

TCEA  
HIGH SCHOOL PROGRAMMING  
CONTEST

STATE PROBLEM SET  
APRIL 28, 2001

**Texas Computer Education Association  
2001 High School Programming Contest  
State Problem Set**

- 0.0 Average (practice problem)
- 2.1 Do You Have Enough Money?
- 2.2 Where Does It Fit?
- 2.3 How Many Weeks?
- 2.4 Lettered Numeration System
- 2.5 MultiplicAverage
- 2.6 Scientific Notation
- 5.1 Which Truck Is Closer?
- 5.2 Spelling Bee
- 5.3 Reverse Pig Latin
- 5.4 Decimal To Fraction Conversion
- 5.5 Relatively Prime Degree
- 5.6 Rock, Paper, And Scissors Tournament
- 9.1 Letter Counter
- 9.2 Decoder
- 9.3 Matrix Spinner
- 9.4 Order It
- 9.5 Average Word Value
- 9.6 Parallelogram Words

**Problem 2.1    Do You Have Enough Money?**

**General Statement:**    Read the amount of money you have and the prices of the items you intend to buy. Determine whether you have enough money to buy everything you selected or whether you are short of money. If you do not have enough money, indicate the amount of the shortfall. Be sure to include 8% tax when figuring the amount you need.

**Input:**    The first line in the data set is an integer that represents the number of data collections that follow. There are an unknown number of money amounts in each data set. The value -1 is used to indicate the end of the collection of prices.

**Name of Data File:**    pr21.dat

**Output:**    All letters are to be upper case. Include the amount of shortfall if you do not have enough money. This money amount is to have a dollar sign (\$) in front of the amount and it is to be rounded to 2 decimal places.

The output is to be formatted exactly like that for the sample output given below.

**Assumptions:**    The -1 used to indicate the end of a data collection is not part of the data for the problem.

**Sample Input:**    3  
10.50 7.60 1.26 3.49 -1  
15.75 6.00 3.98 -1  
21.00 5.25 5.75 4.76 3.98 1.50 -1

**Sample Output:**    \$2.84 SHORT  
ENOUGH MONEY  
\$1.94 SHORT

**Problem 2.2    Where Does It Fit?**

**General Statement:**    For an input word, determine whether it is alphabetically located before the word EXERCISE, after the word MUSCLES, or between EXERCISE and MUSCLES.

**Input:**    The first line of the data set for this problem is an integer that represents the number of words in the list. Each word is on a separate line

**Name of Data File:**    pr22.dat

**Output:**    The output is to be formatted exactly like that for the sample output given below.

**Assumptions:**    All letters are upper case.

**Sample Input:**    4  
REST  
ACHE  
STRETCH  
GYM

**Sample Output:**    REST IS AFTER MUSCLES  
ACHE IS BEFORE EXERCISE  
STRETCH IS AFTER MUSCLES  
GYM IS BETWEEN EXERCISE AND MUSCLES

**Problem 2.3    How Many Weeks?**

**General Statement:**    A town in Death Valley has a water tank that contains 10,000 gallons of water. If there is no rain, calculate the number of weeks the water will last for an input weekly water usage.

**Input:**    The data set is on a single line. There are an unknown number of integers in the data set. The integer 0 is used to indicate the end of the data.

**Name of Data File:**    pr23.dat

**Output:**    Use all upper case letters.

The output is to be formatted exactly like that for the sample output given below.

**Assumptions:**    The weekly usage does not exceed 10,000 gallons. The 0 used to indicate the end of the data is not part of the data for the problem.

**Discussion:**    Do not include the last week if the water remaining for that week is less than the weekly usage amount.

**Sample Input:**    1750 1000 4325 0

**Sample Output:**    1750 GALLONS PER WEEK WILL LAST 5 WEEKS  
1000 GALLONS PER WEEK WILL LAST 10 WEEKS  
4325 GALLONS PER WEEK WILL LAST 2 WEEKS

**Problem 2.4 Lettered Numeration System**

General Statement: The number equivalents in this numeration system are as follows:

A	B	C	D	E	F	G
1	10	100	1,000	10,000	100,000	1,000,000

Read the lettered version of the number and convert it to its numerical equivalent.

