[1] Conceptually, a compiler operates in phases, each of which transforms the source program from one representation to another. The phases of a compiler usually include lexical analyzer, syntax analyzer and intermediate code generator. Explain the functions of these three phases and illustrate what representation will be generated by each of them. (12%)

[2] Compare the difference between a compiler and an interpreter. (8%)

[3] Show the following grammar is ambiguous. (10%)

E -> E + E | E * E | (E) | - E | **id**

[4] In a computer system, there are three types of resources (r1,r2,r3) and there are three processes.
Given the following arrays A,N and T
where array A represents the number of resources allocated to the processes
array N represents the maximum number of resources needed
array T represents the total number of resources that the computer originally has

A:

ALLOCATED NOW

	r1	r2	r3
p1	4	3	3
p2	3	2	0
p3	1	2	2

N:

MAX NEED

	r1	r2	r3
p1	6	4	3
p2	4	2	4
p3	1	2	4

T:

TOTAL NUMBER OF RESOURCES IN THE SYSTEM

r1	r2	r3
11	8	9

(a) If the system should avoid any deadlock to occur, when process p2 now requests for three instances of resource type r3, should the request be granted ?
(You should explain why) (4%)

(b) Is the banker's algorithm practically useful for deadlock avoidance ? Please explain why. (4%)

[5] Given two concurrent processes P1 and P2 shown below, a semaphore, sem, is used for synchronization.

```
process P1            process P2

S1;                   S4;
P(sem);                 V(sem);
S2;                   S5;
V(sem);                 P(sem);
S3;                   S6;
```

/* S1, S2, S3, S4, S5, S6 are instructions */

The value of the sema phore is 0 initially.
The scheduler of the concurrent system would schedule any process for execution at any time except for synchronization points.

For the following statements, which are true and which are false ?
(You should explain why) (6%)

(a) S1 will be (一定) executed before S5
(b) S4 will be (一定) executed before S2
(c) S5 will be (一定) executed before S3

(背面仍有題目,請繼續作答)

[6] Given a kernel of a demand-paging operating system which has the following components :

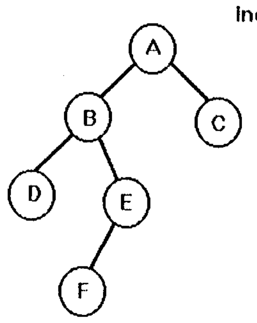
* real memory manager
* virtual memory manager
* process scheduler
* disk block cache manager
* file manager
* disk driver

In servicing the following system calls, what operations or processing would be done by the operating system components (listed above) ?
** In answering the questions, you should refer to some important data
** structures that may be used by the operating system components. (24%)

(a) create_process ("execution_file")
/* to create a process in which the "execution_file" will be run */

(b) open_file (file_id)
/* to open a file, the file identifier is stored in file_id */

[7] The table (an array) below represents the following binary tree in in-order threaded form. Please complete filling the table.(6%)



Index of array

	info	left	right
1	A	2	3
2	B	4	5
3	C		
4	D		
5	E		
6	F		

[8] 在一 demand-paging virtual memory 系統中，一高階語言程式之某個變數，其對應之 virtual address 及 real address，何時被決定 ？何時可能被更動 ？(8%)

[9] 針對以下各問題之空白處，請自題後所列可能的答案中找出最適當的一個.
(每題答對得 3 分，答錯倒扣 2 分，未答者不得分不扣分） (18%)

(1) 以 Huffman Encoding 方法作編碼時，應建立之資料結構是________.
(2) 若要設計一程式，計算幾百位有效位數之整數之加與減運算，及比較大小應以________之資料結構來表示此類整數最恰當.
(3) 在組合語言程式中若 operand 之 addressing mode 是_________時，則在 linking 及 loading 時，該 operand 不必作relocation.
(4) 一部有保護功能之電腦中，當一個_______在 user mode 被執行時，將會產生 exception.
(5) 若欲在一部電腦上同時執行多種不同的作業環境，則可利用 ________ 技術建立其作業系統，
(6) 在 page table 中，提供 virtual memory 系統作 page replacement參考之資訊包括 ___________.

可能的答案：
(A) singly-linked list
(B) double-linked list
(C) stack
(D) general tree
(E) binary tree
(F) graph
(G) array
(H) hash queue
(I) index mode
(J) PC-relative mode
(K) indirect mode
(L) direct mode
(M) relative mode 或 direct mode
(N) virtual machine
(O) virtual memory
(P) client-server
(Q) page fault
(R) frame number
(S) dirty bit
(T) privileged instruction
(U) reference bit
(V) layer
(W) reference bit and dirty bit
(X) exception handler
(Y) synchronization
(Z) read_program_status_word instruction