國立交通大學 96 學年度碩士班考試入學試題

科目：作業系統(1005)　　考試日期：96 年 3 月 17 日 第 3 節

系所班別：資訊學院聯招　　組別：資訊聯招　　第 1 頁，共 5 頁

＊＊作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符!

共八大題，請按題號依序作答，未按題號作答者不予給分。

一、單一選擇題，共四大題，每一大題三小題，每一小題答對給五分，答錯倒扣兩分

1. Processes, Threads, and CPU Scheduling

1.1 Which of the descriptions about the following C program forking a process is correct?

```
1. #include <stdio.h>
2. int main(int argc, char *argv[]){
3.   int pid = fork();
4.   if (pid <0) {
5.      fprintf(stderr, "Fork Failed");
6.      exit(-1);
7.   } else if (pid ==0) {
8.     execlp("/bin/csh","csh",NULL);
9.   } else {
10.    wait(NULL);
11.    exit(0);
12.  }
13. }
```

(a) the statement of line 8 will be executed by the parent process

(b) the fork system call will destroy the memory image of the original program

(c) the child process consists of a copy of address space of the original process right after its creation

(d) none of the above

1.2 Which of the following is correct for the multithreaded C program using the Pthread API below?

```
#include <pthread.h>
#include <stdio.h>
int sum;
void *runner(void *param);
main(int argc, char *argv[]) {
   pthread_t tid;
   pthread_attr_t attr;
   if (argc !=2 ) return -1;
   if (atoi(argv[1])<0) return -1;
   pthread_attr_init(&attr);
   pthread_create(&tid, &attr, runner, argv[1]);
   pthread_join(tid,NULL);
   printf("sum = %d\n", sum);
}
void *runner(void *param) {
  int i, upper = atoi(param);
  sum = 0;
  for (i=1; i <= upper; i++) sum += i;
  pthread_exit(0);
    }
```

(a) Pthread is a kind of kernel threads

(b) two threads share the same address space

(c) the value of "sum" will depend on the execution sequence of the two threads

(d) none of the above

1.3 Suppose the Linux scheduler chooses the process with the most credits to run, and if no runnable processes can be chosen, the recrediting operation is performed according to the following rule for every process in the system:

credits = credits/2 + priority

For each time slice, currently running process will lose one credit. When the credits reach zero, it is suspended. According to the above description, which of the following statements is correct?

(a) this credit system gives high priority to CPU-bound processes

(b) the scheduling will exhibit short response time

(c) interactive processes will receive fewer credits than non-I/O bound processes

(d) none of the above

2. Process Synchronization and Deadlocks

2.1 Consider a system consisting of three processes, P_0, P_1, and P_2, each accessing three semaphores, A, B, C, set to the value 1:

P_0	P_1	P_2
wait(A)	wait(C)	wait(A)
wait(B)	wait(B)	…
wait(C)	wait(A)	signal(A)
…	…	wait(B)
signal(C)	signal(A)	…
signal(B)	signal(B)	signal(B)
signal(A)	signal(C)	wait(C)
		…
		signal(C)

The system

(a) always has deadlocks

(b) has a race condition

(c) is always in safe state

(d) none of above

2.2 Which of the following statement is NOT correct?

(a) most operating systems ignore the deadlock problem

(b) most operating systems ignore the race condition problem

(c) the critical-section problem could be solved by disabling interrupts while accessing a shared variable in a uniprocessor environment

(d) priority inversion never occurs for a system without any shared variables

2.3 Consider a system with five processes P_0 through P_4 and five resource types A, B, C, D. Suppose that, at time T_0, the following snapshot of a system has been taken:

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P_0	0	0	1	2	0	0	1	2	1	5	2	0
P_1	1	0	0	0	1	7	5	0				
P_2	1	3	5	4	2	3	5	6				
P_3	0	6	3	2	0	6	5	2				
P_4	0	0	1	4	0	6	5	6				

Which of the following statement is NOT correct?

(a) The system is in a safe state. The sequence <P0, P2, P1, P3, P4> satisfies the safety criteria

(b) The system is in a safe state. The sequence <P0, P2, P4, P3, P1> satisfies the safety criteria

(c) If a request from process P1 arrives for (0,4,2,0), the request can be granted immediately

(d) If a request from process P2 arrives for (1,0,0,0), the request cannot be granted immediately

3. Memory Management

3.1 Paging has been popularly used in memory management. Consider the terms: (A) possibility of shared memory (B) avoidance of internal fragmentation (C) dynamic memory allocation (D) variable-sized segments. Which one is true?

(a) (A)(C) are advantages of paging

(b) (C)(D) are advantages of paging

(c) (B) is an advantage of paging

(d) None of the above

3.2 In a paging system with two-level page tables, suppose that the hit ratio is 80% and it takes 10 ns to search the TLB (translation look-aside buffer) and 100 ns to access memory. What is the effective memory-access time?

(a) 130 ns

(b) 160 ns

(c) 180 ns

(d) None of the above

3.3 Suppose a demand-paging system with the following time-measured utilizations:

CPU utilization 15%　　Paging disk 98%　　Other I/O devices 4%

Which modification will improve the CPU utilization?

(a) Install a faster CPU

(b) Install more main memory

(c) Install a bigger paging disk

(d) Increase the degree of multiprogramming

4. File Systems and I/O

4.1 Consider a collection of disk requests with arbitrary arrival times. Which one of the following disk scheduling algorithms always completes all requests with the shortest total seek time?

(a) Short-seek-time-first

(b) SCAN

(c) LOOK

(d) none of the above

4.2 Consider a RAID-5 disk array of 4 disks. Let reads of data and parity be absorbed by cache. If there is no disk left idle, what are the largest number and the smallest number of stripe blocks that can be written in parallel?

(a) 3 and 2

(b) 4 and 1

(c) 4 and 2

(d) non of the above

4.3 In Linux, which data structure(s) must be stored on disks?

(a) the super block

(b) inodes

(c) both of them

(d) none of them

二、問答題，共四大題，每題十分

5. Each process will run in the sequence of the listed amount of time interleaved with CPU and I/O burst in the following table:

Process	Arrival Time	Priority	CPU and I/O Burst sequence
P1	0	3	1(CPU),3(I/O),3(CPU),1(I/O),2(CPU)
P2	3	2	2(CPU),1(I/O),1(CPU),1(I/O),1(CPU)
P3	2	1	1(CPU),2(I/O),6(CPU)
P4	1	4	2(CPU),1(I/O),2(CPU),1(I/O),1(CPU)

Please consider the round-robin scheduling algorithm with different time quanta. The

context-switch time is 10 percent of the 1 time unit. Please calculate the average turnaround time with the context-switch overhead in the time quanta of 1,2,3,4, and 5 respectively. Assume the process with the highest priority will be chosen if several processes can be scheduled for running.

6. The design considerations of the solutions for solving the critical-section problem for a single-processor system are different from that for a multi-processor system. Please describe the differences and explain your answer.

7. A system provides a 2^8-byte virtual memory and its physical memory is 2^7 bytes. The virtual memory is implemented by demand paging and the page size is 2^5 bytes. Consider the following page-reference string:

   0, 1, 2, 3, 2, 5, 4, 1, 6, 4, 3, 4, 1, 6, 0, 6

   Assume that all the frames are initially empty and LRU page replacement is applied. How many page faults occur? Please draw the content of the 1-level page table after the above access sequence.

8. What is a log-structured file system, and what is a journaling file system? What are the motivations behind the two kinds of file-system implementations?