Input: The first line in the data set is an integer that represents the number of data collections that follow. There are an unknown number of letters in each data set. The letter X is used to indicate the end of the collection of letters.

Name of Data File: pr24.dat

Output: Place values to the right of the first digit must all be filled. Use a zero for any missing letters. Do not use leading zeros.

The output is to be formatted exactly like that for the sample output given below.

Assumptions: The letters in the data will be in order from highest to lowest and all letters of the same value are grouped together. The X used to indicate the end of a data collection is not part of the data for the problem.

Sample Input: 3  
CCBBBBAX  
EEEECCX  
DCCCAAAAAAX

Sample Output: 241  
30400  
1306

**Problem 2.5     MultiplicAverage**

**General Statement:** For a collection of integers, multiply them together and then divide by the number of integers in the collection. Round the answer to 3 decimal places.

**Input:** The first line in the data set is an integer that represents the number of data collections that follow. There are an unknown number of integers in each data set. The integer  $-1$  is used to indicate the end of the collection of integers.

**Name of Data File:** pr25.dat

**Output:** Round the answer to 3 decimal places. Trailing zeros to the right of the decimal point are required.

The output is to be formatted exactly like that for the sample output given below.

**Assumptions:** The integers are in the range 1..500. The  $-1$  used to indicate the end of the data collection is not part of the data for the problem.

**Sample Input:**

```
3
6 8 7 2 9 -1
1 2 3 4 5 6 7 -1
11 8 13 -1
```

**Sample Output:**

```
AVERAGE = 1209.600
AVERAGE = 720.000
AVERAGE = 381.333
```

**Problem 2.6 Scientific Notation**

**General Statement:** Read a number in scientific notation and output its equivalent decimal value.

**Input:** All data is on a single line. The first integer indicates how many pairs of numbers follow. The first of each pair is A, the base number, and the second is E, the power of 10.

**Name of Data File:** pr26.dat

**Output:** Round each answer to 2 decimal places. Trailing zeros to the right of the decimal point are required. A leading zero to the left of the decimal point is not required.

The output is to be formatted exactly like that for the sample output given below.

**Assumptions:** E is in the range  $-10 \dots 10$ . A is 1 or larger but less than 10.

**Discussion:** If  $A = 3.926$  and  $E = 4$ , the number represented is  $3.926 \times 10^4$  or 39260, which is 39260.00 when rounded to 2 decimal places.

**Sample Input:** 4 4.296 3 3.8 -2 1.8 2 2.8678 1

**Sample Output:** 4296.00  
0.04  
180.00  
28.68



**Problem 5.1 Which Truck Is Closer?**

**General Statement:** The Jones Trucking Company tracks the location of each of its trucks on a grid similar to an (x, y) plane. The home office is at location (0, 0). Read the coordinates of truck A and the coordinates of truck B and determine which is closer to the office.

**Input:** The first line of the data set for this problem is an integer representing the number of collections of data that follow. Each collection contains 4 integers: the x-coordinate and then the y-coordinate of truck A followed by the x-coordinate and then the y-coordinate of truck B.

**Name of Data File:** pr51.dat

**Output:** All letters are upper case.

The output is to be formatted exactly like that for the sample output given below.

**Assumptions:** The x-coordinate is in the range -20 .. 20. The y-coordinate is in the range -20 .. 20.

**Discussion:** The distance between point #1 with coordinates (x1, y1) and point #2 with coordinates (x2, y2) is:

$$\sqrt{(x2 - x1)^2 + (y2 - y1)^2}$$

**Sample Input:**

```
4
3 -2 -5 -3
0 6 1 2
-7 8 4 -1
3 3 -2 2
```

**Sample Output:**

```
A IS CLOSER
B IS CLOSER
B IS CLOSER
B IS CLOSER
```

**Problem 5.2    Spelling Bee**

**General Statement:**      Given a pair of words (the first is the correct spelling and the second is the contestant's spelling of the word) determine if the word is spelled correctly.

