國立交通大學 99 學年度碩士班考試入學試題

科目：作業系統(1005)　　考試日期：99 年 3 月 13 日 第 3 節

系所班別：資訊聯招　　

【不可使用計算機】＊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！！

二、單一選擇題，共 15 題，每一題答對給 4 分，未答得 0 分，答錯倒扣 1.5 分。 請使用答案卡作答

1. Which one of the following is *correct*?
(a) Global variables will not be shared across threads in a multithreaded process.
(b) Multilevel queue scheduling will create several queues for processes in waiting status.
(c) The waiting time of the scheduling criteria is the sum of the periods spent waiting in the waiting queue.
(d) The shortest-job-first scheduling will give the minimum average turnaround time for a given set of processes.

2. How many processes including the original process will the following C programs with the unix system call fork() create? Suppose all fork() system calls succeed.

```
int main() {
    int i;
    for (i=0; i < 3; i++) {
        if (fork()==0) { fork(); fork();fork()}
    }
}
```

(a) 125
(b) 64
(c) 729
(d) 512

3. If a process is terminated with some exit value in the UNIX operating system, which system call in the parent process can be used to obtain the value ?
(a)wait()
(b)kill()
(c)mmap()
(d)abort()

4. Consider a two-processor system running three processes P1, P2, and P3. The processes P1 and P2 run on the first CPU, while the process P3 runs on the second CPU. All these three processes share one mutually exclusive resource. Suppose that processes never migrate from a CPU to the other one. In terms of CPU utilization and hardware cost, which one of the following design options is improper?
(a) Using interrupt disabling to synchronize processes P1 and P2.
(b) Using interrupt disabling to synchronize processes P2 and P3.
(c) Using spin locks to synchronize processes P1 and P3.
(d) None of the above.

5. Consider a multithreaded process consisting of three threads T1, T2, and T3. These three threads use five semaphores S1…S5 for synchronization. Both T2 and T3 read input data from a table T, which is protected by the semaphore S3.

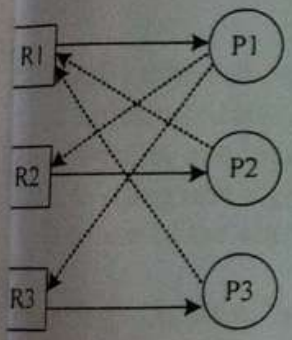
```
T1()
{
    signal(S1);
    signal(S2);
    wait(S4);
    wait(S5);
    merge results from T2 and T3
    done.
}
```

```
T2()
{
    wait(S1);
    wait(S3);
    get input data from table T
    signal(S3);
    do computation
    signal(S4);
}
```

```
T3()
{
    wait(S2);
    wait(S3);
    get input data from table T
    signal(S3);
    do computation
    signal(S5);
}
```

Which one of the following is correct?

(a) The initial value of S1 is 1.
(b) The initial value of S3 is 1.
(c) The initial values of S1, S2, S4, and S5 are different.
(d) This program is still free from race conditions after removing S3.



6. Consider the resource-allocation graph shown in the left-hand side. The resources R1, R2, and R3 have one single instance. Which one of the following statement is correct?

(a) Not all the processes are deadlocked.
(b) Killing process P2 recovers the system from all deadlocks.
(c) Killing process P1 recovers the system from all deadlocks.
(d) Increasing R1's instances to 2 resolves all deadlocks.

Which one of the following is an *Incorrect* statement about address binding?

(a) Running absolute code needs special hardware support.
(b) Relocatable code can be generated at compile time.
(c) Execution-time address binding must have special hardware support.
(d) Running relocatabe code does not need special hardware support.

Which one of the following is a *Correct* statement about address space?

(a) Logical addresses are sent to the memory unit to fetch program/data.
(b) Physical addresses are generated by CPU during program execution.
(c) The size of logical address space need not be the same as the size of physical address space
(d) The size of physical address space rather than the size of logical address size limits the address space size of a program execution.

Which of the following is *not* a step that must occur in every page fault?
(a) Trap to the operating system
(b) Allocate the CPU to some other ready-for-execution process
(c) Perform a read operation on the disk
(d) Save the user registers and process state

0. Consider a file system on a disk that has both logical and physical block size of 128 bytes and the information about each file is already in memory. Assume it uses indexed allocation and no block data is cached. If we are currently at logical address 653 and want to access logical address 422, how many physical blocks must be read from the disk?
(a) 1
(b) 2
(c) 3
(d) 4

1. Suppose the linked allocation strategy is used in the above question, how many physical blocks must be read from the disk?
(a) 1
(b) 2
(c) 3
(d) 4

2. Which of the following statements is correct?
(a) Splitting data across disk array reduces the throughput of large data access.
(b) Writing one logical block data to a RAID-4 system of five disks requires reading four physical blocks.
(c) Writing one logical block data to a RAID-5 system of five disks requires reading five physical blocks.
(d) None of the above statement is correct.

