

九十二學年度 計算機概論

1. Please describe the advantages and disadvantage of Microsoft window and Linux OS with the following three respects, 1) maintenance and management, 2) software and hardware compatibility, 3) executing performance. (15%)
2. What is polymorphism in Object Oriented Language? (5%) Please describe it with the overriding mechanism. (5%)
3. Relational Database could be used to store data and it is very helpful for researchers to analyze the data and get important information. Please describe the characteristics of relational database? (10%) And use ER model to construct the relationship for courses, students and teachers? (10%)
4. Why does TCP/IP protocol play an important role in the Internet? Please list your opinions based on the concept of the OSI layers (15%)
5. With inheritance mechanism, please write three Java classes for point, square and cube, respectively? (10%) Use another mechanism, composition, to design point, square and cube ? (10%)
6. Try to explain what SMP(Symmetric Multiple Processors) is and figure its architecture with processors, memory and bus. (20%)

一、對於下列元素：

1, 6, 7, 2, 4, 3, 5, 8

依序加入 (insert) 到原來為空 (empty) 的 AVL 樹 (AVL tree)。請畫出結果的 AVL 樹。(10 分)

二、對於下列元素：

2, 7, 1, 8, 4, 5, 9, 0, 3, 6

依序加入 (insert) 到原來為空 (empty) 的度數為 6 的 B 樹 (B tree of order 6)。請畫出結果的 B 樹。(10 分)

三、某校資訊系課程可視為 N 個資料元素 (data elements) 構成的一個集合，裏面每個資料元素即一門課，含(1)課號(四位數字) (4 digits), (2)名稱(四個中文字)等資料欄位 (data fields)，以"課號"為鍵 (key)，假設依序加入 (insert) 下面四門課於該集合：

1234 資料結構

2345 軟體工程

3456 網際網路

2333 離散結構

分別用下面三種資料結構來表示該集合，請分別畫圖表示之：

(一) 陣列 (array)

(二) 雙鏈結環狀串列 (double linked circular list) (要有頭節點 (head node))

(三) 二元搜尋樹 (binary search tree) (20 分)

四、下面陣列 (array) 表示一個 min-heap:

1 3 4 5 8 9 6

(一) 請畫出此 heap 圖。

(二) 請畫出加入 (insert) 2 後，此 heap 變化後之圖。(10 分)

五、對於下列元素：

1, 6, 7, 2, 4, 3, 5, 8

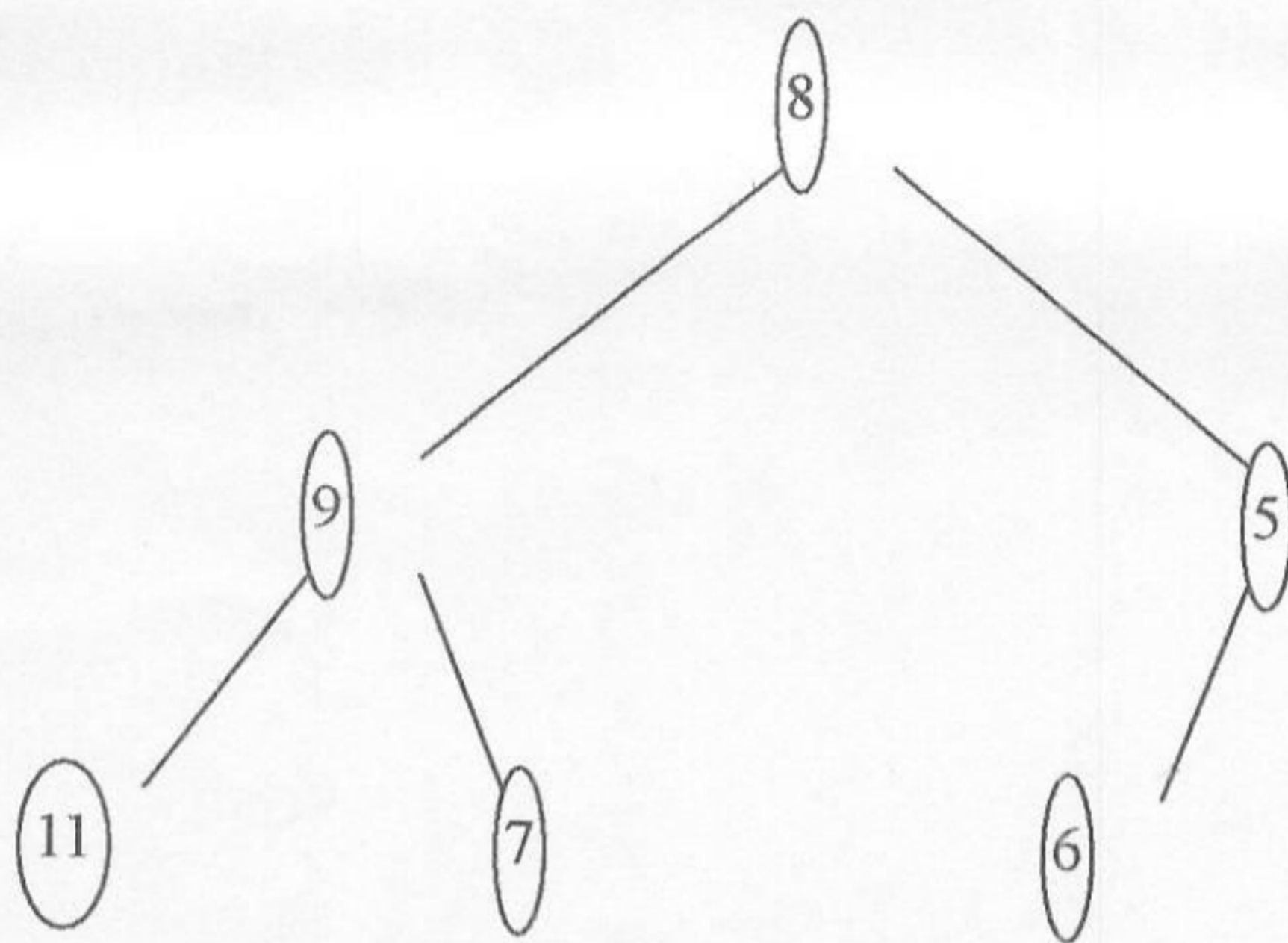
依序加入 (insert) 到原來為空 (empty) 的二元搜尋樹 (binary search tree)。請畫出結果的二元搜尋樹。(10 分)