The degree of correctness is as follows:  
CORRECT if it is an exact match  
ALMOST CORRECT if no more than 2 letters are wrong  
WRONG if 3 or more letters are wrong

**Input:**                      The first line of the data set for this problem is an integer that represents the number of pairs of words in the list. Each word is on a separate line.

**Name of Data File:**      pr52.dat

**Output:**                    Output the contestant's spelling of the word and the rating. All letters are upper case.

The output is to be formatted exactly like that for the sample output given below.

**Assumptions:**            Words contain only upper case letters. The maximum word length is 10.

**Sample Input:**            3  
SAMPLE  
SIMPLE  
THEIR  
THEIR  
WINDMILL  
WINDOWS

**Sample Output:**           SIMPLE IS ALMOST CORRECT  
THEIR IS CORRECT  
WINDOWS IS WRONG

**Problem 5.3    Reverse Pig Latin**

- General Statement:**    Each word of a sentence has been translated into Pig Latin. Do a reverse translation and output the original sentence.
- Input:**    The first line of the data set for this problem is an integer that represents the number of sentences in the list. Each sentence is on a separate line.
- Name of Data File:**    pr53.dat
- Output:**    Punctuation is to be output in its original location. All letters are upper case.
- The output is to be formatted exactly like that for the sample output given below.
- Assumptions:**    All letters are upper case.
- Discussion:**    To convert a word to Pig Latin, the first letter of the word was moved to the end (after the last letter of the word) and the letters "AY" were added. For example, IGPAY was originally PIG.
- Sample Input:**    3  
    HEREWAY ASWAY ALDOWAY?  
    ELLOHAY, ARYMAY!  
    IMPLESAY IMONSAY ETMAY HETAY IEMANPAY.
- Sample Output:**    WHERE WAS WALDO?  
    HELLO, MARY!  
    SIMPLE SIMON MET THE PIEMAN.

**Problem 5.4    Decimal To Fraction Conversion**

**General Statement:**    Convert a number in decimal form to the equivalent mixed number with the fraction portion reduced to lowest terms.

**Input:**    There are an unknown number of values on a single line. A -1 is used to indicate the end of the data set.

**Name of Data File:**    pr54.dat

**Output:**    Output the integer part of the number, followed by the word AND where the decimal point was, and then the reduced fraction. There is to be a division symbol (/) between the numerator and the denominator of the fraction.

The output is to be formatted exactly like that for the sample output given below.

**Assumptions**    The numbers are in the range 1..500. There are no repeating decimals. The -1 used to indicate the end of the data set is not part of the data for the problem.

**Sample Input:**    2.95 14.2 5.625 -1

**Sample Output:**    2 AND 19/20  
14 AND 1/5  
5 AND 5/8

**Problem 5.5    Relatively Prime Degree**

**General Statement:**    For a set of 3 positive integers, determine the degree to which they are relatively prime.

DEGREE 0 – no relatively prime pairs  
DEGREE 1 – 1 pair of relatively prime numbers  
DEGREE 2 – 2 pairs of relatively prime numbers  
DEGREE 3 – all 3 numbers are relatively prime

**Input:**    The first line in the data set is an integer that represents the number of data collections that follow. Each data collection contains 3 integers.

**Name of Data File:**    pr55.dat

**Output:**    All letters are upper case.

The output is to be formatted exactly like that for the sample output given below.

**Assumptions:**    The integers are in the range 1..500.

**Discussion:**    Two integers are relatively prime if they have no common factors other than 1.

**Sample Input:**

```
3
4 2 12
5 7 10
3 4 5
```

**Sample Output:**

```
4 2 12 = DEGREE 0
5 7 10 = DEGREE 2
3 4 5 = DEGREE 3
```

**Problem 5.6    Rock, Paper, And Scissors Tournament**

**General Statement:**    A tournament is being held for champion players of the game Rock, Paper, and Scissors. For Player A and Player B, determine who wins each game and who wins the overall tournament.

