

國立臺北大學 104 學年度碩士班一般入學考試試題

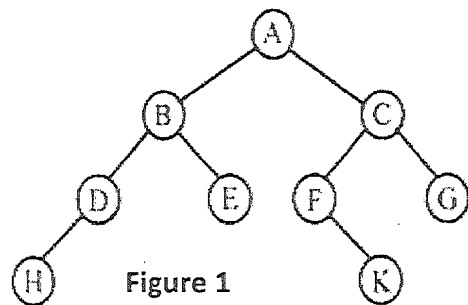
系(所)組別：資訊管理研究所甲組

科 目：資料結構

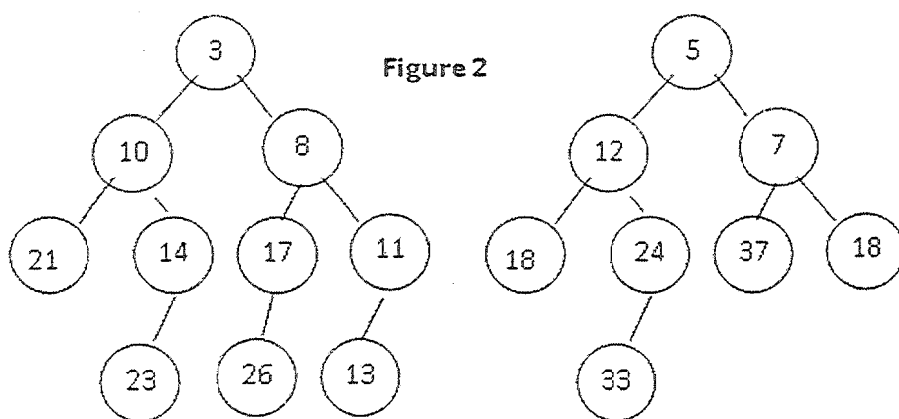
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可 不可使用計算機

1. (12 points) (a). 對於用 Linked list 表示的 n 個點的二元樹共有多少 link 是浪費掉的(i.e. null links)? (b). 請說明何謂引線二元樹(Threaded Binary Trees)?目的為何? (c). 請將 Figure 1 的二元樹表示成引線二元樹(引線以虛線表示)。



2. (12 points) (a). 請寫出利用堆疊(Stack)將中序式(Infix)與後序式(Postfix)互轉的演算法(式子包含“(”及”)”) (b). 請寫出 $(A+B)*D-E+H/(F+C)+G$ 後序式(Postfix)
3. (12 points) Use heap sort to sort the sequence number 9, 17, 43, 62, 5, 33, 7, 2, 1 and 40. (you have to show the tree for each step)
4. (14 points) Please describe the definition for Leftist tree and combine the following two leftist trees in Figure 2.



5. 選擇題(36 points)

(a) Given the following sample code:

```
initialize a stack
while (more characters to be read) {
    read a character
    push the character into the stack
}
while (the stack is not empty) {
    pop a character from the stack
    print the character
}
```

What is the output results for the input "university"?

A. unnniivveerrssiitty B. university C. ytisrevinu D. secret

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接背面

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(b) The following code are executed:

```
IntQueue q = new IntQueue( );
q.insert(1);
q.insert(2);
q.insert(3);
```

```
System.out.println(q.getFront( ));
```

Suppose q is a circular array. Trace and find what is the output result?

A. 1 B. 2 C. 3 D. 4



(c) There are CAPACITY elements can be store in a circular array. The rear is an index for the circular array, what is the formula for the index after rear?

A. (rear % 1) + CAPACITY B. rear % (1 + CAPACITY)
C. (rear + 1) % CAPACITY D. rear + (1 % CAPACITY)

(d) Given the following Secret() pseudocode:

```
void Secret(int number) {
    if (number < 0) {
        System.out.println("-");
        Secret (-1 * number);
    }
    else if (number < 8)
        System.out.println(number);
    else {
        Secret (number / 8);
        System.out.println(number % 8);
    }
}
```

Which one of the following condition is used to handle the stopping case?

A. number < 0 B. number < 8
C. number >= 0 && number < 8 D. number > 8

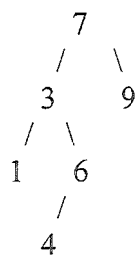
(e) Given the sample() function as followings:

```
void sample(int i) {
    if (i > 1) {
        sample (i / 2);
        sample (i / 2);
    }
    System.out.print("*");
}
```

How many asterisks "*" are printed when a function sample(5) is run?

A. 3 B. 4 C. 7 D. 8 E. Some other number

(f) Given the following binary search tree:



After removing the root and replacing it the left subtree. What will be the new root?

A. 1 B. 3 C. 4 D. 6 E. 9

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- (g) Which of the following statement is **TRUE** for a B-tree?
- A. All entries of a node are greater than or equal to the entries in the node's children.
 B. All nodes contain the exact same number of entries.
 C. The depth of all leaves are exact the same.
 D. All non-leaf nodes have the same number of children.
- (h) Given a non-leaf node has 42 entries in a B-tree. How many children does this node have?
 A. 2 B. 41 C. 42 D. 43 E. 84
- (i) What is the time complexity in worst-case for binary search finding an item in an array?
 A. Constant time B. Logarithmic time
 C. Linear time D. Quadratic time
- (j) Suppose there are m items to be put in a hash table with an array size of s . What is the correct formula for the load factor?
 A. $s + m$ B. $s - m$ C. $m - s$ D. $m * s$ E. m / s
- (k) Selectionsort and quicksort both belong to the same category of sorting algorithms. What is this category?
 A. $O(n^2)$ sorts B. Average time is quadratic
 C. Interchange sorts D. Divide-and-conquer sorts.
- (l) How many boolean values are required for a directed graph G using an adjacency matrix with 20 vertices?
 A. 20 B. 40 C. 200 D. 400

6. (14 points) 假設你正在一個edge-weighted圖(如下表1所示)上執行Dijkstra's的演算法，以0作為起始點，給定表2中所示為節點2已於權重佇列中刪除且釋放後所包含的連結[]和距離[]值結果，

表1 edge-weighted圖

連結	權重	連結	權重
0→2	6	5→1	12.0
0→4	6	5→2	1.0
0→5	17	5→4	3.0
1→3	17	5→7	10.0
2→5	11	5→8	4.0
2→7	6	6→0	12.0
3→0	1	6→1	5.0
3→10	3	6→2	1.0
3→1	25	6→4	9.0
3→6	13	6→9	4.0
3→8	9	7→1	7.0
4→5	3	7→5	11
4→6	4	7→9	6
4→7	3	10→1	15
4→8	1	10→5	2
4→9	15	10→9	7

表2 權重佇列

v	距離[]	連結[]
0	1	3→0
1	17	5→1
2	6	5→2
3	0	null
4	7	0→4
5	5	10→5
6	13	3→6
7	12	2→7
8	9	3→8
9	∞	null
10	3	3→10

- (a) 給定上述情形之下，Dijkstra's演算法之中間執行過程，請列出權重佇列中前五個被刪除的節點

					2
--	--	--	--	--	---

- (b) 列出節點2被選取之後，下一個節點將被選出，依權重佇列中被刪除後之連結[]和距離[]值結果為何？即下一個處理之後列出如表2的結果。

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