) 中断方式
- (3) DMA 方式
- (4) 通道方式

得 分	
评分人	

### 四、计算题(每题 10 分,共 30 分。)

作业名	提交时刻	运行时间 (小时)	SJF	
			IN	OUT
J1	10: 00	2	10: 00	12: 00
J2	10: 30	1	12: 30	13: 30
J3	10: 50	1.5	13: 30	15: 00
J4	11: 20	0.5	12: 00	12: 30

1

作业 J1 进入内存时间为 10: 00; 1 分

作业 J2 进入内存时间为 12: 30; 1 分

作业 J3 进入内存时间为 13: 30; 1 分

作业 J4 进入内存时间为 12: 00; 1 分

平均周转时间为:  $(2+3+3.17+1.17)/4=2.34$

6 分

2.

(1) FIFO: (5 分)

	2	3	2	1	5	2	4	5	3	2	5	2
1	2	3	3	1	5	2	4	5	3	2	5	5
2	1	2	2	3	1	5	2	4	5	3	2	2
		×		×	×	×	×	×	×	×	×	

$$F=9/12=75\%$$

(2) LRU: (5 分)

	2	3	2	1	5	2	4	5	3	2	5	2
1	2	3	2	1	5	2	4	5	3	2	5	2
2	1	2	3	2	1	5	2	4	5	3	2	5
		×		×	×	×	×	×	×	×	×	

$$F=9/12=75\%$$

3.

(3) (5 分)

用最短查找时间优先算法, 响应的次序为 68、73、60、50、8、100、108、120。

(2) (5 分)

用电梯调度算法, 响应的次序为 73、100、108、120、68、60、50、8。

得 分	
评分人	

### 五、综合分析题(每题 10 分, 共 20 分)

1.

进程	最大资源需求量			已分配资源数量		
	R1	R2	R3	R1	R2	R3

P1	5	5	9	2	1	2
P2	5	3	6	4	0	2
P3	4	0	11	4	0	5
P4	4	2	5	2	0	4
P5	3	2	4	3	1	4

(4) (5 分)

$A=(1, 3, 2); N5=(0, 1, 0) < A$ , 假分配 P5,  $A=(4, 4, 6);$

$N2=(1, 3, 4) < A$ , 假分配 P2,  $A=(8, 4, 8);$

$N1=(3, 4, 7) < A$ , 假分配 P1,  $A=(10, 5, 10);$

$N3=(0, 0, 6) < A$ , 假分配 P3,  $A=(14, 5, 15);$

$N4=(2, 2, 1) < A$ , 假分配 P4,  $A=(16, 5, 19)$ . 故 T0 状态是安全状态。

(5) (5 分)

$A=(1, 3, 2); R2=(1, 0, 1) < A$ , 假分配,  $A=(0, 3, 1), U2=(5, 0, 3);$

$N5=(0, 1, 0) < A$ , 假分配 P5,  $A=(3, 4, 5);$

$N2=(0, 3, 3) < A$ , 假分配 P2,  $A=(8, 4, 8);$

$N1=(3, 4, 7) < A$ , 假分配 P1,  $A=(10, 5, 10);$

$N3=(0, 0, 6) < A$ , 假分配 P3,  $A=(14, 5, 15);$

$N4=(2, 2, 1) < A$ , 假分配 P4,  $A=(16, 5, 19)$ . 实施分配, 因为是安全的。

2.

mutex,empty,fullsemaphore; 1 分

mutex=1,empty=2;full=0; 2 分

以下内容 7 分

cobegin

procedure Hunter(x)

begin:

P(empty);

P(mutex);

//放兔子;

V(mutex);

V(full);

Goto begin;

```
procedure Boss(x)
```

```
begin:
```

```
P (full);
```

```
P (mutex);
```

```
//放兔子;
```

```
V (mutex);
```

```
V (empty);
```

```
Goto begin;
```

```
coend;
```

\_\_\_\_\_类型；如果操作系统在用户提交作业后，不提供交互能力，它所追求的是计算机资源的高利用率，大吞吐量和作业流程的自动化，则属于\_\_\_\_\_类型。

2. 虚拟设备是通过\_\_\_\_\_技术，把\_\_\_\_\_设备变成能为若干用户\_\_\_\_\_的设备。

3. 磁盘与主机之间传递数据是以\_\_\_\_\_为单位进行的。

4. 静态重定位在\_\_\_\_\_时进行；而动态重定位在\_\_\_\_\_时进行。

5. 进程调度负责\_\_\_\_\_的分配工作。

2007-2008 学年第一学期考试试卷 A  
《操作系统》

注意事项：

1. 请考生按要求在试卷装订线内填写姓名、学号和年级专业。
2. 请仔细阅读各种题目的回答要求，在规定的位置填写答案。
3. 不要在试卷上乱写乱画，不要在装订线内填写无关的内容。
4. 满分 100 分，考试时间为 120 分钟。

