华南理工大学期末考试

《操作系统》试卷(B)

注意事项：1. 考前请将密封线内填写清楚；
2. 所有答案请答在答题纸上；
3. 考试形式：闭卷；
4. 本试卷共 四 大题，满分 100 分， 考试时间 120 分钟。

题 号	一	二	三	四	五	总分
得 分						
评卷人						

一、选择题(共 20 分，每题 2 分)

1. When the printing event which a process requested is finished, transition _____ will occur.
   A. Running→ready　　C. blocked→running
   B. running→blocked　　D. blocked→ready
2. Shared variables are those that _____
   A. can only be accessed by system processes
   B. can only be accessed by a lot of process mutual exclusively
   C. can only be accessed by user processes
   D. can be accessed by a lot of process
3. It is provable that _____ scheduling algorithm is optimal if all the jobs are available simultaneously.
   A. FCFS　　B. SJF　　C. Round-robin　　D. Priority
4. In a system, we require all processes to request all their resources before starting execution. This is a method for preventing deadlock to attack the _____ condition.
   A. Mutual Exclusion　　C. No Preemption
   B. Hold and Wait　　D. Circular Wait
5. Which of the following algorithm can result in external fragmentation problem?
   A. first fit　　C. best fit
   B. next fit　　D. worst fit
6. Which of the following page replacement algorithm need to clear R bit periodically?
   A. FIFO　　B. Second Chance　　C. Aging　　D. Working Set
7. Writing commands to the device registers is done in which layers?
   A. Interrupt handlers　　C. Device-independent OS software
   B. Device drivers　　D. User-level I/O software
8. “Device independence” means
   A. that devices are accessed dependent of their model and types of physical

device.

B. systems that have one set of calls for writing on a file and the console (terminal) exhibit device independence.

C. that files and devices are accessed the same way, independent of their physical nature.

D. None of the above

9. The purpose of the open file call is to _____.
   A. search for the specified file in main memory
   B. copy the specified file into main memory
   C. search for the directory of the file in storage medium
   D. fetch the directory of the file into main memory
10. As for MS-DOS/Windows system, the attributes of file are stored in_____.
   A. file B. directory C. directory entry D. i-node

二、填空题(共 10 分，每空 1 分)

1. Operating systems can be viewed from two viewpoints: _____ and _____.
2. If we implement thread in kernel space, _____ (process or thread) is a basic unit of CPU utilization.
3. The initial value of the semaphore S is 2. If the current value is -1, then there are _____ (how many) processes waiting.
4. _____ scheduling algorithm can deal with the urgent process in time.
5. 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 system, an 11-bit second page table field, and an offset. Each page is _____ bytes. And there are _____ (how many) pages in the address space.
6. Disk requests come in to the disk driver for cylinders 10, 22, 20, 2, 40, 6, and 38, in that order. The arm is initially at cylinder 20. A seek takes 6 msec per cylinder moved. How much seek time is needed for Elevator algorithm (initially moving upward)? _____ ms; And how much seek time is needed for Closest cylinder next algorithm? _____ ms
7. With _____ links, only the true owner of the file has a pointer to the i-node.

三、简答题(共 20 分，每题 5 分)

1. Please describe the difference between a process and a program.
2. Describe the concept of the critical resource and critical region, and give an example for them each.
3. Will Resource Allocation Graph with a cycle lead to deadlock? Why?
4. How many disk operations are needed to fetch the i-node for the file /usr/ast/workspace/mp1.tar? Why? Assume that the i-node for the root directory is in memory, but nothing else along the path is in memory. Also assume that all directories fit in one disk block.

四、综合题(共 50 分)

1. (12 分)There are 32 pages in the user space of virtual storage. Each page is 1K bytes size. And the computer has 16K bytes main memory.
   (1) How many bits are needed to describe logical address space?
   (2) How many bits are needed to describe physical address space?
   (3) Assume one instance that the page 0, 1, 2, 3 was respectively loaded into frame page 5, 10, 4, 7, please calculate the physical address of the logical address 2,652 and 1,340(Decimal).

