TCEA
HIGH SCHOOL
PROGRAMMING CONTEST

AREA PROBLEM SET
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Area Problem Set

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Problem 2.1 Lemon Autos

General Statement: Sales Associates at Lemon Autos earn $400 commission for each new car they sell and $200 for each used car they sell. Read the name of a salesperson, the number of new cars sold, and the number of used cars sold, and calculate the commission earned.

Input: The first line of the data set for this problem is an integer that represents the number of lines that follow. Each line contains the salesperson's name, followed by the number of new cars sold, and then followed by the number of used cars sold.

Name of Data File: pr21.dat

Output: Output the name of the Sales Associate, followed by the word "EARNED" in upper case letters, a space, a dollar sign ($), and finally the commission amount. All letters are to be upper case.

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

Assumptions: The range of the total commission amount is $0 .. $10000. The letters in the names are all upper case.

Sample Input:

```
3
CHARLIE 4 2
BILL 3 6
ARCHIE 0 1
```

Sample Output:

```
CHARLIE EARNED $2000
BILL EARNED $2400
ARCHIE EARNED $200
```

Problem 2.2 Stock Market

General Statement: Read the number of shares Sam owns of a stock, yesterday's closing price, and today's closing price. Then calculate the amount of change in the value of Sam's stock, indicating whether it is a gain or a loss.

Input: The first line of the data set for this problem is an integer that represents the number of lines that follow. Each line contains the number of shares of stock followed by yesterday's value and then today's value.

Name of Data File: pr22.dat

Output: Output the label "GAIN OF" or "LOSS OF" followed by a dollar sign and then the amount of gain or loss. The money amount is to be rounded to 2 decimal places. Any zeros at the right of a money amount are to be printed. The label is to be upper case.

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

Assumptions: The number of shares of stock is an integer. The closing prices are both decimal values.

Sample Input:

```
3
43 10.50  9.10
57 21.33 25.00
38 5.00 9.32
```

Sample Output:

```
LOSS OF $60.20
GAIN OF $209.19
GAIN OF $164.16
```

Problem 2.3 How Many Are There?

General Statement: For a given string, count and output the number of times the first letter of the string occurs in that string. This count is to include the first occurrence of that letter.

Input: The first line of the data set for this problem is an integer that represents the number of lines that follow. Each line contains a string that is composed of words with a single space between the words. The maximum string length is 40.

.

Name of Data File: pr23.dat

Output: Output the first letter of the string, followed by a colon, and then followed by the count of the number of times that first letter occurs in the string. The letter is to be upper case.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: The string contains only letters and spaces. All of the letters are upper case. There are only letters in the "words" and there is exactly one space between "words".

Discussion: You are to include the first occurrence of the initial letter in the count.

Sample Input:

```
3
HIGH HOPES
PAUL REVERE
ANT EATING AARDVARK
```

Sample Output:

```
H:3
P:1
A:5
```

Problem 2.4 Paint Calculator

General Statement: Pat Painter is to paint the walls of several rooms. Each room is to be a different color. She needs to calculate how many gallons of each color paint to buy. Paint must be bought in 1-gallon containers, and 1 gallon covers 300 square feet.

Input: The first line of the data set for this problem is an integer that represents the number of lines that follow. Each line contains the length, the width, the height, and the total window and door area.

Name of Data File: pr24.dat

Output: Output the number of whole gallons Pat needs to purchase, followed by the label GALLON(S). The label is to be in upper case.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: Each number in the data set for length, width, and height values are in the range 1..50

Discussion: Since Pat must buy paint by the gallon, she must buy 6 gallons if she needs 5.1 gallons to cover the walls. The ceiling and the floor are not painted. Window and door openings must not be included when calculating the amount of paint needed. One gallon of paint covers 300 square feet.

Sample Input:

```
3
18 15 9 64
24 20 8 50
30 30 9 100
```

Sample Output:

```
2 GALLON(S)
3 GALLON(S)
4 GALLON(S)
```

Problem 2.5 Operation / Operands

General Statement: Read a letter followed by two integers. Based on the letter, perform the correct arithmetic operation. Refer to the chart below to match the letter with the operation.

T = times (multipy)
A = add
S = subtract
R = real division (including the decimal portion)
M = modulus (remainder only of a division)
D = integer division

Input: The first line of the data set for this problem is an integer that represents the number of lines that follow. Each line contains a letter followed by 2 integers. There is 1 space after the letter.

