TCEA
HIGH SCHOOL
PROGRAMMING CONTEST

AREA PROBLEM SET
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Texas Computer Education Association
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Area Problem Set

Problem 2.1 Newspaper Profit Or Loss

General Statement: Read the original quantity of newspapers and the number sold and calculate the profit or loss for the day's sales. You must pay 25 cents for each newspaper you get from the publisher and you sell each paper for 50 cents. Any newspapers left over at the end of the day cannot be returned to the publisher.

Input: All data is on a single line. The first integer indicates how many pairs of numbers follow. The first of each pair is N, the original number of newspapers you have, and the second is S, the number of newspapers sold.

Name of Data File: pr21.dat

Output: First print the amount of profit or loss. This amount must be preceded by a dollar sign ($) and rounded to 2 decimal places. If necessary, fill in trailing zeros so that 2 decimal places show. This is followed by the word PROFIT or the word LOSS.

All letters are upper case.

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

Assumptions: S is less than or equal to N.

Sample Input:
```
3 50 40 125 45 100 53
```

Sample Output:
```
$7.50 PROFIT
$8.75 LOSS
$1.50 PROFIT
```

Problem 2.2 Dog Food Days

General Statement: Assuming that there are 5 cups to 1 pound of dog food, read the number of pounds (P) and the number of cups used per day (C) and calculate the number of days the bag of dog food will last. The final day does not count if there are fewer than the required number of cups of food needed.

Input: The first line in the data set is an integer that represents the number of data collections that follow. Each collection consists of P, then C. Each collection is on a separate line.

Name of Data File: pr22.dat

Output: Output the number of days followed by the word DAYS.

All letters are upper case.

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

Assumptions: All answers are whole numbers.

Sample Input:

```
3
40 4.0
40 3.5
20 7.25
```

Sample Output:

```
50 DAYS
57 DAYS
13 DAYS
```

Problem 2.3 Shrink Then Expand (page 1 of 2)

General Statement: Read a word with N letters and output this word in a pattern as follows:
1. all N letters, then the first N-1 letters, etc. until 1 letter is on the line
2. first 2 letters, then first 3 letters, etc. until all N letters are on a line

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: pr23.dat

Output: All letters are upper case.

Output some white space between output patterns.

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

Assumptions: All letters are upper case.

Word length is in the range 2..10.

There are only letters in the words.

Discussion: Only the first and the last line of the pattern contain the entire word. The single first letter only occurs 1 time in the middle of the pattern.

See page 2 for sample run.

Problem 2.3 Shrink Then Expand (page 2 of 2)

Sample Input:

```
3
SAMPLE
WORD
TODAY
```

Sample Output:

```
SAMPLE
SAMPL
SAMP
SAM
SA
S
SA
SAM
SAMP
SAMPL
SAMPLE

WORD
WOR
WO
W
WO
WOR
WORD

TODAY
TODA
TOD
TO
T
TO
TOD
TODA
TODAY
```

Problem 2.4 Pizza Order

General Statement: A medium pizza costs $8 and is cut into 10 pieces. A large pizza costs $11 and is cut into 16 pieces. Read the number of pieces of pizza in the order and determine the fewest number of pizzas to order for the lowest total cost.

Input: There are an unknown number of values on a single line. A 0 is used to indicate the end of the data set.

Name of Data File: pr24.dat

Output: Output a dollar sign ($), the total cost of the order, the word FOR, the number of medium pizzas, the words MEDIUM AND, the number of large pizzas, and the word LARGE.

All letters are upper case.

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

Assumptions: There is only 1 possible correct answer to meet the requirements of fewest number of pizzas and lowest cost.

You must buy whole pizzas.

Sample Input:

```
8 30 19 0
```

Sample Output:

```
$8 FOR 1 MEDIUM AND 0 LARGE
$22 FOR 0 MEDIUM AND 2 LARGE
$16 FOR 2 MEDIUM AND 0 LARGE
```

Problem 2.5 Framed

General Statement: Read the length and the width (in inches) of a picture and calculate the cost for framing it. Picture framing supplies include glass, mat (surrounds the picture), and the wood frame (surrounds the mat). The mat board is 2 inches wide.

Supply costs are:
glass – 25 cents per square inch
mat board – 10 cents per linear inch
wood frame – 50 cents per linear inch

Input: All data is on a single line. The first integer indicates how many pairs of numbers follow. The first of each pair is the length (L) and the second is the width (W).