2. (14 分) One tunnel, which is very narrow, allows only one passenger to pass once, Please using semaphores to realize the following situation:
   The passengers at one direction must pass the tunnel continuously. Another direction's visitors can start to go through tunnel when no passengers want to pass the tunnel from the opposite direction.

3. (12 分)Basing on the Banker's Algorithm，if exists the following allocation：

Process	Allocation				Need				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P1	0	0	3	2	0	0	1	2	1	6	2	2
P2	1	0	0	0	1	7	5	0				
P3	1	3	5	4	2	3	5	6				
P4	0	3	3	2	0	6	5	2				
P5	0	0	1	4	0	6	5	6				

   Please answer：
   (1) Is state safe?
   (2) If P3 Requests Resources (1,2,2,2)，should system meet the demand and allocate them to it?

4. (12 分) In a batch system，the arrival time and burst time of three jobs are listed in following table (time unit: hour in decimal), if schedule with FCFS and SJF Algorithm respectively:

Job	Arrival time	Burst time
1	10.00	2.00
2	10.10	1.00
3	10.25	0.25

   (1) Please calculate start time and finish time of each job.
   (2) Calculate average Turnaround Time.

选择题(共 20 分，每题 2 分)

NO.	1	2	3	4	5	6	7	8	9	10
answer	A	D	B	B	C	C	B	C	D	D

五、填空题(共 10 分，每空 1 分)

1. Extended Machine(扩展机器)，Resource Manager(资源管理者)
2. thread
3. 1
4. Priority(优先级)
5. 4K，2^{20}
6. 348ms，360ms
7. symbolic(符号)

六、简答题(共 20 分，每题 5 分)

1. 答：进程是具有独立功能的程序关于某个数据集合的一次运行活动，是系统进行资源分配和调度的独立单位。程序是指令的有序序列。进程与程序的区别：
   - 进程是动态的，程序是静态的；
   - 进程是短暂的，程序可以永久保存；
   - 进程与程序之间不具有一一对应关系：一个程序可以对应一个进程，也可以对应多个进程；一个进程可以对应一个程序，或者对应一段程序；
   - 进程可以创建子进程。

2. 答：临界资源：一次仅允许一个进程访问的资源。如：硬件资源：输入机、打印机等；软件资源：共享变量、表格、队列、文件等。
   临界区：访问临界资源的程序段。假设 a 为共享变量，则访问 a 的那段程序就是临界区。如：a:=a+1; print(a);
3. 答：不一定。
   如果每个资源只有一个资源实例，则有环路的资源分配图会导致死锁；
   如果每个资源有多个资源实例，则有环路的资源分配图可能、但不一定会导致死锁。

4. ① directory for /
   ② i-node for /usr
   ③ directory for /usr
   ④ i-node for /usr/ast
   ⑤ directory for /usr/ast
   ⑥ i-node for /usr/ast/workspace
   ⑦ directory for /usr/ast/workspace
   ⑧ i-node for /usr/ast/workspace/mp1.tar
   In total, 8 disk reads are required.

七、综合题(共 50 分)

1. 解：

(4) 用户空间的大小为 32×1KB=32KB，所以需要 15 位逻辑地址。

(5) 内存空间的大小为 16KB，所以需要 14 为物理地址。

(6) 页表如下：

页号	块号
0	5
1	10
2	4
3	7

- $(2652)_{10}=(000,1010,0101,1100)_2$，后 10 位为页内偏移量(offset)，前 5 位 00010 为虚页号 2，查页表知，该页装入到内存第 4 页，故实页号为 0100，与后 10 位页内偏移量拼接形成物理地址为：$(01,0010,0101,1100)_2=(125C)_{16}=(4700)_{10}$
- $(1340)_{10}=(000,0101,0011,1100)_2$，后 10 位为页内偏移量(offset)，前 5 位 00001 为虚页号 1，查页表知，该页装入到内存第 10 页，故实页号为 1010，与后 10 位页内偏移量拼接形成物理地址为：$(10,1001,0011,1100)_2=(293C)_{16}=(10556)_{10}$