Name of Data File: pr25.dat

Output: Output in this order: the first number, a space, the letter of the operation, a space, the second number, a space, an equal sign (=), a space, and the arithmetic result of the calculation. Round the real division answer to 2 decimal places.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: Numbers in the data set are in the range 1..50. The operation letter is upper case.

Discussion: Perform the operations in the order the numbers are given in the data file. For example, S 17 4 means 17 - 4 (or 13), and D 27 4 means 27 / 4 (or 6). For the answer to real division, round to 2 decimal places. All other answers are integers.

Sample Input:

```
4
T 15 6
M 17 4
R 20 6
S 19 10
```

Sample Output:

```
15 T 6 = 90
17 M 4 = 1
20 R 6 = 3.33
19 S 10 = 9
```

Problem 2.6 Yesterday's Attendance

General Statement: For each of grades 9..12, read the number of students in the class and the number of students absent yesterday. Calculate for each class the percent of students who were present yesterday.

Input: The data set is on a single line. There are 4 pairs of integers, the first value in the pair is the number of students in the class and the second is the number of students absent. The pairs are in order from 9th grade through 12th grade.

Name of Data File: pr26.dat

Output: Output the calculated per cent followed by a per cent sign (%). Round the percent to 1 decimal place. Then output the words "PRESENT IN GRADE" in upper case letters. The last item of output is the grade level. The grade levels are to be output in ascending order from 9 through 12.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: There are exactly 8 integers in the data set. The data pairs are in the same grade-level order as required in the output, starting with 9th.

Sample Input:

```
412 31 356 20 319 20 350 45
```

Sample Output:

```
92.5% PRESENT IN GRADE 9
94.4% PRESENT IN GRADE 10
93.7% PRESENT IN GRADE 11
87.1% PRESENT IN GRADE 12
```

Problem 5.1 Reciprocal Adder

General Statement: For a given value of N, calculate the sum of

$$\frac{1}{1} + \frac{1}{2} + \frac{1}{3} + ... + \frac{1}{N}$$

Input: The data set for this problem consists of one or more positive integers in a single line. The integer 0 is used to indicate the end of the data set.

Name of Data File: pr51.dat

Output: Output the sum rounded to 3 decimal places. Trailing zeros are required if they are needed to print 3 digits to the right of the decimal.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: There will be one or more integers in the range 1..15. The 0 that indicates the end of the data set is not part of the data for the problem.

Sample Input:
```
4 3 6 0
```

Sample Output:
```
2.083
1.833
2.450
```

Problem 5.2 Check That Speedometer

General Statement: Read a distance traveled (miles) and time traveled (hours and minutes) and calculate the speed in miles per hour.

Input: The first line of the data set for this problem is an integer that represents the number of lines that follow. Each line contains 3 integers in this order: distance, hours, and then minutes.

Name of Data File: pr52.dat

Output: Calculate the miles per hour and output that value rounded to the nearest integer. After the integer answer, also output 1 space and then the abbreviation MPH in upper case letters with no spaces and no periods.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: The integers in the minutes column are in the range 0..59.

Discussion: distance = rate * time

Sample Input:

```
3
45 0 32
100 2 50
96 1 43
```

Sample Output:

```
84 MPH
35 MPH
56 MPH
```

Problem 5.3 Axis Scale By Fives

General Statement: For a value N, represent N as a horizontal axis with one character each from 1 through N. Use only the numbers 0 and 5 and the asterisk (*) character. Each multiple of 10 is represented by 0 and each number that ends in 5 is represented by 5. All other values are represented by an asterisk.

Input: The data set for this problem consists of one or more positive integers in a single line. The integer 0 is used to indicate the end of the data set.

Name of Data File: pr53.dat

Output: Output the axis from 1 through N using only *, 0, and 5.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: The value of N is in the range 1..50. The 0 that indicates the end of the data set is not part of the data for the problem.

Sample Input:
```
17 9 20 0
```

Sample Output:
```
****5****0****5**
****5****
****5****0****5****0
```

Problem 5.4 No Repeats

General Statement: For a given string, output the unique characters in their original order with no spaces.

Input: The first line of the data set for this problem is an integer that represents the number of lines that follow. Each line contains a string. The string contains only letters with a single space between words.

Name of Data File: pr54.dat

Output: Output each unique letter in the same order as it occurred in the original string with no spaces between the letters.

Output is to be formatted exactly like that of the sample output given below.

Assumptions Each string contains only upper case letters with a single space between words. The maximum string length is 50.

Discussion: Each letter is to be output only the first time it occurs. The string FEBRUARY would result in FEBRUAY, and the string BOOKKEEPER would result in BOKEPR. In both examples only the unique letters are output and their original order is preserved.

