

# 國立交通大學 102 學年度碩士班考試入學試題

科目名稱：資料結構與網際網路概論 (5122)

考試日期：102 年 2 月 3 日 第 3 節

系所班別：資訊管理研究所

組別：資管所甲組

第 1 頁, 共 2 頁

【不可使用計算機】\*作答前請先核對試題、答案卷(試卷)與准考證上之所組別與考試科目是否相符!!

問答題：

1. In highly reliable computers, *residue codes* are sometimes used to enable checking of the basic arithmetic operations. The residue of a number  $N$  is defined by
$$R(N) = N \bmod p$$
where  $p$  is called the *modulus*, that is the remainder after dividing a number  $N$  by another number  $p$ .
  - (5%) Construct the addition table for modulus 3 arithmetic using binary notation.
  - (5%) Construct the multiplication table for modulus 5 arithmetic using binary notation.
2. (8%) Please briefly explain the architecture of web services and how it is working.
3. (6%) During the program implementation, please explain concisely what criteria you would use for a sequential search, binary search, or hashing search.
4. (6%) What is the Hawthorne Effect? Why is it significant?
5. (4%) Convert -90 to its pure binary equivalent.
6. (16%) Please explain the following terminology.
  - 6(a) Baud Rate
  - 6(b) p-persistent CSMA (Carrier Sense Multiple Access)
  - 6(c) Digital Certificate
  - 6(d) Message Digest
7. (17%) Signal.
  - 7(a) There are two types of signal, analog and digital. Explain their differences.

Why is today's network moving toward digital instead of analog signaling?
  - 7(b) Describe how data, both analog and digital, are converted into digital signal.
8. (5%) Write down the prefix expression for
  - 8(a)  $A+B*C$
  - 8(b)  $!A+B\&\&C*D$
9. (6%) Prove or disprove the following arguments:
  - 9(a) If  $f(n)$  is  $\Omega(g(n))$ , then  $g(n)$  is  $o(f(n))$
  - 9(b) If  $f(n)=1+2+3+\dots+n$ , then  $f(n)$  is  $O(n^2)$

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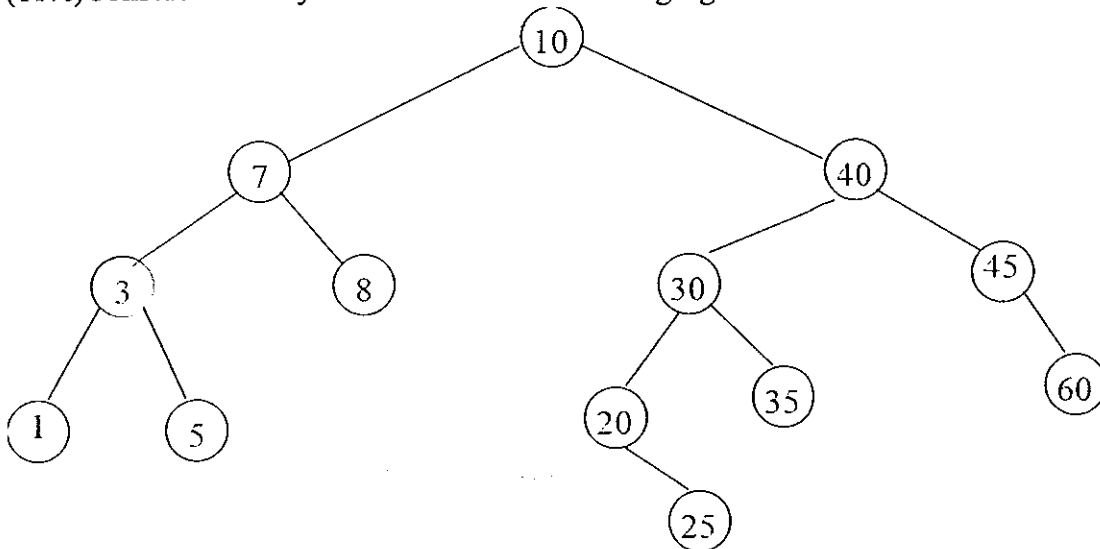
系所班別：資訊管理研究所

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第 2 頁, 共 2 頁

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10. (11%) Consider a binary search tree in the following figure:



10(a) Explain the properties of a binary search tree.

10(b) Please insert a node with key=6.

10(c) An AVL tree is a self-balancing binary search tree that the heights of the two child subtrees of any node differ by at most one. Please show how the AVL tree is adjusted after the insertion mentioned in question B.

11. (11%) Assume that a linked list is implemented by the following classes:

```
template <class T>
class Node
{
    T data;
    Node<T> *link;
    Node(const T& data, Node<T>* link)
        {this->data = data;
         this->link = link;}
};
```

```
template <class T>
class LinkedList
{
private:
    Node <T> *first;
};
```

, where the object Node denotes an element of the linked list and the \*first point to the first element of the linked list."

11(a) Write a member function Count(T& X) that counts the number of element "X" in the linked list.

11(b) Write a member function Replace(T& X, T& Y) that replace each element "X" in the linked list by the element "Y".