

Problem 1 – Framing Squares

It is your job in the framing company, to not only print a painting, but to also frame it. You will be given a painting that is of dimensions M by N. In addition, you must construct a mat of width P around the painting, and a frame of width Q around the template.

To give your customers a sample of what the painting will look like, you must print a picture of it. Draw the actual painting just using dots (.), with N being the horizontal dimension and M being the vertical dimension. The mat around the painting will be drawn using plusses (+). Around the mat, the border will be drawn using the number sign (#).

In the file DATA11.txt (DATA12.txt for the second try), you will find five lines, with each line containing the variables M, N, P, Q in that order. Each of M and N will always be greater than 0, but the overall width or height of any picture will not exceed 50 characters. Print to screen the corresponding pictures with a blank line separating each picture.

Sample Input:

```
1 1 1 1
1 1 0 2
2 2 1 0
2 3 1 1
3 4 1 2
```

Sample Output:

```
#####          +++++          #####
#++++#          +.+.          #####
#+.+#          +.+.          ##+++++##
#++++#          +++++          ##+. . . .+##
#####          #####          ##+. . . .+##
#####          #+++++#          ##+++++##
#####          #+. . .+##          #####
##.##          #+. . .+##          #####
#####          #+++++#          #####
#####          #####
```

Problem 2 –Base 27 Cipher

A message written in capital letters and the spaces only has been disguised in a secret code. For convenience the space character has been replaced by the dot (.). There are then only 27 characters. These characters are arranged in groups of 5, adding several extra periods to the last set of 5 as needed. The letters are replaced by their corresponding place values: “.” = 0, “A”=1, “B”=2 ..., “Z”=26. Each set of 5 then represents a 5 digit base 27 number which can be converted into its decimal equivalent. The first 5 letters of some secret key are likewise converted to a decimal number and added to each number of the message mod 14348907. The resulting numbers are then converted back to alphabetic code.

For example using the key “ALICE”, and the message “I . DONT . KNOW . I . LOST . COUNT”.

“ALICE” converts to (1,12,9,3,5) and becomes the number 774284.

“I . DONT . KNOW . I . LOST . COUNT” to: (9,0,4,15,14-20,0,11,14,15-23,0,9,0,12-15,19,20,0,3-15,21,14,20,0) and becomes the numbers: 4786304, 10637232, 12229716, 8360175, 8395704

Adding the ALICE code mod 14348907: 5560588, 11411516, 13004000, 9134459, 9169988

Converting back to individual base 27 digits:

(10,12,13,18,19,21,12,20,17,20,24,12,18,3,17,17,5,2,3,8,17,6,23,23,5)

And the characters they represent:

JLMRSULTQTXLRQCQEBCHQFWWE (see the last line of **Sample Input**)

Data21.txt (data22.txt for the second try) contains five sets of data. Each set contains two lines: The first line contains the word representing the key and the second line contains the message in code. The message contains less than 256 characters and both the message and the key contain only the 27 characters described above.

Write a program that will decode the five messages.

Sample Input

```
ALICE
KGNLCMBPIQTUTRQLBJNWEU . ILEDMWWEUMTHEOA . HE
HATTER
FQNTRMCGUCWVTWFVUUMFSFUEJ . TUBY . BOYWFAYUXFBNHEACDYEUQKYEAIVGEVQANVHTTE
QUEEN
TVSFLFOEJBQVI IWKCTSNBZFZFRISJNSHIFBDZEGAUUTSSQVSINFHJEODYEUAVUEEN
QUEEN
SHIFBDZEGAUUTSSQVSINFHJEODYEUAVUFSRRISJN
ALICE
JLMRSULTQTXLRQCQEBCHQFWWE
```

Sample Output

```
IVE . HAD . NOTHING . YET . SO . I . CANT . TAKE . MORE
YOU . MEAN . YOU . CANT . TAKE . LESS . ITS . VERY . EASY . TO . TAKE . MORE . THAN . NOTHING
CAN . YOU . DO . ADDITION . WHATS . ONE . AND . ONE . AND . ONE . AND . ONE . AND . ONE
AND . ONE . AND . ONE . AND . ONE . AND . ONE . AND . ONE
I . DONT . KNOW . I . LOST . COUNT
```

Problem 3 – Floor Tiles

Our tiles come in all sizes, but there are three types: (1) square tiles, (2) rectangular tiles, (3) two-third tiles. The square tiles have sizes 1×1 , 2×2 , 3×3 , etc. The rectangular tiles have sizes 1×2 , 2×4 , 3×6 , etc; one side is twice as long as the other. The two-third tiles have sides in the ratio 2:3, for example, 2×3 , 4×6 , 6×9 etc.

Given a room of any length x any width in whole numbers, you must find the one appropriate size tile to tile the entire room, in such a way that no tile needs to be cut, and the entire floor will be covered. As well, the tiles must be large enough, so that the number of tiles is as small as possible.

Data31.txt (Data32.txt for the second try) contains 5 sets of two positive integers on 5 lines, representing 5 different rooms, as in the sample below. Find the size of tiles and the number of tiles needed to tile the room.

When describing the size of a tile, always name the larger of the two sides first.

Sample Input:

```
27 6
36 72
30 66
16 16
456918 3421089
```

Sample Output:

```
For a (27 x 6) floor: Use 3 (9 by 6) tiles
For a (36 x 72) floor: Use 1 (72 by 36) tiles
For a (30 x 66) floor: Use 55 (6 by 6) tiles
For a (16 x 16) floor: Use 1 (16 by 16) tiles
For a (456918 x 3421089) floor: Use 1116753 (1449 by 966) tiles
```

Problem 4 - Roman Additions

Note that Roman numerals are composed of the symbols

I (1), V (5), X (10), L (50), C (100), D (500), M (1000).

For example, 67 is written as LXVII and 3788 is written as MMMDCCLXXXVIII

And in order to avoid 4 of the same symbols in a row (and only for that reason) the subtraction principle is applied: 4 is written as IV: 9 is written as IX: 40 is written as XL: 90 is written as XC etc.

However 49 is written as XLIX and NOT as IL (XLIX does not have 4 symbols in a row.)

No matter how attractive it is to write: MIM for the year 1999,

the correct Roman equivalent is: MCMXCIX.

You might say that Roman numerals are composed of:

I (1), IV (4), V (5), IX (9), X (10), XL (40), L (50), XC (90), C (100), CD (400), D(500), CM (900), M (1000).

Data41.txt (data42.txt for the second try) contains ten lines, each containing a Roman Numeral, representing 5 sets of numbers, two numbers per set. Write a program that will read the numbers and find their sum as shown in the sample. All numbers will be strictly less than 4000.

Sample input

```
MMCM I
CIII
MCCCXCVII
MCIII
XX
LXX
III
III
XCVII
DIII
IX
IX
```

Sample output:

```
MMCM I + CIII = MMMIV
MCCCXCVII + MCIII = MMD
XX + LXX = XC
III + III = VI
XCVII + DIII = DC
```