

長庚大學105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. There are a lot of functions and services provided by an OS to help users to efficiently use computers. For each of the services listed below, please indicate one drawback if the OS does not provide such a service.
  - (1) Virtual memory **(4 pts)**
  - (2) File system **(4 pts)**
  - (3) Process synchronization **(4 pts)**
  - (4) Process scheduling **(3 pts)**
  
2. Please explain the difference between a program and a process. **(10 pts)**
  
3. Please (1) define “Race Condition” and (2) provide an example for Race Condition. You can use the case, counter ++ and counter -- are in two different processes, as the example. **(10 pts)**
  
4. There is system with only 3 memory frames. Given a reference string of page numbers  $\{7 \rightarrow 0 \rightarrow 0 \rightarrow 2 \rightarrow 0 \rightarrow 3 \rightarrow 0 \rightarrow 4 \rightarrow 1 \rightarrow 3 \rightarrow 7\}$ . Please illustrate the page replacement of (1) the Least Recently Used (LRU) algorithm and (2) 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 pts)**
  
5. Banker’s Algorithm is a deadlock avoidance algorithm. Assume there are 5 processes  $\{P_0, P_1, P_2, P_3, P_4\}$  and three types of shared resources  $\{A, B, C\}$  in the system, and the details are in the following table. Please answer the following questions. If your answer is yes, please provide a safe sequence. If your answer is no, please provide the reason.
  - (1) By Banker’s Algorithm, is the system in a safe state? **(5 pts)**
  - (2) Now,  $P_0$  further has a request  $(2, 1, 0)$  to use 2 more instances of A and 1 more instances of B. Should the request be granted? **(5 pts)**
  - (3) Discard sub-question (2). Now,  $P_1$  further has a request  $(1, 2, 1)$  to use 1 more instance of A, 2 more instances of B and 1 more instance of C. Should the request be granted? **(5 pts)**

6. For the thrashing in operating systems, please answer the following questions:
- (1) Please define the thrashing in operating systems. **(5 pts)**
  - (2) How can an operating system avoid thrashing? **(5 pts)**
7. Please illustrate the concepts about memory fragmentation by answering the following questions:
- (1) Give an example to explain the external fragmentation. **(5 pts)**
  - (2) Give an example to explain the internal fragmentation. **(5 pts)**
8. Consider the following processes, assume that the time unit is one millisecond,
- (1) Draw the scheduling charts for First Come First Serve (FCFS) scheduling and preemptive Short Job First (SJF) scheduling **(6 pts)**
  - (2) Derive the average waiting time of each scheduling algorithm. **(4 pts)**

<u>Process</u>	<u>Burst Time (ms)</u>	<u>Ready Time (ms)</u>
P1	5	0
P2	8	1
P3	1	2
P4	3	3
P5	2	4

9. Please briefly define the following terms related to deadlock and explain how to avoid them.
- (1) Mutual exclusion **(2 pts)**
  - (2) Hold and wait **(3 pts)**
  - (3) No preemption **(2 pts)**
  - (4) Circular wait **(3 pts)**