. While using an ATM (automatic teller machine) card, the user is requested to enter his 4-digit PIN number (personal identification number), where each digit ranges from 0 to 9. A user is only allowed to make three attempts toward success. Otherwise, the ATM card will be detained. What is the chance of compromising an ATM card? Choose the following number that is nearest the solution.
(a) 0.0001
(b) 0.0002
(c) 0.0003
(d) 0.0004

. A user password of UNIX-like systems is stored in a special form in the operating system. Which term below can best describe the special form?
(a) cleartext form
(b) ciphertext form
(c) one-way hash digest form
(d) digital signature form

. Which one of the following is true?
(a) The best password is the one that is easy to remember.
(b) Buffer overflow attack is to pollute the stack region.
(c) Access Matrix is usually dense.
(d) Capability list is usually associated with a file.

一、複選題，共十題，每題全對得 4 分，答錯一個選項得 2 分，答錯兩個以上選項、或未答得 0 分。

Which item(s) is(are) shared by threads of a multi-threaded process?
(a) static local variables
(b) program text/executable binaries
(c) register values of the CPU
(d) heap memory

Which statement(s) is(are) true about CPU scheduling?
(a) The shortest-remaining-time first scheduling algorithm is nonpreemptive.
(b) Processes in the waiting status will wait for the CPU resource.
(c) The shortest-job-first algorithm can be implemented for the short-term CPU scheduling.
(d) The scheduling is preemptive if the CPU-scheduling decisions take place during the process switches from the running state to the ready state.

Which one(s) of the following can possibly resolve deadlocks?
(a) Kill some ready processes.
(b) Delete some files from the disk.
(c) Swap out some inactive processes.
(d) Increase the priories of the processes involved in deadlocks.

Consider that a system schedules three processes P1, P2, and P3 using Round-Robin with time quantum=2 units of time. These three processes arrive in the order P1, P2, and P3, all ready at time 0. The three processes share a resource R, which is protected by a mutex lock. The first process P1 runs 3 units of time, locks the resource R 3 units of time, unlocks this resource, and then runs 1 unit of time before it completes. Let this execution of P1 be denoted by {3,R(3),1}. The execution of the second process P2 and the third process P3 are denoted by {2,R(1),3} and {2,R(2),2}, respectively. Let waiting queues be FIFO. Which one(s) of the following is (are) correct?
(a) The total number of context switches is not less than 9.
(b) T2 has the longest turnaround time.
(c) Decreasing P1's execution time from {3,R(3),1} to {3,R(1),1} reduces P2's turnaround time.
(d) Increasing P1's execution time from {3,R(3),1} to {4,R(3),1} reduces P2's turnaround time.

Which statement(s) is(are) true about page replacement?
a) The optimal page-replacement algorithm can be implemented in the kernel.
b) Careful selection of data structures and programming structures can lower page fault rates.
c) When a system is thrashing, the degree of multiprogramming should be increased to increase CPU utilization.
d) For the optimal page-replacement algorithm, the page-fault rate may increase as the number of allocated frames increases.

Which statement(s) is(are) true about page tables?
a) A page table can be further paged.
b) In the inverted page table scheme, the bits of a logical page number are first inverted and then used as an index into the page table to find the corresponding frame number.
c) In the hashed page table scheme, no hash collisions are allowed.
d) None of the above.

2. Suppose that a disk drive has 200 cylinders (0 to 199). The drive is currently serving a request at cylinder 60, and the previous request was at cylinder 53. The queue of pending requests in FIFO order is: 19, 83, 31, 121, 166.
Starting from the current head position, which of the following statement(s) about the total disk-arm-movement distance (in cylinders) for all the pending requests is(are) correct?
(a) The total distances by shortest-seek-time-first (SSTF) and LOOK scheduling are the same in this case.
(b) If SCAN scheduling is applied, the total distance is 253.
(c) If C-LOOK scheduling is applied, the total distance is 265.
(d) If first-come-first-serve (FCFS) scheduling is applied, the total distance is longer than the above methods mentioned.

3. Which of the following statements about I/O is(are) correct?
(a) For short and frequent I/O, polling I/O can be more efficient than interrupt I/O.
(b) Non-blocking I/O can be implemented by block I/O system call with multithreads.
(c) When an I/O transfer completes, the correct interrupt handler receives the interrupt and moves the user process to the ready queue.
(d) Displaying high-performance graphics requires double-buffering and memory-map I/O.

4. Access Control Matrix is normally sparse, and therefore UNIX (Linux) uses permission bits to control users' access to files. Suppose a file is associated with permission bits of 0751. What is(are) the access right(s) of the following users?
(a) The file owner can write the file.
(b) The group members can read the file.
(c) The group members can execute the file.
(d) Others can read the file.

5. Which statement(s) is(are) true?
(a) Modern operating systems do not need secure hardware support to separate the kernel space from the user space.
(b) A system administrator (super user) can directly access a file without the need to make any system call.
(c) A LINUX process's effective UID will be changed while executing a setuid program.
(d) A thief who stole a computer running MS Windows cannot access its files because he does not have the user login password.