北京邮电大学 2019——2020 学年第一学期

《操作系统》期中考试试题

考试注意事项	一、书本、参考资料、书包等物品一律放到考场指定位置。 二、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。 三、第一题须用英文应答，中文答对得一半分。

课程	操作系统			考试时间		2019 年 11 月 15 日			
题号	一	二	三	四	五	六	七	八	总分
满分	10	10	20	20	20	20			
得分	7	7	17	20	14	20			80
阅卷教师									

一、FILL IN BLANKS (1 point * 10)

1. Programming interface provided by operating system is system call.
2. Two execution modes in operating systems are user mode and kernel mode.
3. The five basic states of processes are new,ready, running, waiting and terminated.
4. Each process is represented in the operating system by a PCB. In Unix, a process can be created with the function call ~~create~~ fork( ).
5. There are 4 processes P_1, P_2, $P_3$and P_4, their CPU-burst time are 2, 6,5 and 3 minutes. Assume they arrive at the same time, running on the same processor in single programming method; running sequence P_1、P_4、P_3、P_2 will have the least average turnaround time.

6. The necessary and sufficient conditions for deadlock are mutual exclusion , hold and wait, no preemption and ~~circular~~ circual wait (循环等待)
7. An interrupt is a signal generated by a prepherial device(e.g, an I/O device) . ~~PCB~~ Intemupte vector contains the addresses of all the service routines for interrupts.
8. The value of a semaphore specifies some meaning, if it is greater than or equal to zero, the value stands for the number of accessiable resource for process
9. Cooperating processes require an ~~communication~~ communication mechanism that will allow them to exchange data and information.
10. It requires an associated monitor process Tinklist for semaphore implementation with no busy waiting .

二、Select the best answer for each blank (1 point * 10)

1. Contents of interrupt vector are C .
   A. begin address of sub-programs
   B. begin addresses of interrupt handling programs
   C. the address of begin addresses of interrupt handling programs
   D. begin address of handling programs

2. Deadlock avoidance is implemented by C .
   A. providing sufficient resources
   B. controlling proper sequence of processes progress
   C. destroying one of the 4 necessary and sufficient conditions
   D. preventing system enter into unsafe state

3. In multiprogramming system, in order to guarantee the integrality of shared variable, processes should enter their critical section mutual exclusively. Critical section refers to D .
   A. a buffer
   B. a data segment
   C. synchronous mechanism
   D. a code segment

4. In multiprogramming system, in order to guarantee the integrality of shared variable, processes should enter their critical section mutual exclusively. Critical section refers to ___D___.
   A. a buffer B. a data segment
   C. synchronous mechanism D. a code segment

5. In the following , ___D___ is not one of the conditions which should be satisfied for a good solution to critical section problem.
   A. mutual exclusion B. progress
   C. bounded waiting D. fairness

6. In a(n) ___A___ temporary queue, the sender must always block until the recipient receives the message.
   A. zero capacity B. variable capacity
   C. bounded capacity D. unbounded capacity

7. Deadlock is mainly caused by ___A___ and wrong sequence of processes progress.
   A. improper resource allocation B. using mutexes for critical sections
   C. improper job scheduling D. improper process scheduling

8. (C) Which of the following migrations is impossible?
   A. running→ready B. running→waiting
   C. waiting→running D. running→terminate

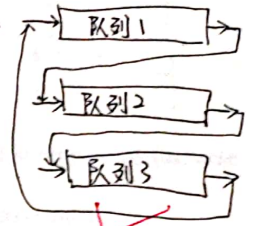
9. ___D___ is the number of processes that are completed per time unit.
   A. CPU utilization B. Response time
   C. Turnaround time D. Throughput

10. Both Linux and Solaris 10 use the ___D A___ mehod for the correspondence between user threads and kernel threads.
   A. One-to-One B. Many-to-One
   C. One-to-Many D. May-to-Many

三、Essay question (20 points)

1. (5 points) Please explain the principles of the multiple feedback queue scheduling algorithm.