**Input:**    The first line in the data set is an integer that represents the number of data pairs that follow. The data begins on the second line. R represents rock, P represents paper, and S represents scissors.

**Name of Data File:**    pr56.dat

**Output:**    The output is to be formatted exactly like that for the sample output given below.

**Assumptions:**    The only letters in the input will be upper case R, P, and S. The first letter in the pair is the choice for player A and the second letter is the choice for player B.

**Discussion:**    The game is a draw if both players choose the same item. Paper wins over rock because paper covers rock. Scissors wins over paper because scissors cuts paper. Rock wins over scissors because rock breaks scissors.

**Sample Input:**    7  
RRRSSRSPPPPSRP

**Sample Output:**    DRAW  
A WINS  
B WINS  
A WINS  
DRAW  
B WINS  
B WINS  
B WINS TOURNAMENT

**Problem 9.1 Letter Counter**

**General Statement:** Read a sentence and output the count of the number of 1-letter words, the number of 2-letter words, etc.

**Input:** The first line of the data set for this problem is an integer that represents the number of sentences that follow. Each sentence is on a separate line.

**Name of Data File:** pr91.dat

**Output:** Do not output any counts of 0. The letter counts are to be in ascending order by the number of letters in the word. All letters are upper case.

The output is to be formatted exactly like that for the sample output given below.

**Assumptions:** Any punctuation in the sentence is not part of the word length. The maximum word length is 10 letters. The maximum sentence length is 70 characters.

**Sample Input:**

```
3
TODAY'S SATURDAY
HI SAM, HOW ARE YOU?
MARCH, THEN APRIL, THEN MAY
```

**Sample Output:**

```
COUNT OF 6 = 1
COUNT OF 8 = 1

COUNT OF 2 = 1
COUNT OF 3 = 4

COUNT OF 3 = 1
COUNT OF 4 = 2
COUNT OF 5 = 2
```

**Problem 9.2    Decoder**

General Statement:    Decode a secret message that has been encoded as follows:

- 1) all letters are upper case
- 2) a space is indicated by an underscore (\_)
- 3) a number is preceded by the number symbol (#)
- 4) all other non-letter characters are unchanged
- 5) each letter was converted to a number that is the sum of its base number and its position in the word
- 6) for the base number, A=1, B=2, C=3, etc.

Input:    The first line of the data set for this problem is an integer that represents the number of messages that follow. Each message is on a separate line.

Name of Data File:    pr92.dat

Output:    All letters are upper case. The only position a space is to be output is where the underscore symbol (\_) appears in the encoded message.

The output is to be formatted exactly like that for the sample output given below.

Assumptions:    There is 1 space between each item on the data line.

Sample Input:    3  
15 23 16 6 10 24 \_ # 2 \_ 17 7 17 7 14 18  
2 18 21 13 17 \_ # 28 , \_ # 2001  
17 20 18 6 17 11 20 \_ # 9 . # 1

Sample Output:    NUMBER 2 PENCIL  
APRIL 28, 2001  
PROBLEM 9.1



**Problem 9.3    Matrix Spinner**

General Statement:    Given the matrix:

17	3	9	6
5	11	2	10
6	4	8	16

Read a command to determine whether a row or a column is to be rotated the indicated direction and number of steps. Rotate a column of values down if the direction is negative or up if it is positive. Rotate a row of values to the left if the direction is negative or to the right if it is positive. Be sure to circle around to the other end when the values “fall off” the matrix.

Input:                    The first line in the data set is an integer that represents the number of commands that follow. Each command consists of a letter (R for row or C for column) followed by an integer indicating the amount of the rotation.

Name of Data File:    pr93.dat

Output:                    Output the matrix so that the numbers are right-justified within each column. Output some white space between columns.