Sample Input:

```
4
SCHOOL ZONE
VACATION
I LOVE YOU TRULY
APPLES AND ORANGES
```

Sample Output:

```
SCHOLZNE
VACTION
ILOVEYUTR
APLESNDORG
```

Problem 5.5 Average Without High And Low

General Statement: For a collection of integers, disregard the highest and the lowest values and calculate the average of the remaining integers.

Input: The first line of the data set for this problem is an integer that represents the number of lines that follow. Each line contains a collection of an unknown quantity of integers. A 0 is used to indicate the end of the collection.

Name of Data File: pr55.dat

Output: Output the words "HIGH OF" in upper case letters, followed by the largest value in the collection. On the next line output the words "LOW OF" in upper case letters, followed by the smallest value in the collection. On the next line output the words "AVERAGE OF" in upper case letters, followed by the average rounded to 1 decimal place. For readability, skip 1 or 2 lines between completed outputs.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: There are at least 3 integers in each collection (not including the 0). The 0 that indicates the end of the data line is not part of the data collection. The data values are in the range 1..500.

Sample Input:

```
3
19 2 18 7 6 3 0
17 18 20 5 86 0
3 7 28 24 0
```

Sample Output:

```
HIGH OF 19
LOW OF 2
AVERAGE OF 8.5

HIGH OF 86
LOW OF 5
AVERAGE OF 18.3

HIGH OF 28
LOW OF 3
AVERAGE OF 15.5
```

Problem 5.6 Decode It

General Statement: Read a cypher alphabet and an encoded message and output the decoded message.

Input: The first line of the data set for this problem is an integer that represents the number of pairs of lines that follow. The first line of the pair is the cypher alphabet. The second line is the encoded message. The maximum length of the encoded message is 50.

Name of Data File: pr56.dat

Output: Output each of the decoded messages on a separate line.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: All letters are upper case. The cypher alphabet contains only letters. The encoded message may contain other characters. The non-letter characters are to remain unchanged.

Discussion: A cypher alphabet is the arrangement of the 26 letters of the alphabet that were used to encode the message. The first letter replaced A, the second letter replaced B, the third letter replaced C, and so on.

Sample Input:

```
2
BCDEFGHIJKLMNOPQRSTUVWXYZA
GFCSVBSZ, 2001
ZYXWVUTSRQPONMLKJIHGFEDCBA
GDL + GDL = ULFI
```

Sample Output:

```
FEBRUARY, 2001
TWO + TWO = FOUR
```

Problem 9.1 Igpay Atinlay

General Statement: Given a sentence, convert it to Pig Latin.

Input: The first line of the data set for this problem is an integer that represents the number of sentences that follow. The maximum sentence length is 50.

Name of Data File: pr91.dat

Output: Output each translated sentence on a separate line.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: Each sentence contains only upper case letters with a single space between words.

Discussion: To convert a word to Pig Latin, move the first letter of the word to the end (after the last letter of the word) and add the letters “AY”. For example, PIG would become IGPAY.

Sample Input:

```
3
THE QUICK BROWN FOX
PIG LATIN
LOOK LOOK
```

Sample Output:

```
HETAY UICKQAY ROWNBAY OXFAY
IGPAY ATINLAY
OOKLAY OOKLAY
```

Problem 9.2 Employment Roster

General Statement: Given a data file containing the type of summer employment and the name of the worker for a collection of employees, output by job type an alphabetical listing of the workers.

The job codes are:
B = BABYSITTING
Y = YARDWORK
M = MAINTENANCE
P = PET GROOMING

Input: The data set contains an unknown number of lines. Each line has a letter for the job code followed by a space and then the worker's name. The end of the data set is marker by an asterisk (*) for the job code and the word DONE for the worker's name.

Name of Data File: pr92.dat

Output: The first line is the four job types in the same order as they are given in the problem description above. There is to be white space between the columns, but all 4 columns must fit on the screen in the same horizontal line. Under each heading list alphabetically all of the workers in that category. Each column is to be left-justified.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: All letters are upper case. There are no duplicate employee names. There is at least 1 worker per category. There are no more than 20 workers in all. The asterisk (*) and DONE used to indicate the end of the data set are not part of the data for the problem.

Sample Input:

```
B MARY
P JANET
M PETE
Y BILL
B CAROL
P SAM
B ANDREA
* DONE
```

Sample Output:

```
BABYSITTING   YARDWORK   MAINTENANCE   PET GROOMING
ANDREA        BILL       PETE          JANET
CAROL                                  SAM
MARY
```

Problem 9.3 Reduced Sentences

General Statement: Given a sentence, output that sentence without the 3-letter words. Beginning on the line below the "reduced" sentence, list alphabetically the "removed" 3-letter words with no duplicates in the list.