答：多级反馈队列调度算法规则：



①按照大的优先级分为多组等待队列，不同组队列的优先级具有绝对差距。将不同的进程分类（如系统、用户等）分别入不同的队列等待CPU资源。

②允许进程在不同的队列间转换，从而改变进程的优先级。

③

2. (5 points) Some atomic machine instructions support mutual exclusion effectively. Define a procedure to make exclusion with instruction SWAP for two boolean variables.

答：

```
boolean lock = False;
do{
    boolean key = TRUE;
    while (swap(&lock, &key));
        //临界区;
    lock = False;
} while (1);
```

3. (5 points) Describe the priority inversion problem in the realtime system with an example.

答：在实时系统中，会出现用户过多而导致响应时间过长。

为进程 priority 分配不均会引起饿死现象。

嵌入式系统、对。

4. (5 points) Explain the implementation of conditional variables with "signal and continue"(P.B Hanson Semantics).

答：条件变量，其中 signal 的方法是将当前一个挂起的进程

唤醒。

四、(20 points) Given processes as following:

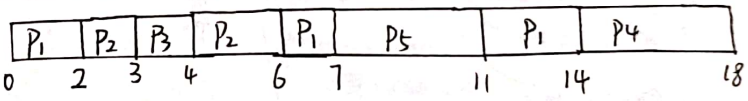
process	Arrival time	priority	CPU burst time
P1	0	3	6
P2	2	1	3
P3	3	0	1
P4	5	4	4
P5	7	2	4

1) Suppose the priority-based preemptive scheduling is employed (assume that low numbers represent high priority).
Draw a Gantt chart illustrating the execution of these processes.
Calculate the average waiting time and the average turnaround time.

2) Suppose the non preemptive SJF scheduling is employed.
Draw a Gantt chart illustrating the execution of these processes.
Calculate the average waiting time and the average turnaround time.

3)Suppose the FCFS scheduling is employed.
Draw a Gantt chart illustrating the execution of these processes.
Calculate the average waiting time and the average turnaround time.

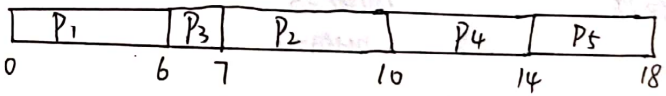
解：(1)



平均等待时间 = (14+6+4+18+11-6-3-1-4-4-0-2-3-5-7)/5 = 3.6

平均周转时间 = (14+6+4+18+11-0-2-3-5-7)/5 = 7.2

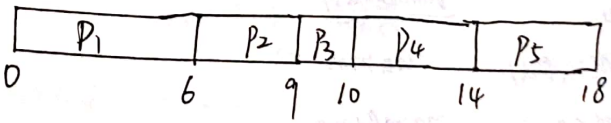
(2)



平均等待时间 = (6+7+10+14+18-0-2-3-5-7-18)/5 = 4.0

平均周转时间 = (6+7+10+14+18-0-2-3-5-7)/5 = 7.6

(3)



平均等待时间 = (6+9+10+14+18-0-2-3-5-7-18)/5 = 4.4

平均周转时间 = (6+9+10+14+18-0-2-3-5-7)/5 = 8.0

+14

五. (20 points) Consider a producer-consumer problem for a coke machine （可乐机） that has 10 slots. The producer is the delivery person and the consumer is the students using the machine. The producer can put one cup of coke each time, and a student can get one cup of coke. At each moment, at most one person can get or put the cups of coke, i.e., these processes access the cups mutual exclusively.

(1) Write a program to synchronize producer processes and consumer processes by using three semaphores.

(2) If the delivery person can at most four cups, and a student can get one or two cups of coke, write a program to synchronize the procedures. (A random function rand() to generate random integer can be used.)

解：(1) Semaphores:

M_mutex=1; //控制机器只能一个人使用

empty=0; //控制架子空出的数量

full=10; //控制架子满出的数量

wait(mutex)

wait(cup_mutex)

if((10-cup)>4)

cdown=4

cdown+=4