大同大學 89 學年度研究所招生入學考試試題

考試科目 資料結構與演算法 所別 資訊經營研究所

註：本次考試 [可/不可] 參考自己的書籍及筆記 [可/不可] 查字典 [可/不可] 使用計算器

1. Give an analysis of the running time (Big-Oh will do) for the following program fragments. (10%)

```
sum = 0;
for (i = 0; i < n; i++)
    for (j = 0; j < i*i; j++)
        for (k = 0; k < j; k++)
            sum++;
```

2. (a) Write the Polish notation of the algebraic expression: x/(a+b)*(c-d). (5%)

   (b) Calculate the expression in reverse Polish notation: 3 5 + 2 ^ 2 2 6 + * / (5%)

3. Find the shortest path of the graph in Figure 1.

   (a) Apply DIJKSTRA's algorithm, starting at *a*. (10%)

   (b) Use WALLSHALL's algorithm. (10%)

4. What is the optimal sequence to compute multiplication of $M_1M_2M_3M_4M_5M_6$, where the dimensions of the matrices are 10×20, 20×2, 2×40, 40×5, 5×15, and 15×30, respectively? (10%)

5. Consider the schedule network in Figure 2. How many critical paths does this digraph have? What is the largest float time for an edge in this digraph? (10%)

6. Give an example of problem that can be solved by "divide and conquer" algorithm. How to do? (10%)

7. A min-max heap (figure 3) is a data structure that supports both deleting minimum and deleting maximum in O(log N). The structure is identical to a binary heap, but the heap-order property is that for any node, X, at even depth, the element stored at X is smaller than the parent but larger than the grandparent, and for any node X at odd depth, the element stored at X is larger than the parent but smaller than the grandparent. Please write algorithm in pseudo codes for the following operations.

   (a) How do we find the minimum and maximum elements and how to adjust the heap? (15%)

   (b) How do we insert a new node into the min-max heap? (15%)

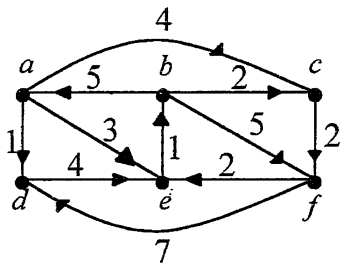

Figure 1

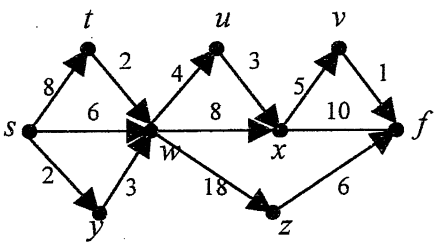

Figure 2

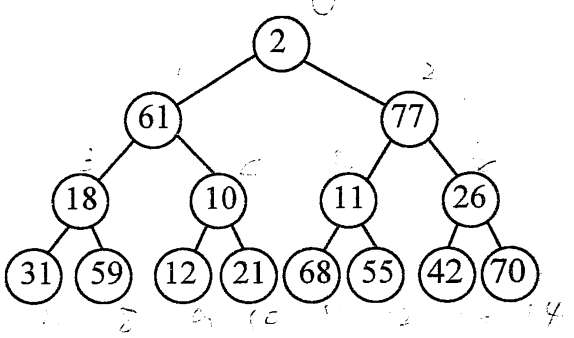

Figure 3