六、對於下列元素：

2, 7, 1, 8, 4, 5, 9, 0, 3, 6

依序加入 (insert) 到原來為空 (empty) 的 2-3 樹 (即度數為 3 的 B 樹) (2-3 tree, a B tree of order 3)。請畫出結果的 2-3 樹。(10 分)

七、



對上圖之樹 (tree) 做走訪 (traversal), 分別依:

(一) 前序走訪 (preorder traversal)

(二) 中序走訪 (inorder traversal)

(三) 後序走訪 (postorder traversal)

請分別寫出節點順序 (nodes sequence)。(10 分)

八、假設我們用五個桶 (buckets) 的雜湊表 (hashing table), 每個桶可放一筆資料, 而雜湊函數 (hash function) h 為:

$$h(i) = i \bmod 5$$

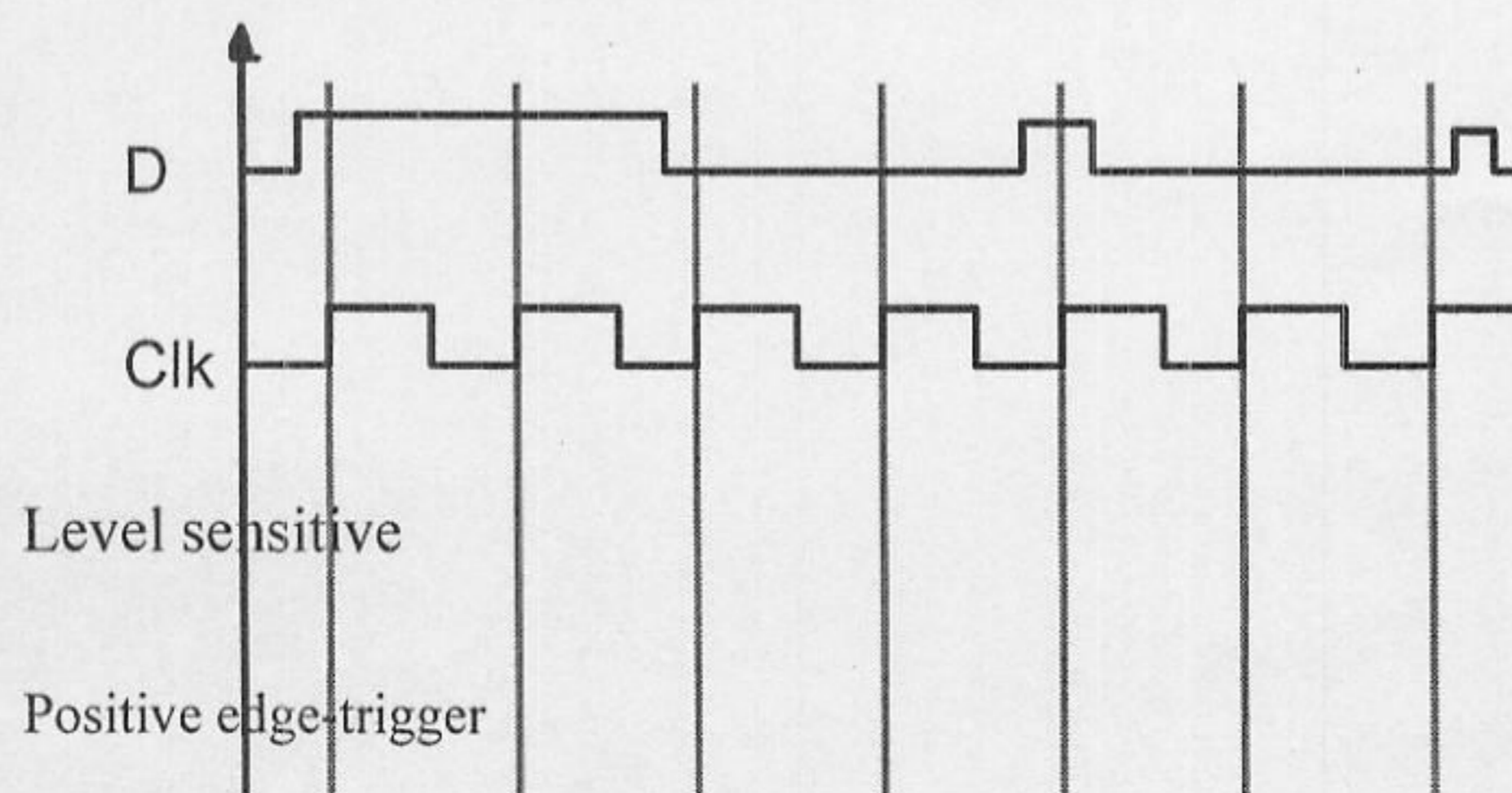
使用線性探測 (linear probing) 來解決碰撞 (collision)。假設一開始雜湊表是空的, 依序加入 (insert) 23, 48, 35, 4, 10 五筆資料。請繪圖顯示最後雜湊表之內容。(10 分)

