長庚大學103學年度第一學期作業系統期中測驗（滿分110）

系級: 姓名: 學號:

1. (10%)在作業系統中請說明Multiprogramming及Time Sharing的定義。

Answer: Multiprogramming: The operating system keeps several jobs in memory simultaneously (5%).
Time Sharing: Time sharing is a logical extension of multiprogramming, in which CPU switches jobs frequently so that users can interact with each job while it is running (5%).

2. (9%)System call的種類有很多，譬如說其中一種是用於Process Control。請取舉出另外至少三種system call的種類

Answer: (3% for each correct answer)

- File Management
- Device Management
- Information Maintenance
- Communications
- Protection

3. (10%)請定義Program和Process的不同。

Answer: A program is a passive entity stored on hard disk, and a process is an active entity which is loaded into memory for the execution on a CPU.

4. (10%)請定義I/O-bound process與CPU-bound process。

Answer: I/O-bound process – spends more time doing I/O than computations, many short CPU bursts. (5%)
CPU-bound process – spends more time doing computations; few very long CPU bursts. (5%)

5. (12%)請寫出以下程式在POSIX環境下執行後的輸出結果。

```
#include<sys/types.h>
#include<stdio.h>
#include<unistd.h>
int main()
{
        pid_t pid, pid2;
        pid = fork();
        if (pid == 0)
        {
                printf("Hello\n");
                pid2 = fork();
                if (pid2 != 0)
                {
                        wait(NULL);
                        printf("ABCD\n");
                }
                else
                {
```

```
                printf("Hi\n");
        }
    }
    else
    {
        wait(NULL);
        printf("12345\n");
    }
    return 0;
}
```

Answer:
Hello (3%)
Hi (3%)
ABCD (3%)
12345 (3%)

6. (10%)當我們在伺服器上設計網服務程式(如：網頁伺服器、FTP伺服器)，一般來說我們會用multiple threads而不是multiple processes來服務多位使用者。請問相較之下使用multiple threads的優點為何？

Answer: (Only one correct reason is required)
Threads can share resources of a process, e.g., global data, binary code and opened files. Thus, it is much more efficient in terms of resource saving.
Commutation among the threads of a process is easier than that among process.

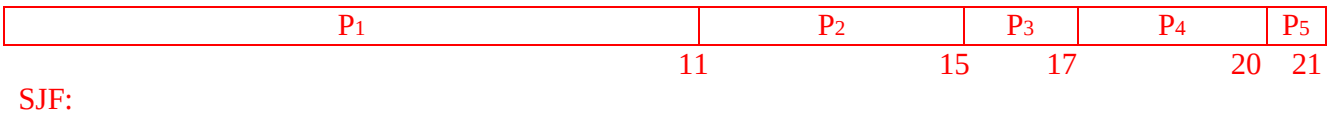
7. (10%)在process scheduling中請說明何謂convoy effect。

Answer: Short processes behind long a process have to wait for a long time.

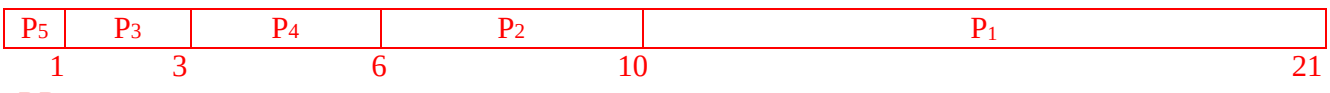
8. (18%)考慮五個工作，依序為P_1, P_2, P_3, P_4, P_5。使用三個排程演算法FCFS、SJF以及RR (time slice=2)來排程。(1)請畫下三個排程演算法的排程圖，(2)請分別算出三個排程演算法中每個工作的等待時間，若無算式一率不給分(3)請分別算出三個排程演算法的平均等待時間，若無算式一率不給分。

Process	Burst Time
P_1	11 ms
P_2	4 ms
P_3	2 ms
P_4	3 ms
P_5	1 ms

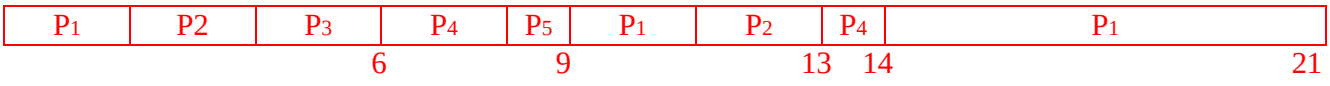
Answer:
(1) (6%)
FCFS:



SJF:



RR



(2) (6%) (一定要有算式才給分)

FCFS: P_1: 11-11=0, P_2: 15-4=11, P_3: 17-2=15, P_4: 20-3=17, P_5: 21-1=20

SJF: P_1: 21-11=10, P_2: 10-4=6, P_3: 3-2=1, P_4: 6-3=3, P_5: 1-1=0

RR: P_1: 21-11=10, P_2: 13-4=9, P_3: 6-2=4, P_4: 14-3=11, P_5: 9-1=8

(3) (6%) (一定要有算式才給分)

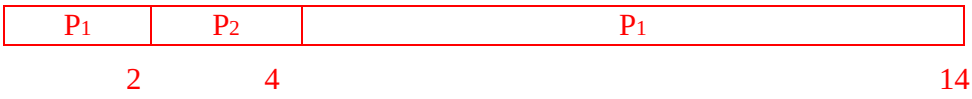
FCFS: (0+11+15+17+20)/5 = 12.6ms SJF: (10+6+1+3+0)/5 = 4ms RR: (10+9+4+11+8)/5 = 8.4ms

9. (12%)有兩個工作P_1及P_2，所需的執行時間(Burst Time)分別是12與2，P_1於時間0到達，P_2於時間2到達，現在考慮兩個排程演算法Preemptive SJF以及Non-preemptive SJF。(1)請畫下兩個排程演算法的排程圖，(2)請分別算出兩個排程演算法的平均等待時間，若無算式一率不給分。

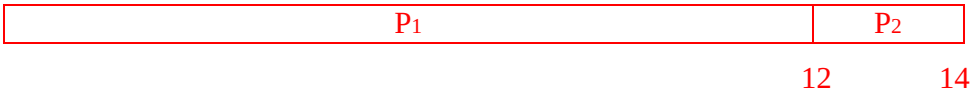
Answer:

(1) (6%)

Preemptive SJF:



Non-preemptive SJF:



(2) (一定要有算式才給分)

Preemptive SJF: (2+0)/2=1

Non-preemptive SJF: (0+10)/2=5

10. (9%)驗證排程演算法效能的方式有四種，其中一種是deterministic modeling，而此次考試中第8題便是使用deterministic modeling來做效能驗證的例子。請條列另外三種方式。

Answer:

- Queuing model
- Simulation
- Implementation