# 上海交通大学计算机考研复试

## 一. 编程题

1. Among grandfather's papers a bill was found. 72 turkeys $_679_ The first and the last digits of the number that obviously represented the total price of those turkeys are replaced here by blanks (denoted _), for they are faded and are illegible. What are the two faded digits and what was the price of one turkey? We want to write a program that solves a general version of the above problem. N turkeys $_XYZ_ The total number of turkeys, N, is between 1 and 99, including both. The total price originally consisted of five digits, but we can see only the three digits in the middle. We assume that the first digit is nonzero, that the price of one turkeys is an integer number of dollars, and that all the turkeys cost the same price. Given N, X, Y, and Z, write a program that guesses the two faded digits and the original price. In case that there is more than one candidate for the original price, the output should be the most expensive one. That is, the program is to report the two faded digits and the maximum price per turkey for the turkeys.

2. Today, facing the rapid development of business, SJTU recognizes that more powerful calculator should be studied, developed and appeared in future market shortly. SJTU now invites you attending such amazing research and development work. In most business applications, the top three useful calculation operators are Addition (+), Subtraction (-) and Multiplication (×) between two given integers. Normally, you may think it is just a piece of cake. However, since some integers for calculation in business application may be very big, such as the GDP of the whole world, the calculator becomes harder to develop. For example, if we have two integers 20 000 000 000 000 000 and 4 000 000 000 000 000, the exact results of addition, subtraction and multiplication are: 20000000000000000 + 4000000000000000 = 24 000 000 000 000 000 20000000000000000 - 4000000000000000 = 16 000 000 000 000 000 20000000000000000 × 4000000000000000 = 80 000 000 000 000 000 000 000 000 000 000 Note: SJTU prefers the exact format of the results rather than the float format or scientific remark format. For instance, we need "24000000000000000" rather than 2.4×10^16. As a programmer in SJTU, your current task is to develop a program to obtain the exact results of the addition (a + b), subtraction (a - b) and multiplication (a × b) between two given integers a and b.

3. John von Neumann, b. Dec. 28, 1903, d. Feb. 8, 1957, was a Hungarian-American mathematician who made important contributions to the foundations of mathematics, logic, quantum physics, meteorology, science, computers, and game theory. He was noted for a phenomenal memory and the speed with which he absorbed ideas and solved problems. In 1925 he received a B.S. diploma in chemical engineering from Zurich Institute and in 1926 a Ph.D. in mathematics from the University of Budapest, His Ph.D. dissertation on set theory was an important contributions to the subject. At the age of 20, von Neumann proposed a new definition of ordinal numbers that was universally adopted. While still in his twenties, he made many contributions in both pure and applied mathematics that established him as a mathematician of unusual depth. His Mathematical Foundation of Quantum Mechanics (1932) built a solid framework for the new scientific discipline. During this time he also proved the mini-max theorem of GAME THEORY. He gradually expanded his work in game theory, and with coauthor Oskar Morgenstern he wrote Theory of Games and Economic Behavior (1944). There are some numbers which can be expressed by the sum of factorials. For example 9, 9 = 1! + 2! + 3! . Dr. von Neumann was very interested in such numbers. So, he gives you a number n, and wants you to tell whether or not the number can be expressed by the sum of some factorials. Well, it is just a piece of case. For a given n, you will check if there are some xi, and let n equal to Σt (上标) i=1（下标） xi! (t≥1, xi≥0, xi = xj <==> i = j) t 即 Σ xi! (t≥1, xi≥0, xi = xj <==> i = j) i=1 If the answer is yes, say "YES"; otherwise, print out "NO".

4. You are given a sequence of integer numbers. Zero-complexity transposition of the sequence is the

reverse of this sequence. Your task is to write a program that prints zero-complexity transposition of the given sequence.

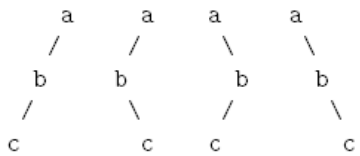
5. Output the k-th prime number.

6. You are given an unsorted array of integer numbers. Your task is to sort this array and kill possible duplicated elements occurring in it.

7. Find a longest common subsequence of two strings.

8. We now use the Gregorian style of dating in Russia. The leap years are years with number divisible by 4 but not divisible by 100, or divisible by 400. For example, years 2004, 2180 and 2400 are leap. Years 2004, 2181 and 2300 are not leap. Your task is to write a program which will compute the day of week corresponding to a given date in the nearest past or in the future using today's agreement about dating.

