[1] There is a technique called "Copy on Write" used for improving something in a virtual memory system.

(a) Please explain the technique (the concept and the advantages or applications) of "Copy on Write" in more details. (6%)

(b) Please show how to implement "Copy on Write" on a demand paging system. (6%)

[2] In a multiprocessor system, there are n processes competing to enter the critical section. In the following, several versions of codes for entering and leaving critical section are listed.

(I)

```
disable-interrupt      /* a hardware instruction to disable interrupt

{ critical section } /* Note: the execution of this critical section takes 5 minutes.

enable-interrupt       /* a hardware instruction to disable interrupt
```

(II)

```
while (test-and-set (lock));    /* a hardware instruction to test and set a memory
                                /* location (lock) atomically

{ critical section }    /* Note: the execution of this critical section takes 5 minutes

lock = false;
```

(III)

```
wait (mutex);    /* mutex is a semaphore with initial value 1

{ critical section }    /* Note: the execution of this critical section takes 5 minutes

signal (mutex);
```

(a) Is version (I) a correct solution to meet the requirements of mutual exclusion ? If no, please explain why. If yes, please evaluate the method (any advantages or disadvantages). (4%)

(b) Is version (II) a correct solution to meet the requirements of mutual exclusion ? If no, please explain why. If yes, please evaluate the method (any advantages or disadvantages). (4%)

(c) Is version (III) a correct solution to meet the requirements of mutual exclusion ? If no, please explain why. If yes, please evaluate the method (any advantages or disadvantages). (4%)

(背面仍有題目,請繼續作答)

[3] Please draw a process state diagram indicating all the possible process state transitions due to the following events. (10%)

(a) a time slice expires (b) an I/O completion interrupt is generated

(c) a page fault occurs (d) a job is selected by the long-term scheduler for execution

(e) a process calls yield() to request reschedule

[4] For each of the following questions, please select the best answer from the items listed below. (16%)

(1)_____ is the data structure used to describe a file in Unix.

(2) A technique, typically implemented in a linker, used to reduce the size of a program space is called____.

(3) A shared library is quite often implemented as a _____ for easy mapping to the address spaces of the sharing processes.

(4) A table that DOS or Windows uses to locate files on a disk is called a (or an)____.

(5) _____ is an operating system design approach which enables to run different copies of operating systems simultaneously on a single computer.

(6) A (or An) _____ for a protection domain is a list of objects together with the operations allowed on those objects.

(7) _____ is the mechanism used in Unix to make a file system (a disk partition) accessible.

(8) _____ is a technique that allows a part of the virtual address space of a process to be logically associated with a file.

The possible answers:

(A)open	(B)access list	(C)overlay	(D)mount
(E)dynamic linking	(F)re-entrant code	(G)capability list	(H)recursive code
(I)relocating code	(J)memory-mapped file	(K) object code	(L) FAT
(M)dynamic mapping	(N) position independent code		(O)access matrix
(P)virtual machine	(Q)directory	(R)protection bits	
(S)NTFS	(T)attach	(U)virtual memory	
(V)Java Virtual Machine	(W)inode	(X)page table	

[5] For each of the following statements, please indicate TRUE or FALSE and briefly explain your reason. (30points)

(a) If grammar G is regular then G is a context-sensitive grammar.

(b) A compiler must generate assembly language code as object code.

(c) The compiler of programming language L can be implemented using L.

(d) Recursive-descent parsing technique can be used to parse LL(1) grammars.

(e) A compiler does not generate any object code for the following statement:

```
int  fun_A (char  p1);
```

(f) Lexical analyzer is usually implemented with the concept of DFA.

(g) To accomplish the function of load-on-call, an absolute loader is required.

(h) There exists ambiguity in programming languages Java and C.

(i) Compiler manages a symbol table during program translation but assembler does not manage any symbol table.

(j) A bootstrap loader is required to run stand-alone programs without an operating system.

[6] Design a non-recursive algorithm to perform in-order traversal of binary trees:

(a) Demonstrate your algorithm using an algorithmic language, programming language or pseudo language. (10 points)

(b) What is the time complexity of your algorithm? (2 points)

(c) What is the space complexity of your algorithm? (2 points)

[Note: Please show the complexity in asymptotic notations.]

[7] Explain briefly the following terms. (2 points each)

(a) Connected graph

(b) Spanning forest

(c) Loading factor (or loading density)