



1980 NATIONAL SCHOLASTIC PROGRAMMING CONTEST

Problem B

SEQUENCE ANALYZER

Consider a sequence of alphabetic characters (A-Z). The sequence is said to have a "constant step" if the distance between adjacent characters in the sequence is the same. (The distance between A and B is 1, D and F is 2, P and V is 6, Z and C is 3, etc.) The following sequences have a "constant step".

ACEG... step=2

AZYX... step=25

Note that "wraparound" from Z to A is defined.

Two or more sequences are said to be "intertwined" if their adjacent elements are separated by exactly one element of each of the other sequences. For example, the following sequences are intertwined:

AQBRCSDT... sequences: ABCD... step 1

QRST... step 1

AZTAYRAXP... sequences: AAA... step 0

ZYX... step 25

TRP... step 24

Read a collection of cards in the following format:

CARD	COL	CONTENTS
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1	1-2	Number of cards to follow
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2:rest	1-12	Alphabetic data (A-Z), the first 12 characters of 2 or 3 "intertwined" sequences
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For each card 2:rest, print the data read and the next 12 characters which should occur in the extended string on a single-spaced line. Remember:

- Two or three sequences may be "intertwined" in the input string.
- All component sequences have a constant step with "wraparound" properties.

For example:

AZTAYRAXPAWN      AVLAUJATHASF

XXYHZRABBLCV      DFEPFZGJHTID

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Problem A

QUERIES

The boss wants a simple way to interrogate her personnel file and asks that you (in 1/2 a day) write a program that will count or list file records that satisfy certain properties. The file is kept on cards, each card containing in 4I6 format four positive integers; employee identification (ID), employee age (AGE), employee wage rate in cents per hour (WAGE), and employee job type code (JOBTYPE) respectively. All such values are less than 32768. The deck of employee records contains 100 or fewer cards and is terminated by a blank card. No validation of these records is needed but the query cards to follow it in the input must be checked for validity.

Each query is contained on a single card and no card contains more than one query. The format of a proper query is given by

$$\left. \begin{array}{l} \{ \text{COUNT} \\ \text{LIST} \} \quad \text{N} \text{RECORDS} \text{WHERE} \text{field} [ \text{.NOT.} \text{ro.} \text{intval} \\ \text{QUIT} \end{array} \right\}$$

where

field={ID,AGE,WAGE,JOBTYPE},  
ro={LT,EQ,GT},  
intval=unsigned integer value<32768,

{ } denotes "one of", [ ] means optional, and N represents one or more blanks. Card columns to the right of a proper query may contain other characters and are to be ignored. Note that a valid query will begin in column 1 and will contain no misspellings.

The program is to operate by performing the following steps for each query card that follows the deck of employee records:

- 1) Read the query card and print it in its entirety on a double-spaced line.
- 2) If the card does not contain a valid query, print ERROR on the following line and go back to step 1.
- 3) a) If the query is QUIT, the program is to terminate.  
b) If the query is COUNT, the number of records in the file satisfying the condition given in the query is to be determined and printed on the following line in the form ANSWER: I7-field. Resume at step 1.  
c) If the query is LIST, all records (if any) satisfying the condition given in the query are to be determined and listed on successive single-spaced lines in the form ANSWER: 4I7. Resume at step 1.

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Problem D

STRING PATTERN MATCHING

It is a fairly straightforward process to compare two strings to see if they are equal. However, if one of the strings (which we will call a "pattern") is allowed to contain "wild card" characters--characters that match zero or more arbitrary characters--the problem becomes more challenging. For example, assume the comparison involves the 26 letters, plus a special character, \*. The character \* means "any group of zero or more characters." The pattern A\*B matches the strings AB, AWB, AMNB, ACEFGHUKPWODJGPOIJWLAB, etc. Likewise, the pattern A\*B\*C matches the strings ABC, ABBABC, etc. (The fixed characters matched have been underlined.)

Write a program that reads arbitrary pairs of a pattern and a string, prints both, and tests whether the string matches the pattern. All of the characters (letter A-Z) of the string must participate in matching the pattern. If the string matches the pattern, the program is to print a message saying so, and also to indicate the value of each "wild card" \*. That is, given the pattern A\*B\*B and the string ABDDGB, it should report that the string matched the pattern, and that \*1 (the first wild card) matched no characters, and that \*2 matched DDG. The program is to read an arbitrary number of such pairs of pattern and string, print them, and report the result of the pattern matching attempt.

The pattern and the string may be located anywhere on the card (the pattern will be first), neither will be a null string, and they are separated by at least one blank. The program is to stop when it reads a card that is all blank. Formats are not crucial in this problem, just see that the requested information is printed.

If there is more than one way to allocate string characters to pattern "wild card" \*'s, select the one that assigns the fewest characters to the first "wild card". If this does not resolve the matter, select from those remaining the one that assigns the fewest characters to the second "wild card", and so on.

Problem F

TRIANGLE PROBLEM

Given: A number,  $N$ , and 3 non-collinear points which define a triangle in the  $(x,y)$ -plane. The first card, format (I5, 3(2F10.5,5X)), will contain  $N$  and the three  $(x,y)$  pairs for the vertices of the triangle.

Find: For each of the  $N$  points to follow, determine if the point is INSIDE or OUTSIDE the triangle, printing a single line to so indicate. Each successive card, format (2F10.5), contains the  $(x,y)$  coordinates of one point.

Where: All points  $(x,y)$  are real numbers,  $N$  is an integer  $\leq 50$ , and no test point lies on an edge of the triangle.