

長庚大學107學年度第一學期作業系統期中測驗 (滿分104)

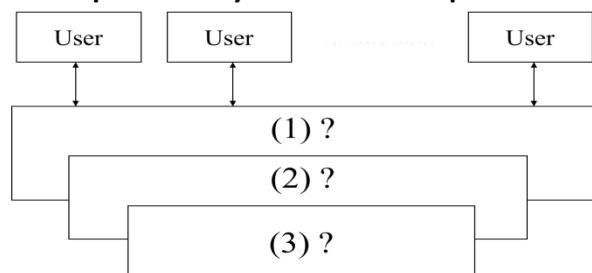
系級:

姓名:

學號:

1. (9%) 下圖為一般電腦系統之組成, 包含Users、Operating System、Application Programs、Hardware。請分別填入(1)、(2)、(3)對應位置內的內容。

Computer System Components



Answer: (1) Application Programs (3%), (2) Operating System (3%), (3) Hardware (3%)

2. (8%) 請描述Application Programming Interface (API)、System Call、Operating System三者之間的關係。

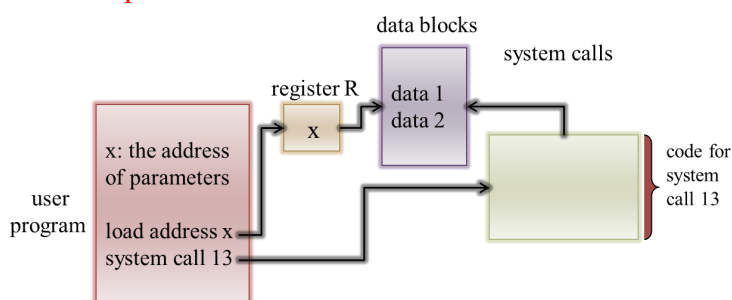
Answer: System calls provide the routines for user applications to use the functions provided by operating systems (4%). The API of a programming language serves as a user-friendly link to system calls made available by the operating system (4%). Thus, most of the details of the operating-system interface are hidden from programmers by the API and are managed by run-time support libraries.

3. (8%) 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 (4%).
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 (4%).

4. (8%) 一般應用程式呼叫作業系統中提供的System Calls時, 若需要傳遞參數給System Calls, 有三種做法: Parameter Passing by Registers、Parameter Passing by Stacks、Parameter Passing by Registers Pointing to Blocks。請說明Parameter Passing by Registers Pointing to Blocks如何完成。

Answer: The user application writes the parameters into data blocks and writes the pointer of the data blocks into a register before the user application invokes the system call. The system call then uses the pointer in the register to get the address of the data blocks and reads the parameters.



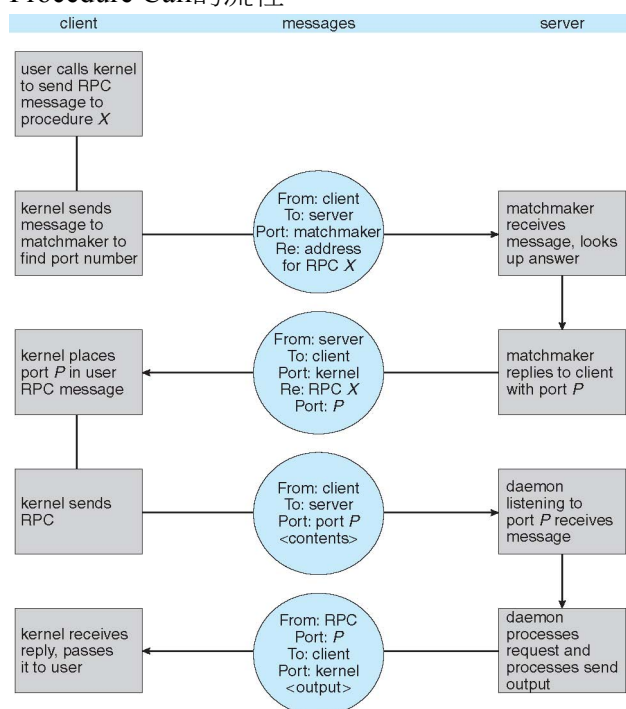
5. (8%) Monolithic Kernel與Microkernel是兩種不同的作業系統設計方式，與Monolithic Kernel相比較之下，請舉出 (1)一個Microkernel的優點、 (2)一個Microkernel的缺點。

