

長庚大學 102 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. List five services provided by an operating system that are designed to make it more convenient for users to use a computer. **(15 pts)**

2. 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)**

3. 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 **(4 pts)**
 - (b) Which of the following components of a program state are shared across multiple threads? **(6 pts)**
 - i. Register values
 - ii. Heap memory
 - iii. Global variables
 - (c) In a process with multiple threads, each thread has its own stack segment. Describe a method for a thread to peek the stack content of another thread. **(5 pts)**

4. For each of the process scheduling algorithm listed below, give an example to explain how the algorithm works. You should draw a time-line to show how a set of processes work.
 - (a) First Come First Serve **(5 pts)**
 - (b) Shorted Job First **(5 pts)**
 - (c) Priority Scheduling **(5 pts)**
 - (d) Round-Robin Scheduling **(5 pts)**

5. How many processes will be created by the following UNIX program? (Please also show how you figure out the answer instead of just giving a number) **(10 pts)**

```
for (i=0;i<3;i++)  
    fork ();
```

6. You are using a new computer and wondering whether the system has virtual memory support or not. Unfortunately, you don't have any document regarding the operating system but you can use standard C/C++ programming tools in this computer. The only hardware spec you know is that the computer has 1 GByte of RAM. Write a program with only standard C/C++ constructs such that you can tell whether the computer has virtual memory or not from the outcome. **(10 pts)**
7. Explain the concepts about memory fragmentation by answering the following questions:
- (i) Give an example to explain what is external fragmentation. **(5 pts)**
 - (ii) Give an example to explain what is internal fragmentation. **(5 pts)**
 - (iii) Explain why a demand paging system does not have external fragmentation. **(5 pts)**