

國立交通大學試題紙

一百零四學年度第二次
博士班資格考

科目：作業系統 A

日期：105 年 7 月 28 日 第 1 頁 共 1 頁

請“✓”明 ✓不可看書 可看書

* 請將答案依題號順序寫入答案卷

答題時字跡需工整，否則不予計分。Write your answers legibly; otherwise you will get zero score.

1. (10%) What is multiprogramming?
2. (10%) What is the difference between kernel and user mode? Explain how having two distinct modes aids in designing an operating system.
3. (10%) What are the major advantage and disadvantage of implementing threads in user space?
4. (10%) Consider the following piece of C code:

```
void main(){  
    fork();  
    fork();  
    fork();  
    exit();  
}
```

How many new processes are created upon execution of this program?

5. (10%) Assume that every process runs for a time T before blocking on I/O. A process switch requires a time S , which is the wasted overhead. For round-robin scheduling with quantum Q , give a formula for the CPU utilization for each of the following:
 - (a) $Q = \infty$
 - (b) $Q > T$
 - (c) $S < Q < T$
 - (d) $Q = S$
 - (e) Q nearly 0

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命題老師簽名：

科目：作業系統 B

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答題時字跡需工整，否則不予計分。Write your answers legibly; otherwise you will get zero score.

For all the questions, you have to provide justifications for your answers.

Answers without justifications will not get any credit.

1. Given a system with
3 processes $P_0 \sim P_2$
3 resource types: A (9 instances), B (6 instances), and C (5 instances)
Resource allocation snapshot at time t_0 :

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

- (a). [5pts] According to Banker's algorithm, is the system in a safe state? If yes, please give the process execution sequence that will satisfy the safety criteria. If no, please explain the reason.
- (b). [5pts] If P_1 would like to request 1 additional instance of resource A, 4 additional instances of resource B, and 2 additional instances of resource C, can the request be granted according to Banker's algorithm? If yes, please give the execution sequence that will satisfy the safety criteria. If no, please explain the reason.
2. [10pts] Program P will spawn n threads at the beginning of its execution and remain that till the end of the execution. Assume that you only have the binary executable file of program P (i.e. you don't have its source code). Please design an experiment to determine the value of n .
3. [10pts] (Continued from question 2) Assume that the hardware platform for running program P has only $n/2$ CPU cores. If we upgrade the hardware platform to n CPU cores, what would be expected

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for the execution time of the program?

4. [10pts] Give an example of OS implementation where using interrupt I/O would be the better choice than using polled I/O. You need to explain why Interrupt I/O is the better choice for the example.
5. [10pts] Give an example of OS implementation where using polled I/O is the better choice than using interrupt I/O. You need to explain why polled I/O is the better choice for the example.

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