

長庚大學九十九學年度第二學期 電機所博士班資工領域資格考試
科目：作業系統

1. You are asked to explain why a computer needs an operating system. For each of the service provided by an OS listed below, indicate one drawback if there is no OS to provide such a service.
 - (a) Virtual memory **(3 pts)**
 - (b) File system **(3 pts)**
 - (c) Process scheduling **(3 pts)**
 - (d) System protection by separating kernel and user mode **(3 pts)**
 - (e) Time-sharing and multi-tasking support **(3 pts)**

2. Explain the difference between a process and a thread. Please also describe the advantage of multi-threading compared to multi-process programming. **(10 pts)**

3. You are asked to explain how a virtual memory system works. Answer each of the questions listed below.
 - (a) With virtual memory system, why you can write a huge program with its size exceeding the size of physical memory? **(3 pts)**
 - (b) For a 32-bit virtual memory with 4KByte page size, explain how a virtual address is translated to physical address. You should clearly specify the address format (number of bits for each field) for the translation. (Draw a figure may help you explain the flow) **(7 pts)**
 - (c) What is the purpose of TLB (Translation Look-aside Buffer)? **(3 pts)**
 - (d) Again, for the virtual memory system stated in (b), explain the flow to get memory data with the addition of TLB. **(7 pts)**

4. For each of the process scheduling algorithm listed below, give an example to explain how the algorithm works. You should draw a time-line to show how a set of processes work.
 - (a) First Come First Serve **(5 pts)**
 - (b) Shorted Job First **(5 pts)**
 - (c) Priority Scheduling **(5 pts)**
 - (d) Round-Robin Scheduling **(5 pts)**

(請翻面繼續作答)

5. How many processes will be created by the following UNIX program? (Please also show how you figure out the answer instead of just giving a number) **(15 pts)**

```
for (i=0;i<3;i++)  
    fork ();
```

6. You are asked to write a parallel program with the semaphore mechanism on UNIX. The task is to compute the dot-product with 4 processes.

$$S = \sum_{i=0}^{9999} A[i] * B[i]$$

Each process has to deal with 2500 multiplications in the computation. Assume that the variable S and arrays A and B are allocated in the shared memory. Other variables you declared will be allocated in the private memory space of a process. Write a C program to realize the dot-product with semaphore. In your answer, amount of computations in the critical section should be minimized. (In your code, you do not need to setup the shared memory and create the parallel processes.) **(10 pts)**

7. Figure 1 show the structure of the virtual address space of a process. Figure 2 is an example C program. For each of the memory object listed below, indicate which segment (one of text, data, heap, and stack segment) the memory object will be allocated.

- (a) the global variable a **(2 pts)**
- (b) the local variable x in function $main$ **(2 pts)**
- (c) the local variable y in function $main$ **(2 pts)**
- (d) the parameter u of function foo **(2 pts)**
- (e) the contiguous memory space allocated by the $malloc$ function call in foo and pointed by the pointer variable p **(2 pts)**

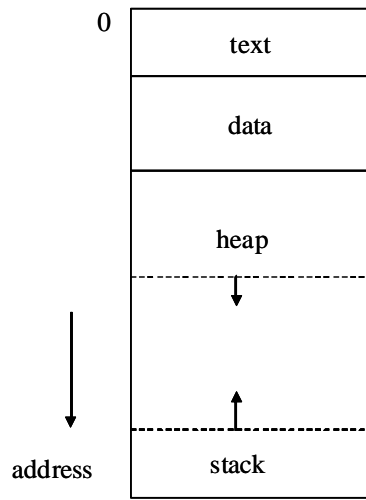


Figure 1

```
int a;  
main ()  
{  
    int x;  
    static int y;  
  
    foo (x, y);  
    ...  
}  
foo (int u, int v)  
{  
    int *p;  
    p = (int*) malloc (sizeof(int)*u);  
    ...  
}
```

Figure 2