系所名稱	類別	科目	節次	准考證號碼 (考生請填入)	考試 日期
電機工程研究所 (資工組)	碩士班	作業系統	第二節		98/5/3

※答案須寫在答案卷內，否則不予計分。

1. Draw a figure to show all of the process's states while executing. **(10%)**

2. Assume that the two processes, P_0 and P_1, share the following variables:
   var *flag*:array[0..1] of boolean; (* initially false *)

       turn: 0..1;

   The following program is for process P_i *(i=0 or 1)*, with P_j *(j=1 or 0)* being the other process.

   ```
                   repeat
                       flag[i] := true;
                       while flag[j]
                           do if   turn = j   then begin
                                               flag[i] := false;
                                               While turn = j do no-op;
                                       end;
                       critical section
                       turn := j;
                       flag[i] := false;
                       remainder section
                   until false;.
   ```

   (a) What are the three requirements that must be satisfied to solve the critical-section problem? **(10%)**

   (b) Does the following algorithm satisfy all the requirements for the critical-section problem? Why? Please give your reasons. **(10%)**

3. Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

Process	Burst Time
P_1	10
P_2	29
P_3	3
P_4	7
P_5	12

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The processes are assumed to have arrived in the order P_1, P_2, P_3, P_4, P_5, all at time 0.

(a) Draw four Gantt charts illustrating the execution of these processes using SJF and RR (quantum=10) scheduling. **(10%)**

(b) What is the turnaround time of each process for each of the scheduling algorithms in question (a)? **(5%)**

(c) What is the waiting time of each process for each of the scheduling algorithms in question (a)? **(5%)**

4. Consider the snapshots of an operating system with five processes P_0 through P_4 and three resources A, B, and C. Please answer the following questions using Banker's algorithm. (a) What is the content of the matrix *Need* ? (b) Is the system in a safe state? If yes, please find a safe sequence; if no, please explain it. **(20%)**

	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P_0	0	2	0	7	6	3	3	3	3
P_1	3	0	0	4	2	2			
P_2	3	0	2	9	0	2			
P_3	2	1	1	2	2	2			
P_4	0	0	2	4	3	3			

5. Page replacements are used to find the least page fault times. How many page fault times will be generated under the following page replacement strategies with 3 frames and the reference string- 0,1,2,3,0,1,4,0,1,2,3,4? (a)FIFO (b)LRU (c) When the memory has 4 frames, would the FIFO occur Belady's anomaly? **(15%)**

6. Please describe the internal fragmentation. When would it occur? **(15%)**