The output is to be formatted exactly like that for the sample output given below.

Assumptions:            If the amount of rotation exceeds the dimension of the matrix, circle around to the other end to complete the rotation. Each new command is to be used to rotate values in the most recent version of the matrix. Do not start over with the original matrix.

Sample Input:

```
3
R 1 2
R 2 -1
C 3 -5
```

Sample Output:

```
 9  6 17  3
 5 11  2 10
 6  4  8 16

 9  6 17  3
11  2 10  5
 6  4  8 16

 9  6 10  3
11  2  8  5
 6  4 17 16
```

**Problem 9.4    Order It**

**General Statement:**    For a square matrix, indicate the ascending order of the elements by placing an A in the location of the smallest value, a B in the location of the next largest value, etc.

**Input:**    The first line in the data set is an integer that represents the number of data collections that follow. There are an unknown number of integers in each data set. The integer -1 is used to indicate the end of the collection of integers.

**Name of Data File:**    pr94.dat

**Output:**    Each column is to be aligned vertically.    Output some white space between columns.

The output is to be formatted exactly like that for the sample output given below.

**Assumptions:**    The largest matrix will be 5 by 5. There may be duplicate values in the matrix. The integers are in the range 1..99. The integer -1 that indicates the end of a data collection is not part of the data for the problem.

**Discussion:**    A square matrix has the same number of rows as columns. If there are duplicate values, use the same letter for all locations of that value and the next larger value is then assigned the letter it would have if there had been no duplicates.

**Sample Input:**

```
3
4 3 9 7 -1
2 8 6 7 9 2 3 2 2 -1
4 5 9 2 7 6 9 8 9 17 6 4 4 5 6 3 -1
```

**Sample Output:**

```
B A
D C

A H F
G I A
E A A

C F M A
K H M L
M P H C
C F H B
```

**Problem 9.5    Average Word Value**

**General Statement:**    Read a sentence and calculate the average word value for that sentence. Word value is calculated by finding the average of the ASCII values of all of the letters in a word. Average word value is the average of the word values of all of the words in the sentence.

**Input:**    The first line in the data set is an integer that represents the number of sentences that follow. Each sentence is on a separate line.

**Name of Data File:**    pr95.dat

**Output:**    Output the average rounded to the nearest integer. All letters are upper case.

The output is to be formatted exactly like that for the sample output given below.

**Assumptions:**    All letters are upper case. Any non-letter characters are not part of the word in which they are located. The maximum word length is 10 letters.  
The maximum sentence length is 70 characters.

**Discussion:**    Round only the final average, not the averages of the individual words.

**Sample Input:**    3  
HAPPY BIRTHDAY  
SUMMER'S ON ITS WAY!  
ST. PATRICK'S DAY WAS IN MARCH.

**Sample Output:**    THE AVERAGE WORD VALUE IS 76  
THE AVERAGE WORD VALUE IS 80  
THE AVERAGE WORD VALUE IS 77

**Problem 9.6    Parallelogram Words**

**General Statement:**    Output a given word horizontally and multiple times vertically so that each letter in the horizontal word matches the position of that letter vertically.

**Input:**    The first line in the data set is an integer that represents the number of words that follow. Each word is on a separate line.

**Name of Data File:**    pr96.dat

**Output:**    The horizontal word is to be in the center of the output. Each vertical word is to read down from the top. The first vertical word uses the first letter of the horizontal word. The last vertical word uses the last letter of the horizontal word.

All outputs are to have the same left edge vertically.

The output is to be formatted exactly like that for the sample output given below.

**Assumptions:**    All letters are upper case. The maximum word length is 10.

**Sample Input:**    3  
TEST  
SAMPLE  
ART

See the reverse side of this page for the sample output.

Sample Output:

```

    T
   TE
  TES
 TEST
 EST
 ST
 T

      S
     SA
    SAM
   SAMP
  SAMPL
 SAMPLE
AMPLE
MPLE
PLE
LE
E

    A
   AR
  ART
 RT
 T
```