

中原大學 100 學年度碩士班入學考試

3 月 19 日 13:30-15:00 資訊工程學系

誠實是我們珍視的美德，
我們喜愛「拒絕作弊，堅守正直」的你！

科目：資料結構與演算法

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■ 不可使用計算機

1. Assume the order of binary operators from highest to lowest is 1. * and /, 2. + and -. (10%)
 - (a) Convert the infix expression $(b*b-4*a*c)/(2*a)$ to postfix form
 - (b) Convert the postfix expression $abc*d+e/+$ to infix form

(請勿在題目卷上作答)

2. The following C++ code is used to sort N unsorted integers in array $arr[]$. Complete the following C++ program. (15%)

```
Void selectionSort(int N, int arr[])
{
    int smallIndex, pass, j, temp;
    for(pass=0; pass < N-1; pass++) {
        smallIndex = pass;
        for (j=pass+1; j < N; j++)
            if(arr[j] < arr[smallIndex])
                smallIndex = __;
        if(smallIndex != pass) {
            temp = arr[__];
            __ = __;
            __ = temp;
        }
    }
}
```

(請勿在題目卷上作答)

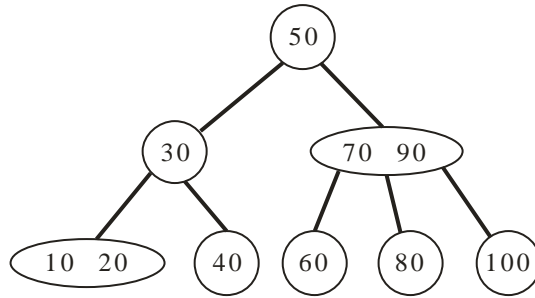
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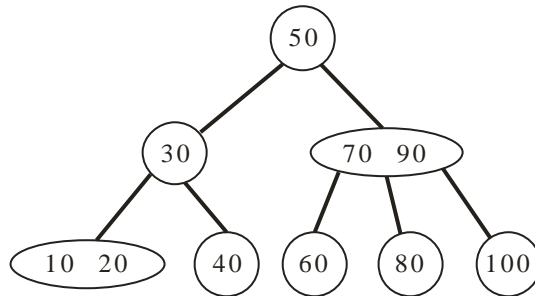
(共 5 頁第 2 頁)

3. Insert the numbers 36, 37, 38, 39 into the following 2-3 tree (5%)



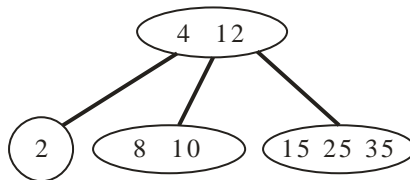
(請勿在題目卷上作答)

4. Delete 70,80, 100 from the following 2-3 tree (5%)



(請勿在題目卷上作答)

5. Insert the numbers 5,7,9,11,55 into the following 2-3-4 tree (5%)



(請勿在題目卷上作答)

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6. Assume there is a C program and the declaration as follow (6%)

```
int x = 50, y = 100, *px = &x, *py = &y;
```

What are the values of x and y after adding the code (a) *px = *py +2;

(b) *py *= 2;

(c) (*px)++;

into the C program?

(請勿在題目卷上作答)

7. What is the result of the following program? (4%)

```
double arr[] = {1.2, 4.5, 6.7, 2.3, 7.8, 3.5, 8.9}, *p = arr;
```

```
int arrSize = sizeof(arr)/sizeof(double)
```

```
while (p != arr+arrSize) {
```

```
    *p += 2.0;
```

```
    p++;
```

```
}
```

```
p = arr+ arrSize;
```

```
while (p != arr) {
```

```
    p--;
```

```
    cout << *p << " ";
```

```
}
```

(請勿在題目卷上作答)

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8. Huffman codes are widely used for data compression. Suppose we have a 1000-character data file that we wish to store compactly. The text file contains only 6 distinct characters, i.e., {A, B, C, D, E, F}, and the corresponding frequencies are given in the following table. (10%)

character	A	B	C	D	E	F
frequency	0.18	0.05	0.15	0.22	0.32	0.08

- (a) Illustrate how to build Huffman's tree and derive your Huffman codes. [5%]
(b) Use your Huffman codes to encode the word "BED". [2%]
(c) How many bits are required to store the data file if Huffman codes are used? [3%]

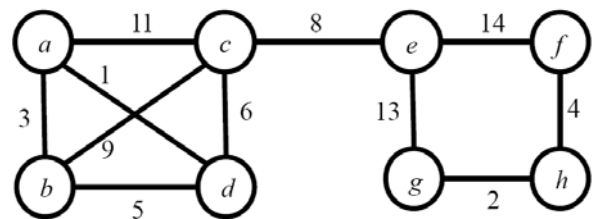
(請勿在題目卷上作答)

9. given a very long string S and a shorter string P, answer the following questions: (10%)

- (a) Write a C/C++ program to find all the occurrences of P in S. [6%]
(b) Express the time complexity of your program. [4%]

(請勿在題目卷上作答)

10. given the following undirected graph G, answer the following questions: (20%)



- (a) List two data structures that are typically used to represent the graph G. [4%]
(b) Use breadth-first search to traverse G (starting at vertex a) and show the BFS sequence. [3%]
(c) Use depth-first search to traverse G (starting at vertex a) and show the DFS sequence. [3%]
(d) Find the minimum-cost spanning tree on G using Kruskal's algorithm. [5%]
(e) Find the minimum-cost spanning tree on G using Prim's algorithm (starting at vertex a). [5%]

(Note1: If more than one vertex can be visited next, always visit them in alphabetic order.)

(Note2: Illustrate step by step how you get the answers!)

(請勿在題目卷上作答)

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11. given a directed acyclic graph, answer the following questions: (10%)

(a) Write an algorithm to find the shortest path from one vertex to another in the graph. [5%]

(b) Write an algorithm to find the vertex sequence (linearly sorted) in topological order. [5%]

(Note: Write your algorithms in the form of pseudo-codes together with detailed comments.)

(請勿在題目卷上作答)