長庚大學106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. Consider a system consisting of four instances of the same resource that are shared by three processes, each of which has to use at most two instances. Please show that the system is deadlock-free. **(10 pts)**

2. In system and network security, please explain the meaning of "stack and buffer overflow"? How can we solve this problem? **(10 pts)**

3. You are asked to explain the concept of virtual memory systems. Please answer the questions listed below.
   (a) With a virtual memory system, please provide the reason for that OS can run a program with its size exceeding the size of the main memory. **(5 pts)**
   (b) For a 32-bit virtual memory system with the 4K-Byte page size, please roughly explain the process for translating a virtual address to a physical address with a page table. **(5 pts)**
   (c) What is the purpose of TLB (Translation Look-aside Buffer)? **(5 pts)**
   (d) How can we use a page table with the TLB? **(5 pts)**

4. Please explain the difference between a program and a process. **(5 pts)**

5. For the thrashing issue in operating systems, please answer the following questions:
   (a) Please define the thrashing problem in operating systems. **(5 pts)**
   (b) How can an operating system avoid thrashing? **(5 pts)**

6. There is system with only 3 memory frames. Given a reference string of pages {1→2→0→3→0→3→7→4→1→3→7}. Please illustrate the page replacement of (a) the LRU algorithm and (b) the optimal algorithm. You should show the memory frames and the queue for the LRU algorithm. The explanation for each page replacement of the optimal algorithm should be provided. **(10 + 10 pts)**

7. Copy-on-Write (COW) allows both parent and child processes to initially share the same pages in memory. So, please explain the details of COW. **(10 pts)**

8. For multiple threads of a process, please explain Thread-Local Storage (TLS). What is the difference between TLS and some local variable in a thread? **(5 pts)**

9. For process scheduling, please define the (a) First-Come First-Served scheduling and the (b) Round-Robin scheduling. **(10 pts)**