1. If Staff is an array of objects of the same class, Company, which of the following would most likely be a static data member of this class?(5%)
(a) Identification No.   (b) the CKO   (c) spouse's name   (d) number of kids   (e) skill

2. When datagrams are sent by a host in a network using IPv4 protocol, which of the following statements about is (are) true?(5%)
I. Datagrams are reassembled only at the destination.
II. Datagrams may be fragmented during routing.
III. Datagrams at the source must be the size of the smallest maximum transmission unit (MTU) of all the links on a path to the destination.
(a) I only (b) II only (c) III only (d) I and II (e) I and III

3. For an object with data element x, which of the following is not equivalent to this->x in the member function of x?(5%)
(a) *this.x   (b) (*this).x   (c) *(this.x)   (d) (*(&(*this))).x   (e) none of the above

4. Which of the following statements is FALSE concerning critical regions in multithreading computing?(5%)
(a) One critical region cannot be nested inside another critical region.
(b) Critical regions involving distinct data may be executed concurrently.
(c) A thread should not be permitted to terminate inside a critical region.
(d) A thread should remain inside a critical region for only a finite amount of time.
(e) none of the above

5. Which of the following statements is FALSE concerning memory management in OS?(5%)
(a) When the working set policy is used, main memory may contain some pages which do not belong to the working set of any program.
(b) The working set size is a monotonically nondecreasing function of the working set parameter.
(c) With the Least Recently Used (LRU) page-replacement policy, when the page size is halved, the number of page faults can be more than double the original number of page faults.
(d) none of the above

6. What will happen to the following program in C++?(5%)

```
0001    #include <stdio.h>
0002    int main() {
0003     0;
0004    }
```

(a) running well without any output   (b) running well but showing "0" on the screen
(c) syntax error at line 0001 when compiling   (d) syntax error at line 0002 when compiling
(e) syntax error at line 0003 when compiling   (f) This is not a C++ program but C.

7. What is the full name for each of following abbreviations? Please also identify which layer it belongs to?(10%)(1) LDAP (2) ARP

8. What does the character "a" in the HTML tag <a href=...> stand for? What does it mean for in World Wide Web? Why is it named for that?(5%)

9. Can one implement an UDP-based HTTP service on the same port, say 8080, where a TCP-based Web server already runs? Why?(5%)

10 (7%) The File Transfer Protocol (FTP) is a software standard for transferring computer files between machines with widely different operating systems. It can transfer ASCII or binary files. Suppose you use a PC with Windows 2000 OS where ftp command is built-in, and your c:\ncku\ contains 1000 files (with filename iim0001.jpg ~iim1000.jpg). Suppose you have opened a MS-DOS window which is currently in c:\.

(a) (2%) Which layer of the Internet protocol suite does FTP belong to?

(b) (2%) Now you have to manually keyin all the commands in the DOS window to transfer all the 1000 files to a remote ftp server **ftp.iimexam.ncku.edu.tw (140.11.22.33)**. After you keyin ftp ftp.iimexam.ncku.edu.tw, it responses "*Unknown host*". However, if you keyin ftp 140.11.22.33, it opens a successful connection. Give a reasonable explanation to the "*Unknown host*" result you encounter.

(c) (3%) Suppose your ftp account in the remote ftp server allows you to create and delete folder/files. After you successfully login the ftp server, create a new folder named **ncku**, change directory to the new folder you just created, and change directory to **c:\ncku** in your local machine. Please write down the exact commands to complete this task as follows:
(c1) turn on binary mode,
(c2) turn off the interactive inquiry mode for multiple transfers,
(c3) upload those files with one command

11 (12%) Briefly answer the following questions:
(a) Describe what you know about Mac OS X. Is its kernel unix-based or MS Windows based?
(b) Describe what you know about X window system. Is it a unix-based OS similar to Solaris?
(c) Describe how a P2P transfer differs from a conventional client-server transfer model?
(d) How many arcs does a forest of n nodes consisting of k components have?

