

1. For each of the following statements, please indicate TRUE or FALSE and briefly explain your reason. (30%, 3 points each)
 - (1-a) Most compilers do the translation based on type-3 grammars.
 - (1-b) It is impossible to implement a one-pass compiler.
 - (1-c) Given a grammar G_A , it can be proved that G_A is not ambiguous.
 - (1-d) The language $L = \{ a^n b^n c^n \mid n \geq 0 \}$ can be generated by a context-free grammar.
 - (1-e) A complete binary tree is a balanced tree, but it is not an AVL tree.
 - (1-f) During translation, a compiler can detect lexical errors, syntactic errors, semantic errors, and logical errors.
 - (1-g) The best-case time complexity of insertion sort for n data objects is $\Omega(n)$.
 - (1-h) Every LL(1) grammar is also an LR(1) grammar.
 - (1-i) A C compiler does not generate any object code for the following structure in a program of C language:

```
#define max(a, b) (a > b ? a : b)
```
 - (1-j) If $f_1(n) = O(g_1(n))$ and $f_2(n) = O(g_2(n))$, then it always follows that

$$f_1(n) + f_2(n) = O(\max(g_1(n), g_2(n))).$$

2. Explain the following terms: (20%, 4 points each)

(2-a) Attribute grammar	(2-b) B-tree
(2-c) Constant folding	(2-d) Stable sort
(2-e) Linear probing	

3. During a program life cycle (from compilation to execution and until termination), when will the physical memory address of a variable in a program be determined? (Suppose that the underlying operating system uses virtual memory technique to manage the memory.) (5%)

4. To prevent deadlock in a concurrent system, we can break one of the four necessary conditions. How can we break the "circular wait" condition? (5%)

5. Discuss why most processors have at least two processor modes (say, user mode and kernel mode) and how these modes are used in typical operating systems. (10%)

(背面仍有題目,請繼續作答)

6. SystemX is an operating system supporting threading in its kernel. When SystemX switches the execution from thread A to thread B (thread A and thread B are within the same process), which of the following actions should be done by the kernel ? (7%, 每答錯一小題扣兩分,扣至零分為止)
- (A) Changing the content of the BASE register pointing to the page table
 - (B) Changing the priority of the process
 - (C) Changing the contents of the CPU registers
 - (D) Closing the files opened by thread A .
 - (E) Destroying thread A
 - (F) Transferring control to the short-term scheduler
7. Concerning the scheduling in a computer, which of the following statements are **TURE** ? (7%, 每答錯一小題扣兩分,扣至零分為止)
- (A) A priority based scheduling must be a preemptive scheduling.
 - (B) A round robin scheduling must be a preemptive scheduling.
 - (C) Both CPU and memory can be managed as preemptible resources.
 - (D) Round robin scheduling is a reasonable method for long-term scheduling.
 - (E) Medium-term scheduling is not necessary for a batch type operating system.
 - (F) The context switch is an essential feature of a multitasking operating system.
8. Concerning the virtual memory systems, which of the following statements are **TURE** ? (8%, 每答錯一小題扣兩分,扣至零分為止)
- (A) The size of a page table for a process is fixed.
 - (B) The protection bits in a page table assigned to a particular process are used to check against the illegal memory access by other processes.
 - (C) The page table of a process logically functions as the capability-list of the process in terms of memory access.
 - (D) Translation Lookaside Buffer (TLB) is a hardware component used for speeding up address mapping.
 - (E) In translating a virtual address to a real address, more than one page faults would occur.
 - (F) The allocation of a 2-dimensional array by a compiler (row-major or column-major) will not affect the system performance. The major factor that affects the system performance is determined by the page replacement algorithm.
 - (G) Small page size (say 256 bytes) will be advantageous to system performance.

9. Concerning the file systems in operating systems, which of the following statements are **TURE** ? (8%, 每答錯一小題扣兩分,扣至零分為止)
- (A) Inode is the data structure describing the attributes of a file in Unix-like systems.
 - (B) The file system in Windows XP recognizes the file format of an object file (generated by a compiler), so it can call the linker to do linking.
 - (C) The file system in Windows XP recognizes the format of a directory (called 資料夾 in Windows).
 - (D) In general, the information describing about the free space in a disk is recorded in the system root directory.
 - (E) The block size of a disk affects only the wasted disk space, it does not affect the total performance of disk I/O.
 - (F) Memory mapped file service allows a programmer to map a file to a process's address space and access the file through pointers as if it is memory.
 - (G) The major difference between FAT16 and FAT32 is how many clusters (allocation unit) a disk drive can be configured.