9. We are all familiar with pre-order, in-order and post-order traversals of binary trees. A common problem in data structure classes is to find the pre-order traversal of a binary tree when given the in-order and post-order traversals. Alternatively, you can find the post-order traversal when given the in-order and pre-order. However, in general you cannot determine the in-order traversal of a tree when given its pre-order and post-order traversals. Consider the four binary trees below:



All of these trees have the same pre-order and post-order traversals. This phenomenon is not restricted to binary trees, but holds for general m-ary trees as well.

10. 12翻一下是21,34翻一下是43,12+34是46,46翻一下是64，现在又任意两个正整数，问他们两个数反转的和是否等于两个数的和的反转。

11. 给你一串路径，譬如： a\b\c a\d\e b\cst d\ 你把这些路径中蕴含的目录结构给画出来，子目录直接列在父目录下面，并比父目录向右缩一格，就像这样： a b c d e b cst d 同一级的需要按字母顺序排列，不能乱。

12. 有一个6*6的棋盘，每个棋盘上都有一个数值，现在又一个起始位置和终止位置，请找出一个从起始位置到终止位置代价最小的路径： 1、只能沿上下左右四个方向移动 2、总代价是没走一步的代价之和 3、每步（从a,b到c,d）的代价是c,d上的值与其在a,b上的状态的乘积 4、初始状态为1 每走一步，状态按如下公式变化：（走这步的代价%4）+1。

13. The Fibonacci Numbers{0,1,1,2,3,5,8,13,21,34,55...} are defined by the recurrence: F0=0 F1=1 Fn=Fn-1+Fn-2,n>=2 Write a program to calculate the Fibonacci Numbers.

14. A common typing error is to place the hands on the keyboard one row to the right of the correct position. So "Q" is typed as "W" and "J" is typed as "K" and so on. You are to decode a message typed in this manner.

15. Finding all occurrences of a pattern in a text is a problem that arises frequently in text-editing

programs. Typically,the text is a document being edited,and the pattern searched for is a particular word supplied by the user. We assume that the text is an array T[1..n] of length n and that the pattern is an array P[1..m] of length m<=n.We further assume that the elements of P and T are all alphabets(∑= {a,b...,z}).The character arrays P and T are often called strings of characters. We say that pattern P occurs with shift s in the text T if 0<=s<=n and T[s+1..s+m] = P[1..m](that is if T[s+j]=P[j],for 1<=j<=m). If P occurs with shift s in T,then we call s a valid shift;otherwise,we calls a invalid shift. Your task is to calculate the number of vald shifts for the given text T and p attern P.

16. Every positive number can be presented by the exponential form.For example, 137 = 2^7 + 2^3 + 2^0。 Let's present a^b by the form a(b).Then 137 is presented by 2(7)+2(3)+2(0). Since 7 = 2^2 + 2 + 2^0 and 3 = 2 + 2^0 , 137 is finally presented by 2(2(2)+2 +2(0))+2(2+2(0))+2(0). Given a positive number n,your task is to present n with the exponential form which only contains the digits 0 and 2.

17. 有两个日期，求两个日期之间的天数，如果两个日期是连续的我们规定他们之间的天数为两天

18. 存在两组数组，和4个数字a,b,c,d,要求做如下操作，将第一个数组第a个数到第b个数，第二个数组的第c个数到第d个数放到一个数组中，求出合并后数组的中间值，如果有两个中间值，取下标较小的那个。

19. 输入一行字符串，计算其中A-Z大写字母出现的次数

20. 对于一个字符串，将其后缀子串进行排序，例如grain 其子串有： grain rain ain in n 然后对各子串按字典顺序排序，即： ain,grain,in,n,rain

21. N个城市，标号从0到N-1，M条道路，第K条道路（K从0开始）的长度为2^K，求编号为0的城市到其他城市的最短距离

22. 对于一个不存在括号的表达式进行计算

23. 一个N*M的矩阵，找出这个矩阵中所有元素的和不小于K的面积最小的子矩阵（矩阵中元素个数为矩阵面积）

24. 设计一个二次方程计算器

25. 给定n，a求最大的k，使n！可以被a^k整除但不能被a^(k+1)整除。