2. 解：将隧道的两个方向标记为 A 和 B；

(1) 设置信号量 AB 和 BA，分别表示轮到哪个方向的行人过隧道，初值都为 1；

设置 mutex 用来实现两个方向的行人对隧道的互斥使用。

A 方向的行人：	B 方向的行人：
P(AB)；	P(BA)；
P(mutex)；	P(mutex)；
通过隧道；	通过隧道；
V(mutex)；	V(mutex)；
V(BA)；	V(AB)；

(2)

用变量 countA 和 conutB 表示 A 和 B 方向上已经在隧道中的行人数目，初值为 0；

再设置三个互斥信号量，初值都为 1：

- SA 实现对 countA 互斥修改
- SB 实现对 countB 变量的互斥修改
- mutex 用来实现两个方向的行人对隧道的互斥使用

A 方向的行人：

```
P(SA);
If(countA=0) then P(mutex);
countA=countA+1;
V(SA);
    通过隧道；
P(SA);
countA=countA-1;
If(countA=0) then V(mutex);
V(SA);
```

B 方向的行人：

```
P(SB);
If(countB=0) then P(mutex);
countB=countB+1;
V(SB);
    通过隧道；
P(SB);
countB=countB-1;
If(countB=0) then V(mutex);
V(SB);
```

3. 解：

(3) 该状态是安全的。

- (1,6,2,2)>(0,0,1,2)，先满足 P1 的请求，执行完毕后回收 P1 资源(0,0,3,2)，则可用资源变为(1,6,5,4)；
- (1,6,5,4)>(0,6,5,2)，可满足 P4 的请求，执行完毕后回收 P4 资源(0,3,3,2)，则可用资源变为(1,9,8,6)；
- (1,9,8,6)>(0,6,5,6)，可满足 P5 的请求，执行完毕后回收 P5 资源(0,0,1,4)，则可用资源变为(1,9,9,10)；
- (1,9,9,10)>(1,7,5,0)，可满足 P2 的请求，执行完毕后回收其资源(1,0,0,0)，则可用资源变为(2,9,9,10)；
- (2,9,9,10)>(2,3,5,6)，可满足 P3 的请求，执行完毕后回收其资源(1,3,5,4)，则可用资源变为(3,12,14,14)，即为资源总量。

存在一安全序列：{P1,P4,P5,P2,P3}，故该状态是安全的。

(4) 当前可用资源(1,6,2,2)大于进程 P3 提出的请求(1,2,2,2)，若满足 P3 的资源请求，则可用资源变为(0,4,0,0)，资源分配情况变为：

Process	Allocation				Need				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P1	0	0	3	2	0	0	1	2	**0**	**4**	**0**	**0**
P2	1	0	0	0	1	7	5	0				
P3	**2**	**5**	**7**	**6**	**1**	**1**	**3**	**4**				
P4	0	3	3	2	0	6	5	2				
P5	0	0	1	4	0	6	5	6				

检查此刻是否为安全状态：可用资源(0,4,0,0)不能满足任何一个进程的Need请求，故此状态为不安全状态，故不能将P3请求的资源分配给它。

4.

(1)

作业	提交时间	执行时间	FCFS			SJF		
			开始时间	完成时间	周转时间	开始时间	完成时间	周转时间
1	10.00	2	10.00	12.00 ①	2.0	10.00	12.00 ①	2.0
2	10.20	1	12.00	13.00 ②	2.8	12.80	13.80 ④	3.6
3	10.40	0.5	13.00	13.50 ③	3.1	12.30	12.80 ③	2.4
4	10.50	0.3	13.50	13.80 ④	3.3	12.00	12.30 ②	1.8

(2) 平均周转时间：

- FCFS法的平均周转时间为：(2.0 + 2.8 + 3.1 + 3.3) / 4 = 2.8小时

SJF法的平均周转时间为：(2.0 + 3.6 + 2.4 + 1.8) / 4 = 2.45小时