

1. (a) Explain the advantages of virtual-machine concept. (5%)
(b) In general, a command interpreter(CI) can be implemented in two ways: CI itself contains the code to execute the command and CI implements all commands by special systems programs. Explain their advantages respectively (5%)

2. (a) Shortest Job First (SJT) is the way to minimize average response time, but it is not practical, why? (5%)
(b) In critical-section problem, considering multiple-process solution a typical process P_i whose general structure is:
Repeat
 entry section
 critical section
 exit section
 remainder section
Until false
Explain the purpose of the code in both *entry* and *exit* section in detail. (5%)

3. Write a bounded-buffer monitor in which the buffers are embedded within the monitor itself and rewrite the producer/consumer processes using the monitor (10%)

4. The blocks of a typical disk drive can be identified using 3-tuple consisting of (cylinder, surface, sector) numbers. As we noted in class, however, it is often more convenient for the operating system to assign a unique *logical block number* to each disk block rather dealing with 3-tuple.
 - (a) State the equation derived in class for calculating the logical block number associated with a given (cylinder, surface, sector) 3-tuple. Using this scheme, what the maximum number of consecutive logical blocks that can accessed without changing the position of the disk head? (5%)

 - (b) When it comes time to initiate a disk I/O operation, the operating system must convert a logical number back to its associated 3-tuple, since the disk device itself generally only understand cylinder, surface, and sector numbers. Complete the following segment of C code, which translates a logical block number to its corresponding cylinder, surface, and sector numbers. Assume that the translation scheme of (a) is used. (5%)

```
extern unsigned nheads; /* number of heads (surfaces) */  
extern unsigned nsectors; /* number of sectors per track */
```

```
void translate (unsigned block)  
{  
    unsigned cylinder;  
    unsigned surface;  
    unsigned sector;
```

5. (a) A machine has 48-bit virtual addresses and 32-bit physical addresses. Pages are 8K. How many entries are needed for a conventional page table? For an inverted page table? (5%)
- (b) Discuss whether each of the following programming techniques and program actions is good or bad with regard to the degree of locality of reference it is likely to exhibit. Explain your reasoning.
- (1) sequential processing of a one-dimensional array
 - (2) sequential processing of a two-dimensional array
 - (3) Hashing
 - (4) indirect addressing (5%)
6. (a) What is the major difficulty to design a one pass assembler? (5%)
- (b) Please explain what is linking loader, linking editor and dynamic linking, especially, the differences among them. (5%)
7. (a) What is activation record? (5%)
- (b) What is the activation record of a block structured language (e.g., PASCAL)? Please explain each item in detail. (5%)
- (c) According to your activation record, please explain how can a non_local variable be accessed? (10%)
8. (a) What are syntax and semantic definition of a programming language? (5%)
- (b) Is there any formal method used to define them? If yes, what are them? (5%)
- (c) Please use your method given in (b) to define the syntax and semantic of the procedure call of a language that you are familiar. (10%)