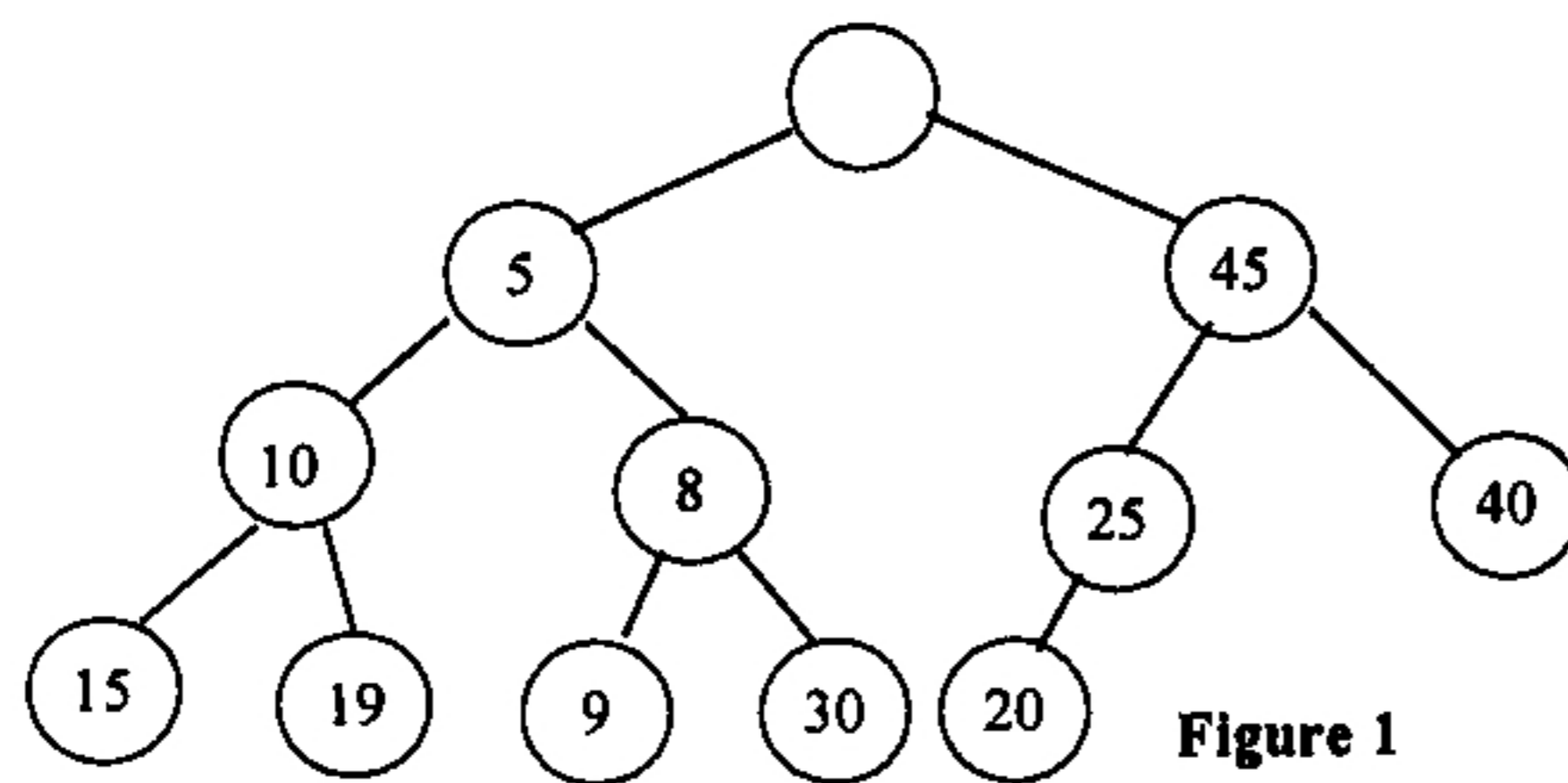


國立臺北大學九十七學年度碩士班招生考試試題

系(所)別：資訊工程學系
科目：資料結構與演算法

組別：
第1頁共2頁
可 不可使用計算機

1. Explain the following terms (a) Binomial trees (3 points) (b) Hamiltonian cycle (3 points) (c) Simple path (3 points) (d) Strongly Connected Graph (3 points) (e) NP algorithm (4 points)
2. (12 points)(a) Please describe the rules for the conversion from Infix to Postfix (b) Write the postfix form of $(A+B)*D+E/((F+A*D)+C)$
3. (12 points) Given an 11-element deap as follows in Figure 1, please show (a) the deap after inserting two new elements with keys 4 and 80, respectively. (the node with key 4 is inserted first) (b) the deap after deleting two min elements from the above 13-element deap.



4. (10 points) Given a Lower Triangular matrix in Column major (i.e. $A(1,1), A(2,1), \dots, A(N,1), A(2,2), A(3,2), A(N,2), \dots, A(N,N)$). What are the functions of $f1(i)$ and $f2(j)$ in the following formula
$$LOC(A(i, j)) = LOC(A(1,1)) + f1(i) + f2(j)$$
5. The following function gives an algorithm that searches an array for the first occurrence of x .

```
int func(int [] a, int n, int x){
    int i;
    for (i=0; i < n && x != a[i]; i++);
    if (i == n) return -1;
    else return i;
}
```

A search is successful when x is one of the array elements. Assume that all array elements are distinct and that each array element is searched for with equal frequency.

- (a)(15 points) What is the average count of comparisons between x and the array elements for a successful search?
- (b)(20 points) A step is any computation unit represented by a single statement. To determine the step count of an algorithm, we first determine the number of steps for each statement, and the frequency each statement is executed. Combining these two quantities gives us the total contribution of each statement to the total step count. For example, the worst-case step count of the above function `func` is as follows.

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statement	steps	frequency	total steps
int func(int [] a, int n, int x){	0	0	0
int i;	1	1	1
for (i=0; i < n && x != a[i]; i++);	1	n+1	n+1
if (i == n) return -1;	1	1	1
else return i;	1	0	0
}	0	0	0
Total			n+3

Then, what is the average step count for a successful search?

6. (15 points) A relaxed red-black tree is a red-black tree without the constraint that the root is black. Consider a relaxed red-black tree with a red root. If we color the root black but make no other changes, is the resulting tree a red-black tree? Give the reasons for your answer.