

# 大同大學 99 學年度研究所碩士班入學考試試題

考試科目: 計算機概論

所別: 資訊工程研究所

第 1/2 頁

註: 本次考試 不可以 參考自己的書籍及筆記; 不可以 使用字典; 不可以 使用計算器。

## Part 1

- (4%) We could write the Dijkstra's algorithm to find the shortest path by using data structures like (1) and (2).
- (4%) A maze is usually stored in a(n) (3) and we could find a path by using data structure like (4) for back tracking.
- (4%) A calculator is usually implemented by transforming an infix equation to (5) representation and then evaluated by using a(n) (6).
- (6%) Polynominal functions are usually stored by singly linked lists. The addition of polynominals  $A(x)$  with  $m$  terms and  $B(x)$  with  $n$  ( $n \leq m$ ) terms could be done in  $O$ ( (7) ),  $\Omega$ ( (8) ), and  $\Theta$ ( (9) ).
- (10%) Fill the blanks in the following:
  - If  $T$  is a  $k$ -ary tree (i.e., a tree of degree  $k$ ) with  $n$  nodes, each having a fixed size of data and  $k$  children, then (10) of the  $nk$  child fields are 0,  $n \geq 0$ .
  - The maximum number of nodes on level  $i$  of a binary tree is (11),  $i \geq 1$ .
  - The maximum number of nodes in a binary tree of depth  $k$  is (12),  $k \geq 1$ .
  - For any nonempty binary tree  $T$  if  $n_0$  is the number of leaf nodes and  $n_2$  is the number of nodes of degree 2, then  $n_0 =$  (13).
  - The height of a complete binary tree with  $n$  nodes is (14).
- (6%) Please transform  $(a+b)*d+e/(f+a*d)+c$  into postfix (15) and prefix (16).
- (4%) Please write the postorder sequence (17) of the binary tree with inorder sequence DGBEAFHC and preorder sequence ABDGECFH.
- (6%) True or False.
  - (18)  $10n^2 + 9 = O(n)$ .
  - (19)  $n^2 \log n = \Theta(n^2)$ .
  - (20)  $3n^n = O(2^n)$ .
- (6%) An algorithm for solving the Towers of Hanoi with  $n$  disks and three posts labeled A, B, and C is as follows:

```
towers(int howMany, int source, int target, int spare)
if howMany is equal to 1
    move it from the source to target
else
    (1) call towers to move howMany - 1 disks from source to spare using target as spare
    (2) move it (disk no. howMany) from source to target
    (3) call towers to move howMany - 1 disks from spare to target using source as spare
```

Find a recurrence equation for the above algorithm and solve the recurrence equation.

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## Part 2

〈接前頁〉

10. (4%) Using + (OR) operation to answer the following questions using  $x$ ,  $y$ , and  $z$  as variables:

| Theorems of Boolean Algebra |              |             |             |
|-----------------------------|--------------|-------------|-------------|
| Identity                    | Commutative  | Idempotence | Associative |
| (21)                        | (22)         | (23)        | (24)        |
| Absorption                  | Distributive | DeMorgan    | Consensus   |
| (25)                        | (26)         | (27)        | (28)        |

11. (15%) Logic function  $F(W, X, Y, Z) = [(\bar{W} + X) \cdot Y] \cdot [\bar{W} + X + \bar{Y}] \cdot [W + Z]$

- What is the form  $F(W, X, Y, Z) = \sum(?)$  ?
- What is the minimum SOP? Implement with 2-input NOR gates only.
- What is the minimum POS? Implement with 2-input NAND gates only.

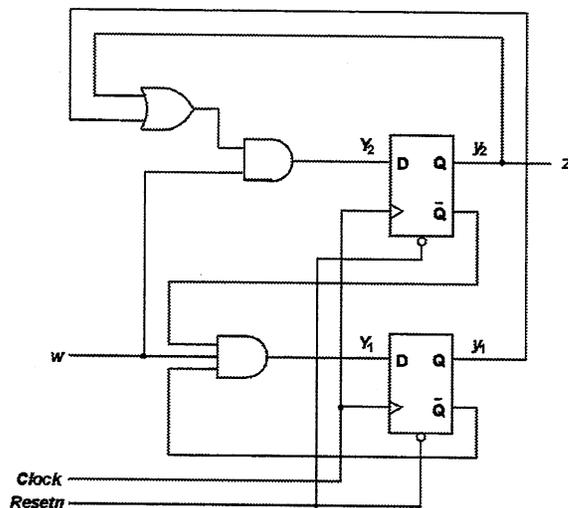
12. (9%)

An odd parity Hamming system is used and the bit sequence is specified as  $X_7X_6X_5X_4X_3X_2X_1$ .

- If the information bit sequence is 0110, what is the Hamming bit sequence?
- If the Hamming bit sequence is 1101101, what is the information bit sequence?
- If single bit error detection and correction scheme is used, what is the correct information of the following sequence: 1111010?

13. (12%)

Analysis the following circuit by following the steps below:



- Find the input equation of each flip flop.
- Draw the state table or transition table.
- Make the state assignment.
- Draw the state diagram.

14. (10%) Using J-K flip-flops to design a synchronous counter with the following sequence:

$0 \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow 2 \rightarrow 1 \rightarrow 0$