Hands #4 - Solving Problems Involving ASCII Designs

Problem Types:

- **Drawing ASCII Shapes**

On the following pages, there are 9 sample problems. The dat files and solutions to these problems are provided in a separate folder.

The solutions are based on Java 5.0. I have used meaningful variable names to make the code more readable. Students in contest situations would certainly use shorter variable names and possibly more anonymous variables.

Problem	**Key Concepts**
pr41 - Right Triangle	Nested Loops
pr42 - Isosceles Triangle	printing leading spaces; printing odd number of columns; decrement counters
pr43 - Empty Triangle	printing leading spaces; printing odd number of spaces; `StringBuffer` to reverse string
pr44 - Hourglass 1	printing top and bottom of triangles - open up; `StringBuffer` to reverse string
pr45 - Square	print same number of spaces; `StringBuffer` to reverse string
pr46 - Diamonds	printing top and bottom of triangles - open down; `StringBuffer` to reverse string
pr47 - Hourglass 2	printing top and bottom of triangles; repeated letters
pr48 - ELL	printing in top and bottom of rectangles
pr49 - Square Digits	matrix of digits; incrementing rows and columns in nested loops

pr41 - Right Triangle

Problem: Write a program that will print an right triangle of letters.

Input: The first line of the data set is an integer that represents the number of lines that follow. Each of the remaining lines contains a single word of only uppercase letters of the alphabet.

data file: `pr41`

Output: Output the letters in a triangular pattern as shown below. Print at least one blank line between data sets.

Assumptions: None.

Sample Input:

```
2
DOG
TIGER
```

Sample Output:

```
D
DO
DOG

T
TI
TIG
TIGE
TIGER
```

pr42 - Isosceles Triangle

Problem: Write a program that will print an isosceles triangle of letters.

Input: There is one line of input. The first integer on the line is the number of integers to follow. The remaining integers indicate the number of number of rows to be output.

data file: `pr42`

Output: Output the letters in a triangular pattern as shown below. Print at least one blank line between data sets.

Assumptions: Each triangle will start with the letter `A`. Left to right placement of the triangle is immaterial.

Sample Input: `2 5 3`

Sample Output:

```
    A
   BBB
  CCCCC
 DDDDDDD
EEEEEEEEE

  A
 BBB
CCCCC
```

pr43 - Empty Triangle

Problem: Write a program that will print of the letters of a word an isosceles triangle.

Input: The first line of the data set is an integer that represents the number of lines that follow. Each of the remaining lines contains a single word of only uppercase letters of the alphabet.

data file: `pr43`

Output: Output the letters in a triangular pattern as shown below. Print at least one blank line between data sets.

Assumptions: Left to right placement of the triangle is immaterial.

Sample Input:

```
2
WISH
TIGER
```

Sample Output:

```
   W
  I I
 S   S
HSIWISH

    T
   I I
  G   G
 E     E
REGITIGER
```

pr44 - Hourglass

Problem: Write a program that will print the letters of a word in an hourglass pattern.

Input: The first line of the data set is an integer that represents the number of lines that follow. Each of the remaining lines contains a single word of only uppercase letters of the alphabet.

data file: `pr44`

Output: Output the letters in an hourglass pattern as shown below. Print at least one blank line between data sets.

Assumptions: All words will have an odd number of letters. Left to right placement of the hourglass is immaterial.

Sample Input:

```
2
ALGORITHM
TIGER
```

Sample Output:

```
ALGORITHM
 L     H
  G   T
   O I
    R
   O I
  G   T
 L     H
ALGORITHM

TIGER
 I E
  G
 I E
TIGER
```

pr45 - Square

Problem: Write a program that will print the letters of a word in a square pattern.

Input: The first line of the data set is an integer that represents the number of lines that follow. Each of the remaining lines contains a single word of only uppercase letters of the alphabet.

data file: `pr45`

Output: Output the letters in a square pattern as shown below. Print at least one blank line between data sets.

Assumptions: Left to right placement of the square is immaterial.

Sample Input:

```
2
COMPUTER
SCIENCE
```

Sample Output:

```
COMPUTER
O      E
M      T
P      U
U      P
T      M
E      O
RETUPMOC

SCIENCE
C     C
I     N
E     E
N     I
C     C
ECNEICS
```

pr46 - Diamond

Problem: Write a program that will print the letters of a word in a diamond pattern.

Input: The first line of the data set is an integer that represents the number of lines that follow. Each of the remaining lines contains a single word of only uppercase letters of the alphabet.

data file: `pr46`

Output: Output the letters in a diamond pattern as shown below. Print at least one blank line between data sets.

Assumptions: Left to right placement of the diamond is immaterial.

Sample Input:

```
2
COMPUTER
SCIENCE
```

Sample Output:

```
       C
      O O
     M   M
    P     P
   U       U
  T         T
 E           E
R             R
 E           E
  T         T
   U       U
    P     P
     M   M
      O O
       C

      S
     C C
    I   I
   E     E
  N       N
 C         C
E           E
 C         C
  N       N
   E     E
    I   I
     C C
      S
```

pr47 - Hourglass 2

Problem: Write a program that will print the letters of a word in an hourglass pattern.

Input: The first line of the data set is an integer that represents the number of lines that follow. Each of the remaining lines contains a single word of only uppercase letters of the alphabet.

data file: `pr47`

Output: Output the letters in an hourglass pattern as shown below. Print at least one blank line between data sets. Words with an even number of letters will be printed so the two middle letters are printed twice. Words with an odd number of letters, the middle letter will be printed once. Working out from the middle, remaining letters will be printed a odd number of times as shown below. Print at least one blank line between data sets.

Assumptions: Left to right placement of the hourglass is immaterial.

Sample Input:

```
2
COMPUTER
SCIENCE
LUCKY
ELEVEN
```

Sample Output:

```
SSSSSSS
 CCCCC
  III
   E
  NNN
 CCCCC
EEEEEEE

LLLLL
 UUU
  C
 KKK
YYYYY

EEEEE
 LLL
  E
  V
 EEE
NNNNN
```

pr48 - ELL

Problem: Write a program that will print a letter in the shape of an ELL.

Input: The first line of the data set is an integer that represents the number of lines that follow. Each of the remaining lines contains an uppercase letter of the alphabet followed by two integers to determine the rows and columns in the ELL.

data file: `pr48`

Output: Output the letters in an ELL pattern as shown below. Print at least one blank line between data sets. The top of the ELL is the rows and columns given, the total height and width of the ELL is the sum of the rows and columns, and the right part of the ELL is the columns tall and width wide as shown in the examples below. Print at least one blank line between data sets.

Assumptions: Left to right placement of the ELL is immaterial.

Sample Input:

```
2
C 3 5
L 5 4
```

Sample Output:

```
CCCCC
CCCCC
CCCCC
CCCCCCCC
CCCCCCCC
CCCCCCCC
CCCCCCCC
CCCCCCCC

LLLL
LLLL
LLLL
LLLL
LLLL
LLLLLLLLL
LLLLLLLLL
LLLLLLLLL
LLLLLLLLL
```

pr49 - Square Digits

Problem: Write a program that will print a square of digits.

Input: The first line of the data set is an integer that represents the number of lines that follow. Each of the remaining lines contains one digit to determine the starting digit and a second digit that determines the ending digit.

data file: `pr49`

Output: Output the letters in a square pattern as shown below. Print at least one blank line between data sets.

Assumptions: None.

Sample Input:

```
2
3 7
4 9
```

Sample Output:

```
33333
34444
34555
34566
34567

444444
455555
456666
456777
456788
456789
```