

# 大同大學 102 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

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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 I. 資料結構 (50 points)

➤ Choose the correct or best answer for each of the following 5 questions (10 points, 2 points each).

1. \_\_\_ For an extremely unbalanced binary search tree, its worst-case insertion efficiency will be  
(1)  $O(1)$  (2)  $O(\log n)$  (3)  $O(n)$  (4)  $O(n \log n)$  (5)  $O(n^2)$  (6)  $O(n!)$ .
2. \_\_\_ If node A is the parent of node B, and B is the parent of node C, then A and B are C's  
(1) root (2) child (3) father (4) descendant (5) ancestor (6) sibling.
3. \_\_\_ If the left sub-tree and right sub-tree of a nonempty binary tree T are  $T_L$  and  $T_R$ , then the height of T,  $\text{height}(T)$ , equals to  
(1)  $\max\{\text{height}(T_L), \text{height}(T_R)\}$  (2)  $\text{height}(T_L) + \text{height}(T_R)$   
(3)  $\min\{\text{height}(T_L), \text{height}(T_R)\}$  (4)  $1 + \min\{\text{height}(T_L), \text{height}(T_R)\}$   
(5)  $1 + \text{height}(T_L) + \text{height}(T_R)$  (6)  $1 + \max\{\text{height}(T_L), \text{height}(T_R)\}$ .
4. \_\_\_ A binary tree in which the key value in each node is no smaller than those in its children (if any) is called  
(1) an AVL-tree (2) a max heap (3) a min heap  
(4) a red-black tree (5) a binary search tree (6) a spanning tree.
5. \_\_\_ Merge sort uses  
(1) divide and conquer strategy (2) decrease and conquer strategy  
(3) brute force approach (4) backtracking approach  
(5) heuristic approach (6) greedy approach

➤ Show the result of each of the following 3 questions (30 points, 10 points each).

6. Evaluate the following prefix and postfix expressions when  $A = 6$ ,  $B = 2$ ,  $C = 5$ ,  $D = 5$ ,  $E = 1$ , and  $F = 2$ .

(i) Prefix:  $+ / \times + A B C - D E F$

(ii) Postfix:  $A B + C \times D E - F \times /$

7. What will (i)  $\text{Recu}(X, Y, 3, 3)$  and (ii)  $\text{Recu}(X, Y, 7, 6)$  return, respectively?

```
int Recu(int i, int j)
{
    int X[] = { 0, 1, 2, 3, 2, 4, 1, 2 }; int Y[] = { 0, 2, 4, 3, 1, 2, 1 };
    if ( i == 0 || j == 0 ) return 0;
    if ( X[i] == Y[j] ) return Recu( i - 1, j - 1 ) + 1;
    else return max( Recu( i, j - 1 ), Recu( i - 1, j ) );
}
```

8. Let  $a$  be the start vertex. Show the traversal orders for  
(i) breadth first search (BFS), and (ii) depth first search (DFS)  
for the graph (represented by the adjacency list) on the right.

a	→	c	→	d		
b	→	c	→	f		
c	→	a	→	b	→	e
d	→	a	→	e		
e	→	c	→	d	→	f
f	→	b	→	e		

➤ Answer the following question (10 points).

9. An ADT list implemented by C/C++ can be array-based (a static approach) or pointer-based (a dynamic approach). Make a comparison of the two approaches by stating their advantages and disadvantages in terms of (i) run-time list size limitation, (ii) list item memory usage, and (iii) list item retrieval time.

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# 大同大學 102 學年度 研究所碩士班 入學考試試題

考試科目：計算機概論

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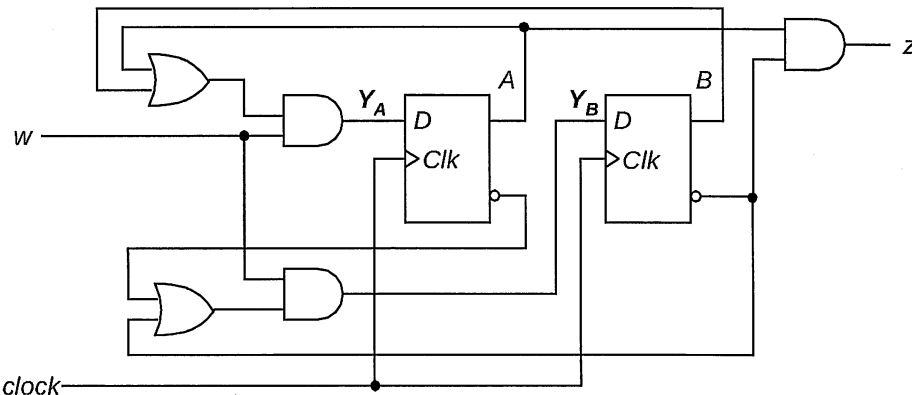
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Part II: 基本數位邏輯 (50 points)

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10. (4 points) Convert the decimal number 247 to (a) binary, (b) hexadecimal.
11. (6 point) Perform subtraction on the given **unsigned binary** number using the 2's complement of the subtrahend. If the results are negative, find their 2's complement and affix a minus sign. (Assume all the performances are limited to 8-bit.)
  - (a) 1010100 - 10100
  - (b) 11001 - 1011001
12. (10 points) Given the Boolean functions  $xy' + x'(y+z) + y'z$ , answer the following questions.
  - (a) Express it as a sum-of-minterms.
  - (b) Simplify it into a minimal sum-of-products using **Boolean algebra** manipulation.
13. (10 points) Given a logic function,  $F(x_1, x_2, x_3, x_4) = \sum m(4, 6, 7, 11, 12, 15) + D(3, 8, 9)$ .
  - (a) Find the minimal sum-of-products expression.
  - (b) **Draw** the minimal **all NAND** circuit. (Assume that the input variables are available in both uncomplemented and complemented forms.)
14. (12 points) A synchronous sequential logic circuit with one input  $w$  and one output  $z$  is shown.



- (a) Find the input equation of each flip-flop and output equation.
  - (a) Find the state table or transition table.
  - (b) Find the state diagram.
15. (8 points) Find the **simplest state diagram** of a synchronous sequence circuit to meet the requirements. The circuit has one input **START** and one output **PCLK**. When the **START** change from 0 to 1, the **PCLK** will send two pulses as shown in figure. Assume the time that **START** returns form 1 to 0 is longer than 10 clock cycles.

