Programming Problems from ADVENTCODER 2015

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Preface

An Advent calendar is a special calendar used to count or celebrate the days in anticipation of Christmas. Advent calendars typically begin on December 1 and provide a window to open until December 24. Usually they have windows, which you can open each day containing some chocolate or other stuff. But what is better to kill some time until Christmas, Hanukkah, Yule, Kwanzaa, Diwali, Boxing Day, etc. than an Advent calendar giving you a programming problem every day?

The Advent Programming Contest allows to program your solution in any of the supported programming languages, which are currently C, C++, Java, Python or Perl. The programming tasks can be solved with short programs (typically less than 100 lines of code). Until a solution is correct you can submit your program as often as you want.

The main intention is fun, but we will announce a winner after the contest is over. The event is open to everyone.

List of Programming Problems

Problem A: Hello Santa (easy)

Santa greets you, greet back! Write a program that writes "Hello Santa Claus!" (without the quotes) to the console.

Sample Output

```
Hello Santa Claus!
```

Problem B: Anagram Checker (easy)

Santa Claus likes to generate anagrams of words and sentences. To check whether he did a correct job he would like a program that confirms his anagrams.

Problem

Write a program that reads two sentences containing only lowercase letters from the English alphabet and whitespace. The two sentences are given each in one line via standard input. Each sentence has a maximum length of 50 characters including whitespace. You program should return "Anagram" if one sentence is an anagram of the other. Otherwise it should return "No anagram". White spaces should be ignored.

Sample Input

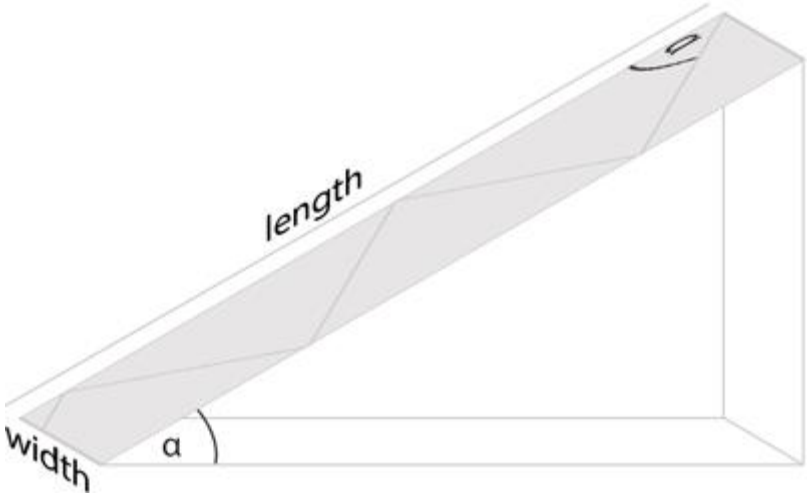
```
it is snowing today
india stowing toys
```

Sample Output

```
Anagram
```

Problem C: Downhill Skiing (medium)

Santa Claus is a very ambitious skier and wants to know more accurately how many kilometers he has skied in a day. Therefore he needs to calculate the actual length of his skiing path rather than just the length of the slopes. This can be done with the knowledge of Santas skiing style: He always traverses the slope at an angle identical to the inclination of the slope. He then zig-zags down until the end (see figure).



Problem

Write a program that reads from standard input the number of slopes that Santa skied that day and their length, width, and inclination in meters and degree respectively (all numbers given as integer values). The length of each path should be calculated in meters (rounded to the next integer). Then output the overall path length of that day according to Santas skiing style. The input will be given in multiple lines following this format:

```
number of slopes
length,width,inclination
length,width,inclination
...
```

Sample Input

```
2
1500,30,15
2250,23,22
```

Sample Output

```
3980
```

Problem D: Fair Price Model (easy)

Santa and the elves also have to keep up with the times, so they are offering a mail order business where they ship christmas presents. However, they decided that they want to play fair and avoid situations where you suddenly pay less for an order that has more items. For example, the price for a teddy bear might be 5 Euro or, if you order 10 or more, it would be 4 Euro. So when you order 9 bears you have to pay more than you would if you order 10 bears. In these cases, Santa adds "virtual" items to the order as long as the overall bill goes down. Thus, an order of 9 bears has one virtual bear added so that the bill is 40 Euro for 9 bears instead of 45 Euro.

