

長庚大學 101 學年度第一學期 電機系博士班資工領域資格考試
科目：作業系統

1. Explain essential properties for each of the following types of operating systems:
 - (a) Batch **(3 pts)**
 - (b) Interactive **(3 pts)**
 - (c) Time sharing **(3 pts)**
 - (d) Real time **(3 pts)**
 - (e) Clustered **(3 pts)**

2. List five services provided by an operating system that are designed to make it more convenient for users to use the computer system. **(10 pts)**

3. Describe the actions that the kernel performs upon context switching between processes. **(10 pts)**

4. You are asked to explain how a virtual memory system works. Answer each of the questions listed below.
 - (a) With virtual memory system, why you can write a huge program with its size exceeding the size of physical memory? **(3 pts)**
 - (b) For a 64-bit virtual memory with 8KByte page size, explain how a virtual address is translated to physical address. You should clearly specify the address format (number of bits for each field) for the translation. (Draw a figure may help you explain the flow) **(7 pts)**
 - (c) What is the purpose of TLB (Translation Look-aside Buffer)? **(3 pts)**
 - (d) Again, for the virtual memory system stated in (b), explain the flow to get memory data with the addition of TLB. **(7 pts)**

(請翻頁繼續作答)

5. Explain basic concepts of multi-threaded computing by answering the following questions:

(a) Describe the actions taken by a thread library to context switch between two user-level threads **(5 pts)**

(b) Which of the following components of a program state are shared across multiple threads? **(5 pts)**

i. Register values

ii. Heap memory

iii. Global variables

iv. Stack memory

(c) Give a program example in which multi-threading does not provide better performance in a multi-core processor. **(5 pts)**

6. Write a parallel program to take the sum of a large array using a 4-core processor.

$$S = \sum_{i=0}^{N-1} A[i]$$

The array is initially stored in the memory shared by the 4 cores and the size N is a constant known at compile time. Use the semaphore mechanism to realize the parallel program. You should make the program run as fast as possible. **(15 pts)**

7. Consider the dining-philosophers problem where the chopsticks are placed at the center of the table and any two of them could be used by a philosopher. Assume that requests for chopsticks are made one at a time. Describe a simple rule for determining whether a particular request could be satisfied without causing deadlock. **(15 pts)**