Name of Data File: pr25.dat

Output: Output a dollar sign ($) followed by the amount rounded to 2 decimal places. If necessary add trailing zeros so that both decimal places show.

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

Assumptions: The dimensions are in the range 1..30.

Sample Input:
```
3 5 6 10 8 9 12
```

Sample Output:
```
$44.50
$72.40
$86.00
```

Problem 2.6 Recipe Adjuster

General Statement: Given a partial basic cookie dough recipe, read a multiplier and write the adjusted recipe.

Basic Recipe:
```
2 C FLOUR
1 C SUGAR
1 EGG(S)
1 TSP VANILLA
```

Input: There are an unknown number of values on a single line. A 0 is used to indicate the end of the data set.

Name of Data File: pr26.dat

Output: All letters are upper case.
Trailing zeros after the decimal point are not necessary. Leading zeros in front of the decimal point are not necessary.

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

Assumptions: The multiplier is in the range 0.1..10.

Discussion: You must use whole eggs. If the adjusted egg amount is not an integer, use the next higher whole number. For example, 1.5 eggs would require using 2 eggs.

Sample Input:
```
2 0.5 4 0
```

Sample Output:
```
4 C FLOUR
2 C SUGAR
2 EGG(S)
2 TSP VANILLA

1 C FLOUR
0.5 C SUGAR
1 EGG(S)
0.5 TSP VANILLA

8 C FLOUR
4 C SUGAR
4 EGG(S)
4 TSP VANILLA
```

Problem 5.1 Longest Word

General Statement: Output the longest word in a given string. If there is a tie for the longest word, output all words of that length in alphabetical order.

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

Name of Data File: pr51.dat

Output: All letters are upper case. Each separate string's longest word is to be on a separate line. For multiple longest words in a string, write them all on the same line with 1 space between words.

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

Assumptions: All letters are upper case.

There are only letters in each word. There is exactly 1 space between words in the string.

The maximum word length is 15. The maximum number of words is 10.

Sample Input:

```
3
FUZZY WUZZY WAS A BEAR
HOW NOW BROWN COW
VACATION IN THE BAHAMAS
```

Sample Output:

```
FUZZY WUZZY
BROWN
VACATION
```

Problem 5.2 Split Sort

General Statement: Read a collection of integers and sort them so that the first half of the list is in descending order and the second half is in ascending order.

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 collection. The integer 0 is used to indicate the end of the collection of integers.

Name of Data File: pr52.dat

Output: Output each final sort result on a single line with 1 space between integers.

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

Assumptions: The 0 used to indicate the end of the data collection is not part of the data for the problem.

The maximum number of integers in a collection is 15.

There are no duplicate values in a collection.

Discussion: If there are an odd number of integers in a data collection, the middle value is to be included in the first half.

Sample Input:

```
3
7 2 9 8 15 0
3 12 17 10 9 4 0
20 35 7 2 0
```

Sample Output:

```
9 7 2 8 15
17 12 3 4 9 10
35 20 2 7
```

Problem 5.3 Replace The Question Mark

General Statement: A sentence has 1 or more words that have been replaced by a question mark (?). Read the sentence and the new word that is to replace the question mark and output the new sentence.

Input: The first line in the data set is an integer that represents the number of strings that follow. There is 1 string per line.

The sentence is first and ends with a period. The period is followed by a space and then the “new word”.

Name of Data File: pr53.dat

Output: 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.

The sentence contains a period at the end, there are 1 or more question marks (?) in the sentence, the words contain only letters, and there is exactly 1 space between words in the sentence.

The maximum sentence length is 60. The maximum “new word” length is 10.

Sample Input:

```
3
HAPPY ? TO YOU. BIRTHDAY
? ? BIRTHDAY. HAPPY
? BIRTHDAY ? BIRTHDAY. SIXTEENTH
```

Sample Output:

```
HAPPY BIRTHDAY TO YOU.
HAPPY HAPPY BIRTHDAY.
SIXTEENTH BIRTHDAY SIXTEENTH BIRTHDAY.
```

Problem 5.4 Sum Table

General Statement: Given: A is in the range 10..50 and B is in the range 10..100. Read the increment for A and the increment for B and output all values of A + B. Stop the output when either limit is reached.

Input: All data is on a single line. The first integer indicates how many pairs of numbers follow. The first of each pair is the increment for A and the second is the increment for B.

