武汉大学计算机学院

2019——2020 学年第二学期

《 操作系统 》考试试卷 A

（**Note: all answers must be written on the answer sheet，the words written on the test paper are invalid**）

（注：所有解答必须写在答题纸上，写在试卷上的无效）

一、Suppose there are 5 jobs, their arrival time and running time as shown in the table below. In a single program system, try to answer：(Required to write a simple calculation process, time unit minute, decimal calculation, 14 points)

(1)If the first-come-first-served scheduling algorithm is adopted, what is the scheduling order of jobs? What is the average turnaround time?

(2)If the short-job priority scheduling algorithm is adopted, what is the scheduling order of the jobs? What is the average turnaround time?

　　假设有 5 道作业，它们的到达时间与运行时间如下表所示。在单道程序系统中，试回答下述问题：（**要求写出简单的计算过程，时间单位分钟，采用十进制计算，14分**）

（1）采用先来先服务调度算法，作业的调度顺序是什么？平均周转时间是多少？

（2）采用短作业优先调度算法，作业的调度顺序是什么？平均周转时间是多少？

Job name	arrival time	running time (minute)
A	8:00	50
B	8:20	30
C	8:40	15
D	9:00	5
E	9:30	20

二、The resource allocation state of a system at time T is shown in the following table. (Write a simple process, 14 points)

(1) Find the value of the need matrix at time T.

(2) If available at time T is (0, 3, 0, 1), is the system state safe?

(3) If the system is safe at time T, what is the minimum number of resources available?

　　某系统在 T 时刻的资源分配状态如下表所示。（**要求写出简单分析过程，14 分**）

resource process	Max				Allocation			
	R1	R2	R3	R4	R1	R2	R3	R4
P1	5	1	1	7	3	0	1	4
P2	3	2	1	1	2	2	1	0
P3	3	3	2	1	3	1	2	1
P4	4	6	1	2	0	5	1	0
P5	6	3	2	5	4	2	1	2

（1）求出 T 时刻的需求矩阵值。

（2）若 T 时刻 available 为（0,3,0,1），此时系统状态是否安全？

（3）若 T 时刻系统状态安全，则可用资源的最小数目是多少？

三、Consider the following page table:

The page size is 1KB, the memory access time is 100ns, the TLB access time is 10ns. Assume that the TLB is accessed first during address translation, and then the page table is accessed if the page number is not in the TLB (ignoring the TLB update time).Please answer: (with a simple process, 14 point)

(1) What is the page number of logical address 2362? What is the physical address?

(2) How long does it take to access the instruction or data at the logical address 1565?

(3) If the hit rate of the TLB is 80%, what is the effective access time of the memory?

假设页表内容如下表所示：

Page number	Frame number	In TLB
0	4	true
1	13	false
2	8	true
3	20	false

页面大小为 1KB，一次内存的访问时间是 100ns，一次快表的访问时间是 10ns。假设地址转换时先访问快表，若快表未命中再访问页表（忽略快表更新时间），请问；（**给出简单过程，14 分**）

（1）逻辑地址 2362 的页号是多少？物理地址是多少？

（2）访问逻辑地址 1565 中的指令或数据需要多少时间？

（3）若快表命中率为 80%，内存有效访问时间是多少？

四、File f has 9 records A, B,..., I, they are stored on the same track, and each record size is equal to sector size. The program p processes the 9 records sequentially which reads one record from disk at a time, then processes the record in 3 ms, and then reads the next record for processing until all 9 records are processed. Each track of the disk is divided into 9 sectors, the disk rotates at 36 ms per revolution and the head stops at the beginning of the record A. Answer: (14 points, write the calculation process)

(1) What are the physical structures of a file?

(2) When the 9 records are stored sequentially on this track, how long does it take to read and process these 9 records?

(3) How to optimize the storage order of records to reduce the time of reading and processing? How long will it take to read and process the 9 records after optimization?