得 分	
评分人	

七、单选题(每题 2 分,共 20 分)

1. 从用户的观点看，操作系统是（ ）。

A、用户与计算机之间的接口

B、控制和管理计算机资源的软件

C、合理地组织计算机工作流程的软件

D、由若干层次的程序按一定的结构组成的有机

题 号	一	二	三	四	五	总 分	统分人
得 分							

得 分	
评分人	

六、填空题(每空 1 分,共 10 分)

A、等待 B、就绪 C、运行 D、完成

3. 信箱通信是一种（ ）通信方式。

A、直接通信 B、间接通信 C、低级通信 D、信号量

1. 如果操作系统具有很强的交互性，可同时供多个用户使用，但时间响应不太及时，则属于\_\_\_\_\_类型；如果操作系统可靠，时间响应及时但仅有简单的交互能力，则属于

4. 某系统中有 3 个并发进程，都需要同类资源 4 个，则该系统不会发生死锁的最少资源数

是( )个。

- A、9      B、10      C、11      D、12

5. 既考虑作业等待时间，又考虑作业执行时间的调度算法是( )。

- A、响应比高者优先    B、短作业优先    C、优先级调度    D、先来先服务

6. 系统在( )，发生从目态到管态的转换。

- A、发出 P 操作时    B、发出 V 操作时  
C、执行系统调用时    D、执行置程序状态字时

7. 在虚拟存储系统中，若进程在内存中占 3 块(开始时为空)，采用先进先出页面淘汰算法，当执行访问页号序列为：1、2、3、4、1、2、5、1、2、3、4、5、6 时，将产生( )次缺页中断。

- A、7      B、8      C、9      D、10

8. 作业在执行中发生了缺页中断，经操作系统处理后，应让其执行( )指令。

- A、被中断的前一条                  B、被中断的  
C、被中断的后一条                  D、启动时的第一条

9. ( )用作连接大量的低速和中速 I/O 设备。

- A、选择通道    B、字节多路通道    C、数组多路通道    D、以上都不是

10. 一个文件的绝对路径名是从( )开始，逐步沿着每一级子目录向下追溯，最后到指定文件的整个通路上所有子目录名组成的一个字符串。

- A、当前目录    B、根目录    C、多极目录    D、二级目录

得 分	
评分人	

八、简答题(共 20 分)

1. 试比较进程和程序的区别 (6 分)

2. 产生死锁的必要条件是什么？(4 分)

3. 什么是虚拟存储器，其特点是什么？(5 分)

4. 什么是文件目录？文件目录中包含哪些信息？(5 分)

得 分	
评分人	

### 九、计算题(每题 10 分,共 30 分)

1. 在某个多道程序系统中,供用户使用的内存空间有 100K, 系统采用可变分区方式分配内存,优先分配内存的低地址区域且不准移动已在内存中的作业。现有一作业序列如下表所示。

假设作业调度和进程调度均采用 FCFS 算法, 问:

- (1) 作业执行的次序是什么?
- (2) 各作业的周转时间
- (3) 平均周转时间

2. 某操作系统采用可变分区分配存储管理方法, 用户区为 512K 且始址为 0, 用空闲分区表管理空闲分区。若分配时采用分配空闲区低地址部分的方案, 且初始时用户区的 512K 空间空闲, 对下述申请序列:

Req(300K), req(100K), release(300K), req(150K), req(30K), req(40K), req(60K), release(30K)

回答下列问题:

- (1) 采用首次适应算法, 空闲分区中有哪些空闲块 (给出图示, 并给出始址、大小)?

作业名	到达时间	运行时间 (分钟)	要求内存量
A	8: 00	25	15K
B	8: 15	15	60K
C	8: 20	20	50K
D	8: 30	20	20K
E	8: 35	15	10K

- (2) 采用最佳适应算法, 空闲分区中有哪些空闲块 (给出图示, 并给出始址、大小)?

