

Internet

1. Give a brief description of the following terminology. (15)
 - a) User Datagram Protocol (UDP)
 - b) HyperText Transfer Protocol (HTTP)
 - c) Point-to-Point Protocol (PPP)
 - d) Open Shortest Path First (OSPF)
 - e) Mobile IP

2. Security is a major concern for conducting electronic commerce over the Internet. (15)
 - a) What are those security issues?
 - b) Briefly describe the Internet standards that address the Email security.

3. Simple Network Management Protocol (SNMP) is the Internet network management protocol. (10)
 - a) SNMP follows the manager-agent paradigm. The interaction mechanism between manager and agent is called "trap-directed polling". What is "trap-directed polling"?
 - b) What are those limitations of SNMP?

4. The Internet Protocol Version 6 (IPv6) is the newest version of the Internet Protocol. What are those major features in IPv6 that enhance the old version of the Internet protocol, IPv4. (10)

Data Structures

1. (6 %) How many stacks need to be used in order to implement a Queue using Stacks? Show how AddQueue (insert an item into the rear of the Queue) and DeleteQueue (remove an item from the front of the Queue) functions can be implemented by using AddStack (insert an item at the top of the Stack) and DeleteStack (remove an item from the top of the Stack) functions. * The time complexity of your DeleteQueue function should be $O(1)$. *
2. A Binary Linked-list Tree, BL-tree, is a binary tree in which each tree-node in the binary tree points to a linked list. A BL-tree is defined as the following.
 - (i) A BL-tree contains two kinds of nodes, binary-tree nodes (B-nodes) and linked-list nodes (L-nodes). B-nodes form a binary search tree. Each B-node also contains a pointer to the first L-node of a linked-list containing only L-nodes.
 - (ii) Every element has a unique key. Each L-node stores pointers, an element's data and key value. B-nodes are only used to store key values and pointers.
 - (iii) For each binary-tree node N in a BL-tree, let P be the set of linked-lists pointed by the B-nodes in the left subtree of N , and R be the set of linked-lists pointed by the B-nodes in the right subtree of N . Q is the linked-list pointed by N . The key values of elements in P are less than the key values of elements in Q , and the key values of elements in Q are less than the key values of elements in R .
 - (a) (3 %) Define your data structure for B-nodes. What key values should be stored in a B-node in order to facilitate an efficient search as well as an efficient insertion on your BL-tree?
 - (b) (4 %) Write an algorithm to search an element in a BL-tree.
 - (c) (7 %) Write an algorithm to insert an element into a BL-tree.
3. A max-3-heap is a complete ternary (degree three) tree that is also a max tree. A max tree is a tree in which the key value in each node is no smaller than the key values in its children.
 - (a) (5 %) Write an algorithm to insert an element into a max-3-heap.
 - (b) (3 %) Analyze the time complexity of your insertion algorithm.
4. (8 %) Write an $O(n^2)$ algorithm to compute the reflexive transitive closure matrix for a given undirected graph.
5. Prove the following for deriving the best possible time for sorting n elements.
 - (a) (4 %) Any decision tree that sorts n distinct elements has a height of at least $\log_2(n!) + 1$.
 - (b) (4 %) Any algorithm that sorts by comparisons only must have a worst case computing time of $\Omega(n \log_2 n)$.

6. The following algorithm takes an undirected connected graph G_{in} and generates a new graph G_{out} with the adjacency matrix, $newcost[][]$.
 (6 %) What kind of graph will the algorithm generate? Explain the property of the generated graph G_{out} with respect to G_{in} .

```

algorithmA(int v, int n, int cost[ ][MAX_VERTICES], int newcost[ ][MAX_VERTICES])
{
    /* cost[ ][ ] is the adjacency matrix for a given undirected connected graph  $G_{in}$  */
    /* newcost[ ][ ] is the adjacency matrix for a new graph  $G_{out}$  */
    /* newcost[i][j] = INT_MAX if edge(i, j)  $\notin$   $G_{out}$  */
    int i, j, u, w, found[MAX_VERTICES], nearest[MAX_VERTICES], from[MAX_VERTICES];
    for (i=0; i < n; i++) {
        found[i] = FALSE; nearest[i] = cost[v][i]; from[i] = v;
        for (j=0; j < n; j++) newcost[i][j] = INT_MAX;
    }
    found[v] = TRUE;
    for (i=0; i < n-1; i++) {
        u = choose(nearest, n, found);
        found[u] = TRUE;
        newcost[from[u]][u] = cost[from[u]][u];
        newcost[u][from[u]] = cost[from[u]][u];
        for (w=0; w < n; w++)
            if (!found[w])
                if (cost[u][w] < nearest[w]) {
                    nearest[w] = cost[u][w]; from[w] = u;
                }
    }
}

choose(int nearest[ ], int n, int found[ ])
{
    int i, min, minvertex;
    min = INT_MAX; minvertex = -1;
    for (i=0; i < n; i++)
        if (nearest[i] < min && !found[i]) {
            min = nearest[i]; minvertex = i;
        }
    return minvertex;
}

```

請參考以下 VB3 程式，回答第十與第十一題

```
Dim I As Integer
Dim S1 As Integer
Dim S2 As Integer
Dim Temp1 As Integer
Dim Temp2 As Integer
```

```
S1 = 0: S2 = 0
For I = 1 To 10
    Call Sum1(Temp1, I)
    Call Sum2(Temp2, I)
    S1 = S1 + Temp1
    S2 = S2 + Temp2
Next I
```

```
Sub Sum1 (A, B)
    A = B * 1000
End Sub
```

```
Sub Sum2 (ByVal A, ByVal B)
    A = B * 1000
End Sub
```

- () 10. S1 的值為 (A) 0 (B) 55000 (C) 32767 (D) 以上皆非
() 11. S2 的值為 (A) 0 (B) 55000 (C) 32767 (D) 以上皆非

- () 12. 考慮在 C++ 語言中的繼承情況：

```
class A { ...//member list } ;
class B : virtual public A { ...//member list } ;
class C : public A { ...//member list } ;
class D : virtual public A { ...//member list } ;
class E : public B, public D { ...//member list } ;
class F : public C, public E { ...//member list } ;
```

請問在 class F 中將有幾份 class A 的複本：

- (A) 1 (B) 2 (C) 3 (D) 4

- () 13. 以下前置式(prefix expression)表示式：+*A-BC/DC, 其值為何?(其中 A=3, B=8, C=3, D=9, E=3)

- (A) 3 (B) 8 (C) 18 (D) 24

- () 14. 以下技術何者不可用在分散式物件(Distributed Object)：

- (A) COM // (Component Object Model)
(B) RMI // (Remote Method Invocation)
(C) DCOM // (Distributed Component Object Model)
(D) CORBA // (Common Object Request Broker Architecture)

- () 15. 下列對電子商務(electronic commerce)概念的描述何者錯誤？

- (A) 所謂電子簽章就是把手寫筆跡數位化
(B) 加密方式目前大多採用 DES 或 RSA 演算法
(C) 認證中心是整個電子商務的核心關鍵
(D) 金鑰有公開金鑰(public key)與私人金鑰(private key)兩種