Answer: (1) Advantage: Microkernel is more modularized, and thus, it is more portable, reliable, and easy for extensions. (4%)
 (2) Disadvantage: There are more inter-process communication (IPC) calls in Microkernel. Thus, the performance might be worse. (4%)

6. (8%) 在作業系統中有 Long-term Scheduler (或稱作 Job Scheduler)以及 Short-term Scheduler (或稱作 CPU scheduler)，請說明 (1)Long-term Scheduler 與 (2)Short-term Scheduler 的任務分別為何？

Answer: (1) Long-term scheduler selects which processes should be brought into the ready queue. (4%)
 (2) Short-term scheduler selects which process should be executed next and allocates CPU. (4%)

7. (9%) 在作業系統中，(1)請問何時會需要用到Remote Procedure Call？(2) 請參考下圖說明Remote Procedure Call的流程。



Answer: (1) We want to use a function which is provided by a remote machine. (3%)
 (2) 1. The client gets the port of the RPC via the matchmaker on the server. (6%)
 2. The client sends its RPC to the port of the server.
 3. The server runs the RPC function and returns the result to the client.

8. (8%) 請說明 (1)Thread Local Storage (TLS)的用途，並 (2)說明TLS與global variable有何不同。

Answer: (1) Purpose: TLS allows each thread to have its own copy of data. (4%)
 (2) Difference: Global variables are visible for all threads in the process, but TLS is visible in only a thread. (4%)

9. (12%) 假設每次呼叫fork()都是成功的，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)
    {
        wait(NULL);
        printf("AAA\n");
        pid2 = fork();
        if (pid2 == 0)
        {
            printf("BBB\n");
        }
        else
        {
            wait(NULL);
            printf("CCC\n");
        }
    }
    else
    {
        printf("DDD\n");
    }
    printf("EEE\n");
    return 0;
}
```

Answer:

DDD
EEE
AAA
BBB
EEE
CCC
EEE

10. (18%) 考慮已經就緒的五個工作，依序為P₁, P₂, P₃, P₄, P₅。使用三個排程演算法FCFS (First-Come, First-Served)、SJF (Shortest-Job-First)以及RR (Round Robin)來排程，而RR所使用的time quantum為4ms。(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(算式可以只是簡單的加減法運算)，(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	14 ms
P ₂	1 ms
P ₃	2 ms
P ₄	3 ms
P ₅	4 ms

Answer:

(1)

FCFS: (2%)

P1					P2	P3	P4	P5	
0					14	15	17	20	24

SJF: (2%)

P2	P3	P4	P5	P1					
0	1	3	6	10					24

RR: (2%)

P1		P2	P3	P4	P5	P1		
0		4	5	7	10	14		24

(2)

FCFS: P1: 14-14=0, P2: 15-1=14, P3: 17-2=15, P4: 20-3=17, P5: 24-4=20 (2%)

SJF: P1: 24-14=10, P2: 1-1=0, P3: 3-2=1, P4: 6-3=3, P5: 10-4=6 (2%)

RR: P1: 24-14=10, P2: 5-1=4, P3: 7-2=5, P4: 10-3=7, P5: 14-4=10 (2%)

(3)

FCFS: $(0+14+15+17+20)/5 = 13.2$ (2%)

SJF: $(10+0+1+3+6)/5 = 4$ (2%)

RR: $(10+4+5+7+10)/5 = 7.2$ (2%)

11. (8%) 作業系統中有一類型的排程演算法稱呼為Multilevel Queue Scheduling，(1)請說明何為Multilevel Queue Scheduling，其延伸的作法還有Multilevel Feedback Queue Scheduling，(2)請說明Multilevel Feedback Queue Scheduling與Multilevel Queue Scheduling有何不同。

Answer: (1) Processes can be classified into different groups, and each group is permanently assigned to one queue. Intra-queue and inter-queue scheduling algorithms are then needed for manage the system. (4%)

(2) Difference: For Multilevel Feedback Queue Scheduling, tasks are allowed to be migrated among queues. (4%)