3. 假定某移动磁盘上，磁头的当前位置为 100 磁道，磁头正向磁道号增加方向移动。现有一磁盘读写请求队列：23, 376, 205, 132, 19, 61, 190, 398, 29, 4, 18, 40。请写出：

(1) 用最短寻道时间优先算法，列出响应的次序，并计算平均寻道长度。

(2) 用电梯调度算法，列出响应的次序，并计算平均寻道长度。

1、某系统有 R1、R2 和 R3 共三种资源，在 T0 时刻 P1、P2、P3 和 P4 这 4 个进程对资源的占用和需求情况如下表所示，此时系统的可用资源向量为 (2, 1, 2)。

进程	最大资源需求量			已分配资源数量		
	R1	R2	R3	R1	R2	R3
P1	3	2	2	1	0	0
P2	6	1	3	4	1	1
P3	3	1	4	2	1	1
P4	4	2	2	0	0	2

问题 1：将系统中各种资源总数和此刻各进程对各资源的需求数目用向量或矩阵表示出来；

问题 2：如果此时 P1 和 P2 均发出资源请求向量 request (1, 0, 1)，为了保证系统的安全性，应该如何分配资源给这两个进程？说明你所采用策略的原因。

得 分	
评分人	

十、综合分析题（每题 10 分，共 20 分）

十二、单选题(每题 2 分,共 20 分。)

1、A 2、B 3、B 4、B 5、A

6、C 7、D 8、B 9、B 10、B

十三、简答题(共 20 分。)

1. 试比较进程和程序的区别 (6 分)

答: (1) 进程是一个动态概念,而程序是一个静态概念,程序是指令的有序集合,无执行含义,进程则强调执行的过程。  
(2 分)

(2) 进程具有并行特征(独立性,异步性),程序则没有。  
(2 分)

(3) 不同的进程可以包含同一个程序,同一个程序在执行中也可以产生多个进程。  
(2 分)

2. 产生死锁的必要条件是什么? (4 分,其中每个条件 1 分)

答: (1) 互斥条件

(2) 不剥夺条件

(3) 部分分配

(4) 环路条件

3. 什么是虚拟存储器,其特点是什么? (5 分)

答: 虚拟存储器是一种存储管理技术,其思想是把辅助存储器作为对主存储器的扩充,向用户提供一个比实际主存大得多的逻辑地址空间。  
(2 分)

其特点是:(1) 程序装入时,不必将其全部读入到内存,而只需将当前需要执行的部分页或段读入到内存,就可让程序开始执行;(2) 在程序执行过程中,如果需执行的指令或访问的数据尚未在内存(称为缺页或缺段),则由处理器通知操作系统将相应的页或段调入到内存,然后继续执行程序;(3) 操作系统将内存中暂时不使用的页或段调出保存在外存上,从而腾出空间存放将要装入的程序以及将要调入的页或段(即具有请求调入和置换功能,只需程序的一部分在内存就可执行)。  
(每个特点 1 分)

2007-2008 学年第一学期考试试卷 A  
《操作系统》参考答案

十一、填空题(每空 1 分,共 10 分。)

- 1、分时操作系统 实时操作系统 批处理操作系统
- 2、SPOOLING 独占 共享
- 3、数据块
- 4、程序装入时 程序执行
- 5、处理机

4. 什么是文件目录？文件目录中包含哪些信息？（5分）

答：一个文件的文件名和对该文件实施控制管理的说明信息称为该文件的说明信息，又称为该文件的目录。（2分）

文件目录中包含文件名、与文件名相对应的文件内部标识以及文件信息在文件存储设备上的始址等信息。另外还可能包含关于文件逻辑结构、物理结构、存取控制和管理等信息。（3分）

十四、计算题(每题10分,共30分。)

1、进程的执行情况如下表所示：

作业名	到达时间	装入内存时间	开始运行时间	结束时间	周转时间
A	8:00	8:00	8:00	8:25	25
B	8:15	8:15	8:25	8:40	25
D	8:30	8:30	8:40	9:00	30
E	8:35	8:35	9:00	9:15	40
C	8:20	8:40	9:15	9:35	75

(1) 作业执行次序是：A, B, D, E, C

(3分)

(2) 各作业的周转时间分别是：25, 25, 30, 40, 75  
分)

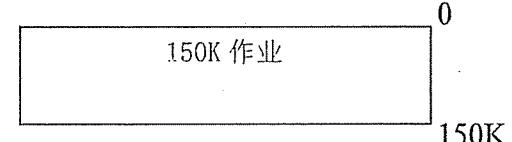
(每个1分, 共5

(3) 作业平均周转时间是： $(25+25+30+40+75)/5=39$

(2分)

2、首次适应算法（5分）（用阴影表示空闲）

(图2分)