九、在二元樹 (Binary Tree) 中, 滿節點 (Full Node) 是有兩個孩子 (children) 的節點 (Node)。請證明: 在非空的二元樹 (non-empty binary tree) 中, 滿節點的數目加 1 等於樹葉 (leaves) 的數目。(10 分)

1. 以 2 變數(X 及 Y)之形式寫出狄摩根定理(DeMorgan's Law)之兩個方程式. (10%)
2. 以 4-to-1 及 2-to-1 之 multiplexer 設計出 8-to-1 multiplexer. (10%)
3. 畫出 2-to-4 decoder 之 (a)功能圖(方塊圖)及; (b)邏輯電路. (10%)
4. 以先 complement 求 F' 再返回求 F 之方式, 求出 F 之表示式(須寫出步驟). (15%)

A B C	F
0 0 0	0
0 0 1	0
0 1 0	1
0 1 1	1
1 0 0	1
1 0 1	1
1 1 0	1
1 1 1	1

5. 寫出 two's complement 表示法較 signed magnitude 表示法優異之處. (15%)
6. 使用 full adders, multiplexers, 及 XOR 設計一個 4-bit two's complement "adder/subtractor" 並具備偵測 "overflow" 之功能. (20%)
7. 以 4-bit carry-look-ahead adder 為例, 寫出以下之 Boolean equations (10%)
 - (a) Group propagate: 以 P_i 及 G_i ($i=0,1,2,3$) 來表達
 - (b) Group generate: 以 P_i 及 G_i ($i=0,1,2,3$) 來表達.
8. 完成以下兩種 D-type Flip/Flop (level sensitive D-F/F 及 positive edge D-F/F) 之 timing diagram (請描繪清晰, 否則不給分). (10%)



1. (25 Points)

A traveler is passing through a country where all the people are either Truth-Tellers, who always tell the truth, or Liars, who always lie. The traveler comes to a fork in the road, and at the fork of the road there is a man who is either a Truth-Teller or a Liar, but the traveler does not know which.

The traveler wants to go to a certain city. This time there are two forks in the road, a left fork, a right fork, and only one of these roads goes to the city.

The traveler must ask the man questions to determine which fork in the road leads to the city. What is the smallest number of questions that are needed? What should the questions be?

2. (25 Points)

Given $f = \{ (a, b), (b, a), (c, b) \}$, a function from $X = \{ a, b, c \}$ to X :

(a) Write $f \circ f$ and $f \circ f \circ f$ as sets of ordered pairs.

(b) Define $f^n = f \circ f \circ f \circ \dots \circ f$ to be the n -fold composition of f with itself. Find f^9 and f^{623} .

(*Definition of Composition of Functions: If $f: A \rightarrow B$ and $g: B \rightarrow C$ are functions, the composition of g and f is the function $g \circ f: A \rightarrow C$ defined by $(g \circ f)(a) = g(f(a))$ for all $a \in A$.)

3. (25 Points)

Let $A = \{1, 2, 4, 6, 8\}$ and, for $a, b \in A$, define $a \leq b$ if and only if $\frac{b}{a}$ is an integer.

(a) Prove that \leq defines a partial order on A .

(b) Draw the Hasse diagram for \leq .

(c) List all minimum, minimal, maximum and maximal elements.

(d) Is (A, \leq) totally ordered? Explain.

4. (25 Points)

(a) What is the maximum degree of a vertex in a graph with n vertices?

(b) What is the maximum number of edges in a graph with n vertices?

(c) How many edges must a Hamiltonian cycle in K_n contain?

(d) How many Hamiltonian cycles does K_n have? (Begin all cycles at the same vertex.)