文件 f 有 9 个记录 A、B、...、I 存放在同一个磁道上，每个记录大小与扇区大小相等。程序 p 顺序处理这 9 个记录，p 每次请求从磁盘上读一个记录，然后对读出的记录花 3 毫秒的时间进行处理，以后再读下一个记录进行处理，直到 9 个记录全部处理结束。磁盘的每个磁道分成 9 个扇区，磁盘转速为 36 毫秒/转，磁头停在文

件的 A 记录开始处。回答：（**14 分，要求写出计算过程**）

（1）文件的物理结构有哪几种？

（2）当这 9 个记录在此磁道上依次顺序存放时，读出并处理这 9 个记录的时间是多少？

（3）如何优化记录的存放顺序来减少读出并处理的时间？优化后读出并处理 9 个记录的时间是多少？

五、Consider the following page reference string:4, 2, 3, 1, 2, 5, 3, 4, 1, 3, 5, 2, 0, 3, 4. Assuming demand paging with 4 frames(initially all empty), how many page faults would occur for the following replacement algorithms?（need to give the replacement process,12 point）

(1) FIFO replacement

(2) LRU replacement

(3)Clock replacement

考虑下述页面引用串 4、2、3、1、2、5、3、4、1、3、5、2、0、3,、4。假设请求分页系统使用 4 个物理块（初始时为空），下述页面置换算法会产生多少次缺页？（**要求给出置换过程，12 分**）

（1）FIFO 置换算法

（2）LRU 置换算法

（3）时钟置换算法

六、A file occupies 8 disk blocks, now the file disk block is to be read one by one into the main memory buffer, and be send to the user area for analysis. Assuming that a buffer is the same size as a disk block, it takes 80μ s to read a disk block into the buffer, 20μ s to transfer the buffer data to the user area, and 50μ s for the CPU to analyze a block of data. Please answer: (12 point, write the calculation process)

(1) What are the three reasons for introducing buffers in I/O systems?

(2) How long will it take to read in and analyze the file when using the single buffer?

(3) How long will it take to read in and analyze the file when using the double buffer?

某文件数据占有 8 个磁盘块，现要将该文件数据逐个读入主存缓冲区，并送到用户区进行分析。假设一个缓冲区与一个磁盘块大小相同，把一个磁盘块读入缓冲区的时间为 80μ s，将缓冲区的数据传送到用户区的时间是 20μ s，CPU 对一块数据进行分析的时间是 50μ s。试问（**12 分，写出简单计算过程**）：

（1）I/O 系统中引入缓冲区的 3 个原因是什么？

（2）使用单缓冲区时，读入并分析完该文件的时间是多少？

（3）使用双缓冲区时，读入并分析完该文件的时间是多少？

七、There are 3 employees in an optical shop responsible for producing glasses. A pair of glasses is assembled from two lenses and a frame. There is a workbench with N positions (N≥3) for placing lenses or frames, and only one lens or frame can be placed in each position. Staff 1 is responsible for processing the frame. After finished processing a frame, he puts it on the workbench, and then repeats this process. Staff 2 is responsible for processing the lenses. After each lens is finished, he puts it on the workbench and then repeats this process. Staff 3 is responsible for assembling glasses.

He takes 2 lenses and 1 frame from the workbench to assemble the glasses, and sends the assembled glasses to the warehouse and then continue the glasses assembly processing. Try：(10 point)

(1) Describe the functions of P and V operations of semaphores.

(2) Use P and V to implement the cooperation program of three employees.

　　某眼镜店有 3 个职员负责生产眼镜，一副眼镜由两个镜片及一个镜架组装而成。眼镜店里有一个工作台，工作台上有 N 个位置(N≥3)用于放置镜片或镜架，且每个位置只能放一个镜片或镜架。职员 1 负责加工镜架，他每加工完一个镜架后，就将其放到工作台，然后重复这一生产过程；职员 2 负责加工镜片，他每加工完一个镜片后，就将其放到工作台上，然后重复这一生产过程；职员 3 负责组装眼镜，他从工作台上取 2 个镜片及 1 个镜架组装成眼镜，将组装好的眼镜送到仓库后继续组装眼镜。试：（10 分）

　　（1）描述信号量 P、V 操作的功能。

　　（2）用 P、V 操作实现三个职员的合作。

八、(1)What requirements should be met to solve the critical section problem?

(2)The following algorithm is used to solve the critical section problem, determine whether it meets the above requirements and explain the reasons. (10 point)

　　（1）解决临界区问题应该遵循哪些条件？

　　（2）以下算法用于解决临界区问题，判断其是否满足上述条件并说明理由。（10 分）

```
enum bool {false, true};
bool mark[2]={false, false};
int order=0;
T0( )
{   do {   mark[0]=true;
            while (order==1)
              {   while (mark[0]);
                  order =0;
              }
            mark [1]=false;
            critical section;
        }   while    (true)
}
T1( )
{   do {   mark[1]=true;
            while (order==0)
              {   while (mark[1]);
                  order =1;
              }
            mark [0]=false;
            critical section;
        }   while    (true)
}
```