题号	1	2	3	4	5	6	总分
满分	10	10	20	20	20	20	
得分							

说明：第 1 题须用英文应答，中文答对得一半分。

1. FILL IN BLANKS (10 points)

(1) Modern operating system is driven by _____.

(2) A _____ is a software-generated interrupt caused either by an error or by a specific request from a user program that an operating system service be performed.

(3) Considering OS interfaces, an application program can utilize _____to acquire services provided by the OS.

(4) The instruction that can only be executed by Operating System is called _____ instruction.

(5) Programs loaded into and executing in memory refers to _____. It needs certain resources, including CPU, memory, files, and I/O devices to accomplish its task.

(6) The most 3 basic states of processes that resident in memory are ready , running, and _____ .

(7) When CPU executes the instructions of operating systems, it is said that CPU is in _____ mode.

(8) Two communication methods between processes are shared memory and _____.

(9) Operations on semaphores are initialization、wait() , and _____ 。

(10) 3 conditions that a good solution for critical section problems should satisfy are Mutual Exclusion, Progress , and _____ .

2. CHOICE (10 points) please note：write all answers in the following table.

(1) _____ is not included in the context of process?

A. code B. PCB C. interrupt vector D. kernel stack

(2) Among the following migrations, _____is impossible?

A. running→ready B. running→waiting

C. waiting→running D. running→terminate

(3) When does a process migrate from waiting state to ready state?_____

A. time slice is used up B. process is selected by scheduler

C. event that the process is waiting for occurs D. the process is waiting for an event

(4) A starvation-free scheduling policy guarantees that no process waits indefinitely for service. Which of the following scheduling policies is starvation free? _____

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

(5) _____is the interval from the time of submission of a process to the time of completion.

A. Turnaround time B. Response time C. Throughput D. Waiting time

(6) In multiprogramming system, in order to guarantee the integrality of shared variable, processes should enter their critical section mutual exclusively. Critical section refers to _____.

A. a buffer B. a data segment C. synchronous mechanism D. a code segment

(7) 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 it's value is 2, how many processes is or are waiting in the queue relevant to S. _____

A. 3 B. 2 C. 1 D. 0

(8) Which handling procedures of the following situations will not switch into monitor mode?_____

A. traps B. interrupts C. procedure calls D. system calls

(9) A deadlock situation can arise if the four necessary conditions hold simultaneously in a system. Which one of the following is not the necessary conditions? _____

A. mutual exclusion B. hold and wait C. preemption D. circular wait

(10) In the following comments on processes and threads, only _____ are correct.

① When a process switches from the waiting state to the ready state, as the result of I/O completion, the CPU scheduling may take place.

② In a system with the operating system supporting kernel-level threads, the process is the basic unit for resources allocation, while the thread is the basic unit for CPU scheduling.

③ For several threads created by one process, one of them's stack and register can be shared by the others.

④ The round robin algorithm will not result in process starvation.

⑤ UNIX is the operating system of micro-kernel structure.

⑥ PCB contains the process state, the program counter, CPU registers, and user data.

A. ① ② ③ B. ① ② ④ C. ① ③ ⑤ D. ② ④ ⑥

3. ESSAY QUESTIONS (20 points)

(1) (6 points) Please list the three classic problems of process synchronization described in the text book.

(2)（6 points）There are 10 processes sharing a type of resource based on a semaphore *S*, if each time,

(a) only one process is permitted to enter its critical section to use the resource, or

(b) at most 3 processes are allowed to enter their critical sections to use the resource,

Then in these two cases, what are the initial, maximum, and minimum values for the semaphore *S* respectively?

Answer：

	initial value	maximum value	minimum value
(a)			
(b)			

(3)（8 points）A computer system has one *CPU*, one *input processor* and one *printer*. Processes A and B enter the system sequentially, and A is scheduled by the CPU scheduler at first. The execution tracks of A and B are as follows:

A: CPU burst lasting 20ms, then I/O burst of 100ms on the *input processor*, and then CPU burst lasting 40ms, exiting.

B: CPU burst lasting 40ms, then I/O burst of 70ms on the *printer*, and then CPU burst lasting 50ms, exiting.

Answer the following questions:

(a) Suppose that FCFS scheduling algorithm is employed, draw the Gantt chart to describe the resource usage of A and B on the *CPU*, the *input processor* and the *printer*.

(b) Calculate the waiting time and turnaround time for process A and B respectively.

4. (20 points) Consider the following set of processes, their arrival time, CPU burst time, and priority numbers are as following.

The length of the CPU burst given in millisenconds, and larger priority numbers imply higher priority.

Process	Arrival Time	Burst Time	Priority number
P1	0	5	1
P2	1	3	3
P3	2	3	7
P4	4	6	5

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

(a) Draw a Gantt chart illustrating the execution of these processes;

(b) Calculate the average waiting time.

(c) Calculate the average turnaround time.

(2). Suppose that priority-based non-preemptive scheduling is employed,

(a) Draw a Gantt chart illustrating the execution of these processes;

(b) Calculate the average waiting time.

(c) Calculate the average turnaround time.

5. (20 points) There is a plate that can hold only one apple or three oranges. Father put an apple once a time into the plate; mother put an orange once a time into the plate.

If there is one or two orange on the plate, another two or one oranges are allowed to be put into the plate.

Son takes an apple from the plate and eats. Daughter takes an orange from the plate once a time and eats.

The processes for the father, mother, son, and daughter are shown as followings.

In order to synchronize these processes, please design semaphores and complete these processes by using wait and signal operations on semaphores.

(1) Define semaphores needed and initialize them.

(2) Write appropriate code segmentation for each process.

6. (20 points) For the system described in the table below

process	Current allocation			Maximum needs			outstanding requests			Available		
	R_1	R_2	R_3	R_1	R_2	R_3	R_1	R_2	R_3	R_1	R_2	R_3
P_1	2	0	0	2	0	1	0	0	1	0	2	0
P_2	1	2	0	2	5	2	0	0	1			
P_3	0	1	1	1	4	2	0	0	0			
P_4	0	0	1	2	0	1	1	0	0			

(1) How many instances are there for each type of resources?

(2) Draw the resource-allocation graph

(3) Is the system in a safe or unsafe state? Specify your judging procedure.

(4) Is the system deadlocked? Specify your judging procedure.