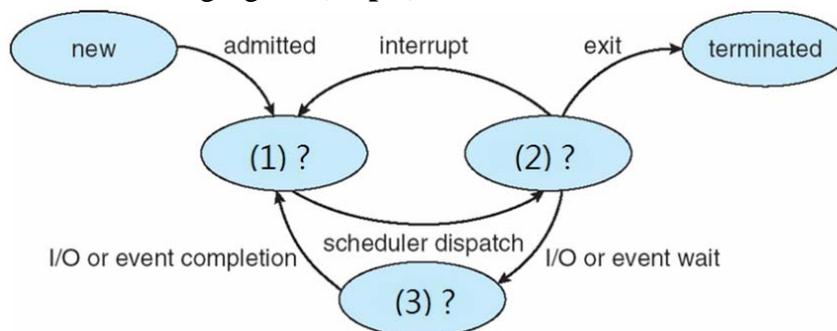# 長庚大學104學年度第一學期 電機系博士班資工領域資格考試
科目: 作業系統

1. Please explain the difference between a program and a process. **(10 pts)**

2. The possible states of a process are ready, running, and waiting. Please indicate the states of (1), (2), and (3) of the following figure. **(15 pts)**

3. There are three processes: **(10 pts)**
   - P_1: a * b → c
   - P_2: c + d → c
   - P_3: c - e → c
   ▶ P_1 should run before P_2 and P_3 do
   ▶ The access to valuable "c" must be protected, e.g., P_2 and P_3 can not run at the same time
   ▶ The initial states of semaphores are: $S_1=0$; $S_2=0$; $S_3=1$;
   ▶ The code of P_1 is: c = a * b; signal(S_1); signal(S_2);

   Please provide P_2 and P_3 by using wait() and signal()

4. For the thrashing in operating systems, please answer the following questions:
   (1) What is the cause of thrashing? **(2 pts)**
   (2) How does an operating system detect thrashing? **(5 pts)**
   (3) Once the system detects thrashing, what can the system do to eliminate this problem? **(3 pts)**

5. Please define (1) I/O-bound processes **(5 pts)** and (2) CPU-bound processes. **(5 pts)**

6. Virtual memory is a technique that allows the execution of a process that may not be completely in memory. Please provide at least one potential benefit for using virtual memory. **(10 pts)**

7. Consider the following processes, assume that the time unit is one millisecond,.
   (1) Draw the scheduling charts for FCFS (first come first serve) scheduling and non-preemptive SJF (short job first) scheduling **(6 pts)**
   (2) Derive the average waiting time of each scheduling algorithm. **(4 pts)**

Process	Burst Time (ms)	Ready Time (ms)
P_1	5	0
P_2	7	1
P_3	1	2
P_4	2	3
P_5	4	4

8. (16%) There is system with only 3 memory frames. Given a reference string of pages {page 7→page 0→page 1→page 2→page 0→page 3→ page 0→ page 4→ page 2→ page 4→ page 1→ page 2→ page 4}, please illustrate the page replacement of the three memory frames of (1) the FIFO (first in first out) algorithm and (2) the LRU (least recently used) algorithm. (Hint: please draw the content in the three memory frames after each page access) **(10 pts)**

9. Please briefly define (1) "Deadlock" in operating systems. **(3 pts)**
   Please define the following terms related to Deadlock:
   (2) Mutual exclusion **(3 pts)**
   (3) Hold and wait **(3 pts)**
   (4) No preemption **(3 pts)**
   (5) Circular wait **(3 pts)**