(乙組)

Part I. Operating Systems (50%)

1. (10%) Compare in implementation the main differences between a system call and a subroutine call.

2. (15%) Explain the implementation of semaphores in multiprocessor environment.

3. (10%) What is a virtual memory system? To implement a virtual memory system some software and hardware support are required. Describe the hardware support required.

4. (15%) In Unix, a buffer-caching system is included in the I/O system to improve the efficiency. Describe the functions and implementation of the buffer-caching system.

Part II. Compilers (50%)

1. (10%) A grammar G is LL(1) if and only if whenever A -> α | β are two distinct productions of G the following three conditions hold.

(1). For no terminal a do both α and β derive strings beginning with a.

(2). At most one of α and β can derive empty string.

(3). If $\beta \overset{*}{\Rightarrow} \epsilon$ (empty string), then α does not derive any string beginning with a terminal in FOLLOW(A).

For each of these conditions explain the reasons.

2. (10%) Variable-length data refers to dynamically-allocated data. Explain in compilation the approach used for handling variable-length arrays (such as variable-length arrays in Ada)?

3. (15%) The two grammars given below are equal in terms of describing the declaration syntax of types real and integer of programming language.

```
declarations -> VAR decl_list
decl_list -> declaration ';'
        | declaration ';' decl_list
declaration -> ID ':' type
        | ID ',' declaration
type -> REAL | INTEGER
```

(Grammar A)

```
declarations -> VAR decl_list
decl_list -> declaration ';'
        | declaration ';' decl_list
declaration -> namelist ':' type
namelist -> ID ',' namelist
        | ID
type -> REAL | INTEGER
```

(Grammar B)

(乙組)

(a) To parse the string 'var x,y,z : real;' by a LR parser derived from <u>Grammar A</u> show the sequence of the productions reduced.

(b) In syntax-directed translation scheme, the semantic rules (actions) associated with the productions of each grammar should enter the declared type into the symbol-table entry for each variable. In terms of syntax-directed translation scheme for bottom-up parsing which one of the above grammars is improper? Why?

4. Answer the following questions.

(a) (8%) Do some grammars have more reduce/reduce conflicts in their LALR parsing table than in their LR(1) parsing table? why or why not?

(b) (7%) What is a <u>display</u>?