1. (a). What is finite automaton? 5%
   (b). Please define the variable name and the integer
        constant of FORTRAN in regular expression. 5%
   (c). Please give a finite automaton to accept regular
        expressions defined in (b). 5%

2. (a). Please explain why the following grammar G is not
        suitable for top down parsing.

$$E \to E + T \mid T$$
$$T \to T * F \mid F$$
$$F \to id \mid (E) \quad 5\%$$

   (b). Please change the left recursive productions of grammar
        G in (a) to right recursive production. 5%

3. What is the LR parsing table of following grammar:

$$E \to E + T \mid T$$
$$T \to T * F \mid F$$
$$F \to id \mid (E) \quad 10\%$$

4. Suppose a file system uses the following definitions for its internal structures:

```
#define BLOCKSIZE 512

struct inode
{
 unsigned long file_size; /* number of bytes in file */
 unsigned long direct[20]; /* direct_zone mappings */
 unsigned long single[4]; /* single_indirect mappings*/
 unsigned long double[1]; /* double_indirect mappings*/
}
```

Assume that zones are exactly one block in size, and that an unsigned long number
requires 4 bytes of storage.

   (a) What is the maximum possible size for a given file? Your answer may be stated
       as an arithmetic expression. 5%
   (b) Suppose a disk drive is initialized to have 150000 data zones. If the anticipated
       average file size is 1500 bytes, how many disk blocks should be reserved for
       the inode table? Explain your answer, which may be stated as an arithmetic
       expression. 5%

5. A process forks a child process using *fork* UNIX system call.
   (a) How do both processes achieve synchronization? Explain your answer using
       UNIX system calls. 5%
   (b) List all resources that both processes may share with. 5%

6.
(a) A computer whose processes have 1024 pages in their address spaces keeps in its page tables in memory. The overhead required for reading a word from the page table is 400 nsec. To reduce this overhead, the computer has an associative memory, which holds 32 pairs, and can do a look up in 100 nsec. What hit rate is needed to reduce the mean overhead to 160 nsec? 5%

(b) What is the relationship between the size of the associative memory and locality? 5%

7. (a) What is Thread? 5%
(b) Explain the advantages of Client-Server approach in designing operating system. 5%

8.
(a) The banker's algorithm is being run in a system with m resource classes and n processes. In the limit of large m and n, the number of operations that must be performed to $m^a n^b$. What are the values of a and b? 5%

(b) Explain Trojan horse condition in protection problems. 5%

9.
(a) Explain the concept of binding. 5%
(b) What is the advantages of delayed binding? 5%

10.
Suppose relocatable programs are considered. There are two alternative schemes: bit mask and modification record. Explain when the designed should use bit mask instead of modification record. 5%