12 (15%) True or False, and EXPLAIN
Circle T or F for each of the following statements to indicate whether the statement is true or false, respectively. If the statement is correct, briefly state why. If the statement is wrong, explain why or give a counter example. Answers without reasons will get at most HALF of the grades.
(a) (**T** , **F**) Building a MAX-HEAP of n elements takes $O(n \lg n)$ since each node has height $\lg n$ and there are n nodes.
(b) (**T** , **F**) An array that contains n identical values is a min-heap.
(c) (**T** , **F**) Every tree of more than 2 nodes is a bipartite graph.
(d) (**T** , **F**) For a digraph where each arc (i,j) has positive integral length c_{ij}, suppose we have computed a shortest path from s to t with length d_{st}. If for every arc (i,j) we change c_{ij} to be $c_{ij} + k$ where k is some positive integer, then $\hat{d}_{st}$, the new shortest path length from s to t, must be equal to d_{st} plus a multiple of k.
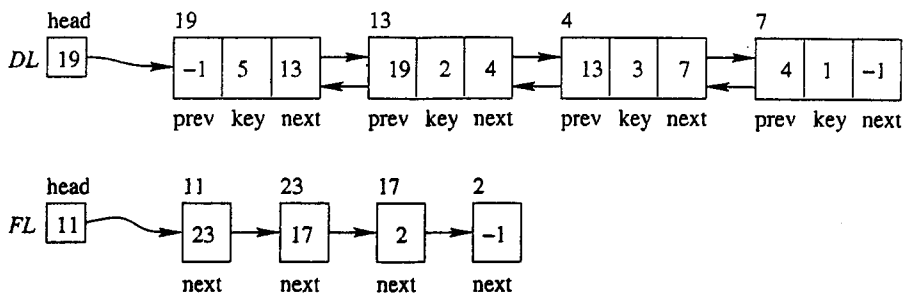(e) (**T** , **F**) For a digraph $G = (N, A)$, the problem to check whether it contains a directed cycle is NOT NP-complete.

Figure 1 (DL, doubly linked list):

```
head        19                13                 4                 7
DL [19]--->[-1 | 5 | 13]<-->[19 | 2 | 4]<-->[13 | 3 | 7]<-->[4 | 1 | -1]
            prev key next     prev key next     prev key next     prev key next

head        11     23     17     2
FL [11]--->[23]-->[17]-->[2]-->[-1]
            next   next   next   next
```

Figure 1: Illustration for DL and FL

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A	-1		3	7	13	1	-1	4		23		2	4	19		2		5	13	-1		17	

Table 1: A single-array representation of a doubly linked list and a singly linked list

13 (16%) Suppose we store 4 objects as a *stack* by a doubly linked list DL using a single-array representation which contains 24 elements. Suppose each object contains 3 fields: *key*, *next*, and *prev* stored consecutively in $A[i]$, $A[i+1]$, and $A[i+2]$ for some integer i that equals 1 plus some multiple of 3 as shown in Table 1.

For example, the second object has *key* = 2 (stored in $A[13] \sim A[15]$) with its next object whose *key* equals $A[A[14]] = 3$, and previous object with *key* = $A[A[15]] = 5$. We also use "−1" to represent NIL. Suppose DL is a structure with two fields: **head** and **tail**. Thus $DL.head = 19$ and $DL.tail = 7$.

Since A can store 8 objects, we also store the remaining 12 free slots as a *stack* which is represented by a free singly linked list FL with $FL.head = 11$ and $FL.tail = 2$ as shown in both Figure 1 and Table 1. Note that each free object in FL only uses its middle slot to store the index for the next free object. For example, the third free object occupies $A[16]$, $A[17]$, and $A[18]$ where $A[17]$ records the middle index for the fourth free object stored (i.e. if we want to insert an object into where the fourth free object occupies, we should insert the object in slots 1, 2, and 3.

Answer the following questions
(a) (8%) Suppose we insert a new object with key equal to 25 to this doubly linked list DL, please write down the updated entries of array $A[\cdot]$. (i.e. you only need to write down those entries that have been affected by this insertion operation.) After the insertion, $DL.head =$? $DL.tail =$?, $FL.head =$?, $FL.tail =$?

(b) (5%) Disregarding (a) (i.e. suppose we have NOT inserted the new object with $key = 25$ yet), in Figure 1 and Table 1, suppose we delete the object with $key = 3$ from DL, please write down the updated entries of array $A[\cdot]$. After the deletion, $FL.head =$?, $FL.tail =$?

(c) (3%) Suppose the objects to be inserted or deleted are homogeneous. Some people suggest that maintaining DL and FL as queues should be more efficient than stacks. Explain why you agree this suggestion or why you disagree this suggestion.

（背面仍有題目，請繼續作答）