Name of Data File: pr54.dat

Output: Output the value for A, then a plus sign (+), then the value for B, then an equal sign (=), and finally the value of A + B.

Do not output any values for A or B outside their stated ranges.

Output some white space between outputs.

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

Assumptions A and B and their increments are integers.

Discussion: If an increment is negative, begin at the higher end of that variable's range.

Sample Input:

```
3 20 20 10 –10 –5 35
```

Sample Output:

```
10 + 10 = 20
30 + 30 = 60
50 + 50 = 100

10 + 100 = 110
20 + 90 = 110
30 + 80 = 110
40 + 70 = 110
50 + 60 = 110

50 + 10 = 60
45 + 45 = 90
40 + 80 = 120
```

Problem 5.5 Decoder

General Statement: A secret message was encoded as follows:
First: the alphabet A..Z was encoded with corresponding integers 1..26
Then: each even number was multiplied by 2
Then: each odd number was increased by 20
Finally: a 0 was used to indicate a space between words

Output the decoded message.

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 collection. The integer –1 is used to indicate the end of the collection of 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 maximum message length is 40 characters.

There are only letters within each word. There is exactly 1 space between words.

Sample Input:

```
3
4 21 39 25 33 25 28 40 0 2 40 0 33 29 8 28 29 27 16 40 -1
28 21 40 21 39 16 21 0 21 28 8 0 4 35 36 29 39 –1
23 21 32 40 21 29 28 0 21 33 25 36 29 23 21 -1
```

Sample Output:

```
BASEMENT AT MIDNIGHT
NATASHA AND BORIS
CAPTAIN AMERICA
```

Problem 5.6 Matrix Word

General Statement: Read a word and place it into a 5 by 5 matrix. Start in the top left corner and place 1 letter per location, working across the row from left to right. When a row is completed, continue at the left end of the next row. Fill any remaining locations with the rest of the alphabet in alphabetical order.

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: pr56.dat

Output: All letters are upper case.
Include some white space between the separate outputs.
The output is to be formatted exactly like that for the sample output given below.

Assumptions: All letters are upper case.
Each word contains only letters, and there are no duplicates within a word.

Sample Input:

```
3
KEYWORD
MATRIX
LION
```

Sample Output:

```
KEYWO
RDABC
FGHIJ
LMNPQ
STUVX

MATRI
XBCDE
FGHJK
LNOPQ
SUVWY

LIONA
BCDEF
GHJKM
PQRST
UVWXY
```

Problem 9.1 Square Sum

General Statement: Given:

```
8 10 12 13 17
7  9  6  4 21
3 11 15  2 35
5  1  0 20 16
```

For an input value V, sum V and all of the values within 1 position of V horizontally, vertically, and diagonally.

Input: There are an unknown number of values on a single line. A 0 is used to indicate the end of the data set.

Name of Data File: pr91.dat

Output: Output the words SQUARE SUM OF, the value of V, the word IS, and then the sum.

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

Assumptions: The zero used to end the data set is not part of the data for the problem.

The input value will be in the matrix.

Sample Input:

```
8 11 6 0
```

Sample Output:

```
SQUARE SUM OF 8 IS 34
SQUARE SUM OF 11 IS 57
SQUARE SUM OF 6 IS 82
```

Problem 9.2 Centered Words

General Statement: For a string, output the individual words vertically so that all words have the same horizontal center. If the number of letters in a word is even, the last letter of the first half of the word is to be on the horizontal center.

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

Name of Data File: pr92.dat

Output: All letters are upper case.
Output some white space between the separate outputs.
The output is to be formatted exactly like that for the sample output given below.

Assumptions: All letters are upper case. There are only letters in the words and there is exactly 1 space between words.
The maximum word length is10, the maximum number of words is 10, and the maximum string length is 80.

Sample Input:

```
3
HOW NOW BROWN COW
SUPER BOWL SUNDAY
COMPUTER CONTEST
```

Sample Output:

```
  B
HNRC
OOOO
WWWW
  N

S S
UBU
PON
EWD
RLA
  Y

CC
OO
MN
PT
UE
TS
ET
R
```

Problem 9.3 Ticket To Ride (page 1 of 2)

General Statement: An airplane has some seats already assigned in the first 5 rows. The chart below indicates those assignments, with the letter O representing an available seat and the symbol # an assigned seat.

```
  ABC  DEF
10##  000
2###  #00
300#  00#
4##0  0#0
50##  00#
```

In the diagram, A and F are window seats, B and E are middle seats, and C and D are aisle seats.