Input: The first line of the data set for this problem is an integer that represents the number of lines that follow. Each line contains a sentence.

Name of Data File: pr93.dat

Output: The first line is to be the sentence without the 3-letter words. In a column that begins at the left on the next line, list alphabetically the 3-letter words that have been left out of the sentence. There are to be no duplicates in the word list. For readability, skip 1 or 2 lines between completed outputs.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: Each sentence contains only upper case letters with a single space between words. There is at least 1 3-letter word in each sentence. The maximum string length for the sentence is 50. There are no more than 10 words in any one sentence.

Sample Input:

```
3
THAT WAS THE WEEK THAT WAS
LITTLE BOY BLUE
THE DOT COMS ARE GONE TO THE DOGS
```

Sample Output:

```
THAT WEEK THAT
THE
WAS

LITTLE BLUE
BOY

COMS GONE TO DOGS
ARE
DOT
THE
```

Problem 9.4 Adjacent Sums

General Statement: Given the matrix below, for any location (row #, column #) calculate and output the sum of all of the values adjacent to that location.

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

Input: The data set contains pairs of integers in a single line. The first number of the pair is the row location and the second is the column location. 0 0 indicate the end of the data set. The zeros are not part of the data.

Name of Data File: pr94.dat

Output: Output the words “THE ADJACENT SUM FOR” in upper case letters, followed by the value of the element in the given location, followed by “IS” in upper case letters, followed by the sum of all of the values adjacent to the given location.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: The row number is in the range 1..4, and the column number is in the range 1..5.

Discussion: Adjacent matrix locations are within 1 step horizontally or 1 step vertically or 1 step diagonally of the original location. For example, if the location is row 3 and column 3, the adjacent sum is 44 (4 + 3 + 7 + 3 + 7+ 6 + 5 + 9). If the location is row 4 and column 1 the adjacent sum is 23 (9 + 9 + 5).

Sample Input:
```
1 1 3 5 2 4 3 3 0 0
```

Sample Output:
```
THE ADJACENT SUM FOR 7 IS 14
THE ADJACENT SUM FOR 2 IS 26
THE ADJACENT SUM FOR 7 IS 35
THE ADJACENT SUM FOR 6 IS 44
```

Problem 9.5 Oldest To Youngest

General Statement: Given a collection of people with their birth dates (month, day, and year), output the names in order of age from oldest to youngest. If more than 1 person has the same birthday, that group is to be output in alphabetical order.

Input: The first line of the data set for this problem is an integer that represents the number of lines that follow. Each line contains a number for the birth month, a number for the birth day, a number for the birth year, and then the person's name.

Name of Data File: pr95.dat

Output: Output the complete list of names in descending order by age. For people with the same birthday, that group is to be listed alphabetically.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: The years are all 4 digits (1978 rather than 78). All letters are upper case. The maximum number of people in the data set is 20.

Sample Input:

```
8
6 17 1975 MARK
5 21 1973 JACK
5 21 1962 JAMES
4 3 1970 JOANN
5 21 1973 TOMMY
12 10 1971 ANN
10 13 1970 CARL
5 21 1973 CINDY
```

Sample Output:

```
JAMES
JOANN
CARL
ANN
CINDY
JACK
TOMMY
MARK
```

Problem 9.6 String Arithmetic

General Statement: Read an arithmetic expression as a string and output the numerical result of that expression. The operations are +, -, *, and ^ (for exponent). There may be parentheses in the expression. Follow the mathematical order of operations when calculating the result.

Input: The first line of the data set for this problem is an integer that represents the number of lines that follow. Each line contains a

single string with only single digit numbers and the characters +, -, *, ^, (, and).

Name of Data File: pr96.dat

Output: Output the original expression followed by an equal sign (=) and then the answer to the expression.

Output is to be formatted exactly like that of the sample output given below.

Assumptions: There are no spaces in the string. All numbers are in the range 1..9. The maximum expression value is 10,000.

Discussion:
4*(3+2) = 4*5 = 20
2+3*4 = 2 + 12 = 14
4+3^2 = 4 + 9 = 13
(4+3)^2 = 7^2 = 49

Sample Input:
```
3
7-(4+8)
8^2+6*2
(9-5+3*2)^(5-2)
```

Sample Output:
```
7-(4+8)= -5
8^2+6*2 = 76
(9-5+3*2)^(5-2) = 1000
```