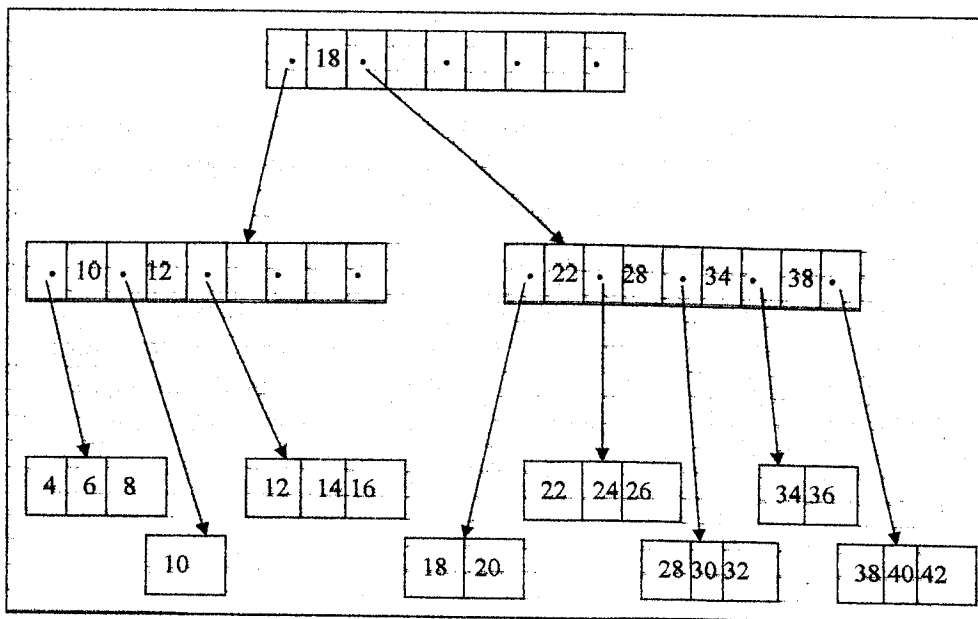


所別：資訊工程學系碩士班 不分組 科目：資料結構與演算法

資料結構與演算法

- (14%) 依序 insert 下列 integers 到一棵空的 binary search tree, 7, 2, 9, 0, 5, 6, 8, 1
 (a) 請繪圖顯示結果。
 (b) 然後, 依序 delete 7, 2, 亦請繪圖顯示結果。
- (16%) 繪圖顯示依序 insert 2, 4, 1, 5, 3, 9, 6, 7 於原本 empty 的一棵 AVL tree。(共需 8 張圖)
- (12%) 下面有一棵 B tree, 其 leaf node 有 1 至 3 個 elements, 其 root node 至少要有兩個 children, 其他 nodes 則有至少 2 個, 至多 5 個, children。



- 畫出 insert 23 後之 B tree。
- 接著(a), 畫出 delete 10 後之 B tree。

- (8%) 假設我們用 5 個 Buckets 的 hash table, 而 hash function 為:
 $h(i) = i \bmod 5$, 使用 linear resolution 來解決 collision, 假設一開始 hash table 是空的, 依序 insert 23, 48, 35, 4, 10 請繪圖顯示最後 hash table 之內容。

參考用

注：背面有試題

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5. (10%) Exactly how many operations (including both division and addition operations and expressing the value as a function of n) are used in the following recursive function when it is called as $f(n)$.

```
f(k)
{
  if(k <= 2) return 2;
  return f(k-1)/f(k-2)+3;
}
```

6. (10%) Given an integer n , design an efficient algorithm for computing $\lceil \sqrt{n} \rceil$. Your algorithm should be more efficient than $\Theta(\sqrt{n})$. Analyze the time efficiency of your algorithm. (Hint: Use the binary search technique.)
7. (10%) Given an array of n numbers, and a number s , determine whether the array contains 4 elements whose sum is s . Analyze the time efficiency of your algorithm. Your algorithm should be more efficient than $O(n^4)$.
8. (20%) Compute the lengths of all-pair shortest paths for the directed graph of 5 vertices represented by the following matrix such that each entry $a_{ij} = t$ represents that there is an edge directed from vertex i to vertex j with weight t . Use your computation result to find a shortest path from vertex 1 to vertex 3. Please describe which algorithm you use to find the lengths of shortest paths.

0	3	8	∞	-4
∞	0	∞	1	7
∞	4	0	∞	∞
2	∞	-5	0	∞
∞	∞	∞	6	0