Read seat requests for additional passengers and fill the seats as follows:

1. fill the numbered rows from left to right
2. begin at seat A1 to search for each new passenger's seat
3. search row 1 before moving to row 2
4. if request = N, place in first available seat
5. if request = A, place in first available aisle seat
6. if request = W, place in first available window seat
7. if request = M, place in first available middle seat
8. if request = M but none available, place in first available seat
9. if request = A but none available, place in first available window seat
10. if request = W but none available, place in first available aisle seat
11. if request is A or W but neither available, place in first available middle seat

Input: There are an unknown number of letters on a single line. The letter X is used to indicate the end of the data set.

Seat preference codes are as follows: A = aisle, W = window, M = middle, and N = no preference.

Name of Data File: pr93.dat

See page 2 for remaining discussion.

Problem 9.3 Ticket To Ride (page 2 of 2)

Output: Output a seating chart like the original, with the letters A..F across the top and the numbers 1..5 in the left-most column.

Place a blank column between columns C and D to represent the aisle of the plane.

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

Assumptions: There will be no more than 30 total passengers.

The symbol O is a letter, not a zero.

All letters are upper case.

Sample Input:

```
AWAWNAAWWAAMX
```

Sample Output:

```
  ABC DEF
1### ###
2### ###
3#0# #0#
4### ###
50## #0#
```

Problem 9.4 Even/Odd Diagonal Words

General Statement: For a string containing an unknown number of words, output each word diagonally as follows:

Odd number of letters – upper left to bottom right
Even number of letters – bottom left to upper right

The first letter of the odd-length words is to be on the same line as the last letter of the even-length words.

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

Name of Data File: pr94.dat

Output: .All letters are upper case.

The words are in the same relative position as in the original string.

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, and the maximum string length is 50.

The words contain only letters, and there is exactly 1 space between words.

See page 2 for sample run.

Sample Input:

```
3
TODAY IS SATURDAY
FEBRUARY MARCH APRIL MAY
COMPUTERS ARE GREAT
```

Sample Output:

```
T       S        Y
 O     I        A
  D            D
   A          R
    Y        U
            T
           A
          S


        Y M     A     M
       R   A     P     A
      A     R     R     Y
     U       C     I
    R         H     L
   B
  E
 F


C         A   G
 O         R   R
  M         E   E
   P             A
    U             T
     T
      E
       R
        S
```

Problem 9.5 TV Decades

General Statement: Read a list of television oldies and sort them alphabetically by decade.

Input: The first line in the data set is an integer that represents the number of data pairs that follow. The first of each pair is a year the show was on television, and the second is the name of the show.

Name of Data File: pr95.dat

Output: Include some white space between the decade and the first letter of the television show name. If there is more than one show in a decade, the names are to begin in the same column.
Include some white space between the decades of the output.

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

Assumptions: The year is in the range 1940..1999.
There is a space between the year and the show name.

The maximum number of television shows is 10, and the maximum length of a show name is 30.

Discussion: Decades are to be in ascending order. Do not list any decades for which shows are not given.
If a show name begins with THE, skip to the second word for alphabetizing purposes.

Sample Input:

```
5
1954 I LOVE LUCY
1975 THE MARY TYPER MOORE SHOW
1956 THE ANDY GRIFFITH SHOW
1963 BONANZA
1970 MY FAVORITE MARTIAN
```

Sample Output:

```
50S THE ANDY GRIFFITH SHOW
    I LOVE LUCY

60S BONANZA

70S THE MARY TYLER MOORE SHOW
    MY FAVORITE MARTIAN
```

Problem 9.6 Multiplying Fractions

General Statement: Multiply two fractions and reduce the answer to lowest terms. Read the numerator and denominator for the first fraction (N1 and N2) and the numerator and denominator for the second fraction (N2 and D2).

Input: The first line of the data set is an integer that represents the number of data collections that follow. The data collection contains 4 integers in order N1, D1, N2, D2.

Name of Data File: pr96.dat

Output: Output the numerator of the answer, a slash sign (/), and then the denominator of the answer.

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

Assumptions: Both fractions are in the range 0..1.

The answer is to be reduced to lowest terms.

The original fractions are not necessarily in lowest terms.

Sample Input:

```
3
7 10 5 15
14 19 3 7
1 3 2 5
```

Sample Output:

```
7/30
6/19
2/15
```