

計算機概論 (含程式設計) 試題 (限用答案本作答)

- (d) Hamilton cycle vs. Euler walk vs. Minimum spanning tree
- (e) NP problem vs. NP-complete problem vs. P problem
- (f) Context-tree grammar vs. Chomsky normal form

(3) (10%) What is the output of the following program?

```

#include <stdio.h>
int temp;
void swap1(int a,int b)
{
    temp = a;
    a = b;
    b = temp;
}
void swap2(int * a,int * b)
{
    temp = *a;
    *a = *b;
    *b = temp;
}
void swap3(int & a,int & b)
{
    temp = a;
    a = b;
    b = temp;
}
void print_x(int & x)
{
    printf("%d ",x++);
}
void print_y()
{
    static int y = 0;
    printf("%d ",y++);
}

void main(void)
{
    int i, x = 5, y = 3;
    swap1(x,y);
    printf("x = %d, y = %d\n",x,y);
    {
        int x = 3, y = 5;
        swap2(&x,&y);
        printf("x = %d, y = %d\n",x,y);
        swap3(x,y);
        printf("x = %d, y = %d\n",x,y);
    }
    swap3(x,y);
    printf("x = %d, y = %d\n",x,y);

    printf("x = ");
    for (i=0; i<y; i++)    print_x(x);
    printf("\ny = ");
    for (i=0; i<x; i++)    print_y();

    printf("\nAt last, x = %d, y = %d", x, y);
}
    
```

(4) (10%) Design minimum circuits implementing the following truth table by using

- (a) PLA; and
- (b) two-input NOR gates:

Input variable			Output variable
A	B	C	R
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

本試題係兩面印刷

- (5) (8%) The longest increasing (contiguous) subsequence of a given sequence is the longest subsequence of increasing terms. For example, the longest increasing subsequence of the sequence 2, 7, 6, 3, 5, 8, 10, 4, 9, 1 is 3, 5, 8, 4. (a) Design an algorithm by using C-like pseudo codes to find the length of the longest increasing subsequence of a given sequence. (b) What is the time complexity of your algorithm?
- (6) (8%) (a) Design an algorithm which detects whether there exists a cycle within a singly linked list. (Suppose that each node in this list contains *data* and *next* fields for storing data and the pointer to the next node respectively.) (b) Please analyze the time and space complexities of your algorithm.
- (7) (4%) Five persons share a large amount of treasure which is protected by some number of different locks. Please design a security system for the shared treasure such that *only when all keys from any group of three or more out of the five persons are present, can all of the locks be opened, while those from all groups less than three persons cannot.* (a) How many locks do you need and (b) how many keys are needed for each of the five persons in your design? (c) Explain why your system is secret?

請依題號順序作答，並務必清楚標示題號！

(1) (30%) Answer  $\circ$  or  $\times$  (for true or false, respectively) for the following questions. Give reasons when your answer is  $\times$ .

1.  $(100110011)_2 = (x)_8 = (y)_{16}$ . Thus  $x = 463$  and  $y = 133$ .
2. As compared with the linked list, an array is easier to accomplish data rearrangement such as insertion and deletion.
3. 1000Base\_T is made of coaxial cable.
4. A context-free grammar can be ambiguous.
5. A partial order is transitive and irreflexive.
6. An interpreter produces no object codes.
7.  $(x_1 \wedge x_2) \vee (\bar{x}_2 \wedge x_3)$  is a conjunctive normal form.
8. MPG is a file format based upon MPEG-1 standard, while MP3 is a file format based upon MPEG-3.
9. LISP is a declarative language.
10. The time complexity of quicksort is  $O(n \log n)$  in the worst case where  $n$  is the number of input elements for sorting.
11. If you want the variables and methods to be accessible only to methods of the class and to methods of derived classes, you can define them as protected type in C++.
12. Theoretically, there are at most 65536 IP addresses in a Class A Subnet.
13. A PROJECT operation merges related tuples in two relations into one tuple.
14. Depth-first search can be implemented by a stack data structure.
15. We call it demodulation when converting a signal from analog to digital.
16.  $(11011001)_2$  is the 2's complement representation of -39.
17. The bitmap of a process is maintained in its process control block.
18. Heapsort and quicksort are optimal algorithms for sorting.
19. A tree is a bipartite graph.
20. For a specific problem, a polynomial time algorithm runs always faster than an exponential time algorithm.
21. A critical section is a piece of code that can only be executed by one process or thread at a time.
22. Given a minimum spanning tree  $T$  of a graph  $G$ , the path connecting  $u$  and  $v$  in  $T$  is the shortest path between  $u$  and  $v$  in  $G$ .
23. Booth's multiplication algorithm multiplies two signed numbers in two's complement notation.
24. A minimum spanning tree of a given graph can be found by the famous Dijkstra algorithm.
25. UDP is a reliable and connection-oriented protocol.
26. When the input to a T flip-flop is 0, the next state is complemented (i.e.,  $\bar{Q}$  if the present state is  $Q$ ).
27. POP is applied to receive emails, while SMTP is to send emails.
28. A race condition is a situation wherein two or more competing actions are waiting for the other to finish, and thus neither ever does.
29. The postfix notation of  $a \times (b+c) / d + e \times (f+g)^h$  is  $abc+ \times d / efg+h^{\wedge} \times +$ .
30. A full binary tree is a complete binary tree.

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(2) (30%) Please be **exact and brief** to **explain** and **make comparisons** for the following terms:

- (a) HTML vs. SGML vs. XML
- (b) JPEG vs. GIF vs. PNG vs. BMP
- (c) Memory hierarchy vs. Memory interleaving

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