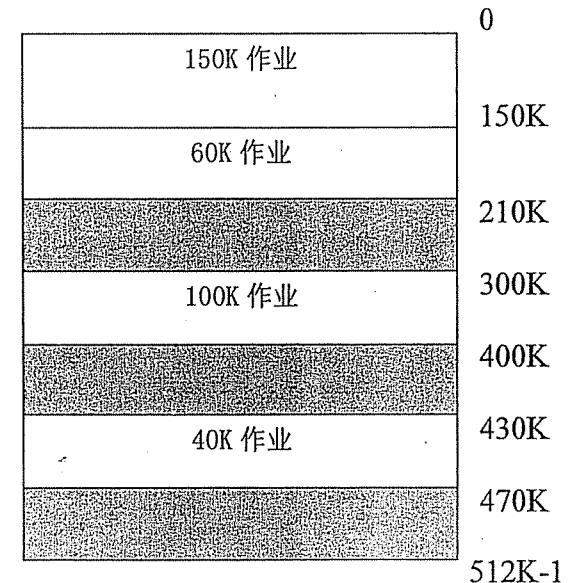


(指出空闲分区大小和始址, 每个1分)

分区	大小	起始地址
0	30K	150K
1	20K	280K
2	112K	400K

(6) 最佳适应算法（5分）（用阴影表示空闲）

(图2分)



(指出空闲分区大小和始址，每个 1 分)

4, 2, 0

分区	大小	起始地址
0	30K	400K
1	42K	470K
2	90K	210K

(2) (5 分)

若此时 P1 发出资源请求 request1 (1, 0, 1), 按银行家算法进行检查:  
request1 (1, 0, 1)  $\leq$  need1(2, 2, 2)  
request1 (1, 0, 1)  $\leq$  available(2, 1, 2)

试分配并修改相应数据结构，资源分配情况如下：

3.

(1) 最短寻道时间优先算法 (5 分)

响应的次序为：132、190、205、61、40、29、23、19、18、4、376、398。 (3 分)

(可以用图表示)

平均寻道长度：58.3 (2 分)

进程	allocation	need	available
P1	2, 0, 1	1, 2, 1	1, 1, 1
P2	4, 1, 1	2, 0, 2	
P3	2, 1, 1	1, 0, 3	
P4	0, 0, 2	4, 2, 0	

(2) 电梯调度算法 (5 分)

响应的次序为：132、190、205、376、398、61、40、29、23、19、18、4。 (3 分)

(可以用图表示)

平均寻道长度：57.7 (2 分)

再利用安全性算法检查系统是否安全，可用资源 Available(1, 1, 1) 已不能满足任何进程，故系统进入不安全状态，此时系统不能将资源分配给 P1。 (2 分)

若此时 P2 发出资源请求 request2 (1, 0, 1), 按银行家算法进行检查:

Request2 (1, 0, 1)  $\leq$  need2(2, 0, 2)  
Request2 (1, 0, 1)  $\leq$  available(2, 1, 2)

试分配并修改相应数据结构，资源分配情况如下：

进程	allocation	need	available
P1	1, 0, 0	2, 2, 2	1, 1, 1
P2	5, 1, 2	1, 0, 1	
P3	2, 1, 1	1, 0, 3	
P4	0, 0, 2	4, 2, 0	

再利用安全性算法检查系统是否安全，可得此时刻的安全性分析情况：

进程	Work	Need	Allocation	Work+Allocation	Finish

{  
2, 2, 2  
2, 0, 2  
1, 0, 3  
}

## 十五、 综合分析题(每题 10 分，共 20 分)

1、(1) (5 分)

系统中资源总量为 (9, 3, 6)

(1 分)

各进程对资源的需求量为：

(每个 1 分，共 4 分)

P2	1, 1, 1	1, 0, 1	5, 1, 2	6, 2, 3	True
P3	6, 2, 3	1, 0, 3	2, 1, 1	8, 3, 4	True
P4	8, 3, 4	4, 2, 0	0, 0, 2	8, 3, 6	True
P1	8, 3, 6	2, 2, 2	1, 0, 0	9, 3, 6	true

从上述分析中可以看出，此时存在一个安全序列 (P2, P3, P4, P1)，故该状态是安全的，  
可以立即将 P2 所申请的资源分配给它。  
(3 分)

2、

Empty1,empty2,full1,full2:semaphore; (1 分)

Empty1=empty2=1; (1 分)

Full1=full2=0; (1 分)

Main() (1 分)

{

Cobegin

PA();

PB();

PC();

coend;

}

PA() (2 分)

{

While(1)

{

从磁盘读一个记录;

P(empty1);

将记录存入缓冲区 1;

V(full1);

}

}

PB()

{

```

While(1)
{
    P(full1);
    从缓冲区 1 中取出记录;
    V(empty1);
    P(empty2);
    将记录存入缓冲区 2;
    V(full2);
}

```

(2 分)

PC()

{

While(1)

{

P(full2);

从缓冲区 2 中取出记录;

V(empty2);

打印记录;

}

}

(2 分)