Current list with per-piece prices dependent on the number of purchased items:

Item	Price 1-4 pcs	Price 5-9 pcs	Price 10-99 pcs	Price 100 pcs and more
Teddy Bear	5 Euro	5 Euro	4 Euro	4 Euro
LBGT Barbie	55 Euro	49 Euro	39 Euro	35 Euro
Train	25 Euro	25 Euro	22 Euro	19 Euro
OGLE (TM)	125 Euro	99 Euro	79 Euro	69 Euro
Star Trek Lightsaber	75 Euro	73 Euro	69 Euro	68 Euro

Problem

Write a program that reads an order list from standard input. The first line contains the number of different items followed by lines formatted as "*number* items". If number is higher than 1, the item name has a plural-"s" except for "OGLE (TM)". Calculate the price using Santa's fair pay rule and write the overall payment amount in a single line in the form "*amount* Euro".

Sample Input

```
3
9 Teddy Bears
8 LBGT Barbies
1 Star Trek Lightsaber
```

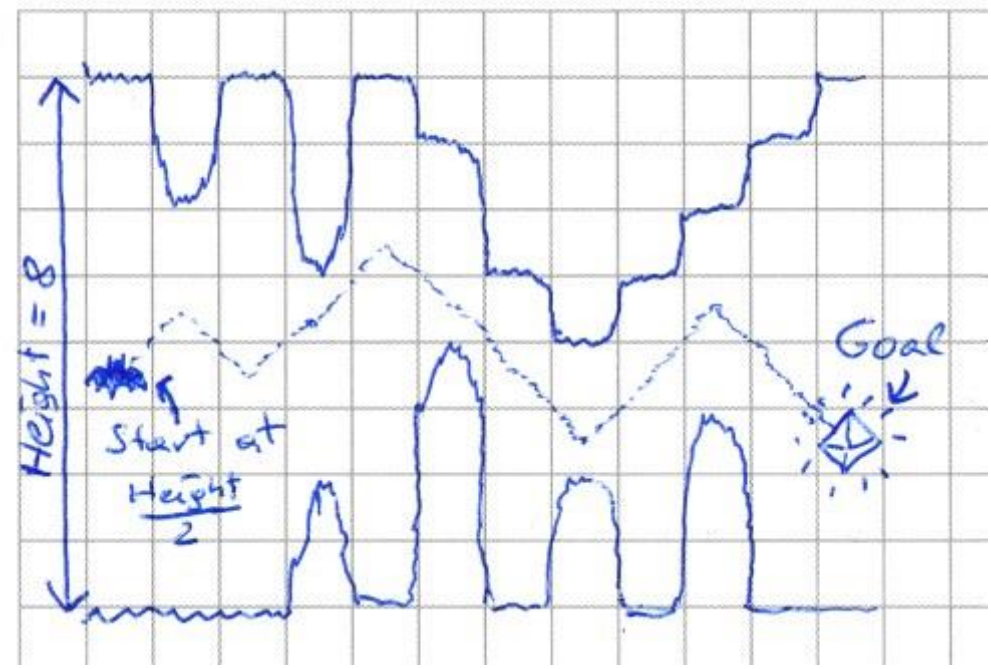
Sample Output

```
505 Euro
```

Problem E: Flappy Bat (hard)

Santa's favorite game is Flappy Bat. In Flappy Bat, you control a bat in a cave which automatically advances forward. When you tap the screen, the bat goes upwards if the screen is not tapped, the bat goes downwards one step while advancing. With each step up or down the bat also advances one step further into the cave. The bat has to avoid touching ground, ceiling, stalagmites, and stalagtites by adjusting its flying height. Being clairvoyant, Santa is a perfect Flappy Bat player, who never makes mistakes.

Problem



Write a program that decides how far Santa gets in a particular Flappy Bat level. The level description shall be read from standard input and consists of the cave height, followed by pairs of integer numbers determining the height of stalagmites (rising form the floor) and stalagtites (hanging from the ceiling), separated by comma. Each line defines one step into the cave. The last line contains only one number defining the height at which a diamond is hovering in the air as the level goal. The first pair is numbered step "1" in the cave, this is also where the bat initally starts at a height of half the cave height, rounded down if necessary.

After reading the level description your program shall determine how far Santa gets into the cave and if he catches the diamond at the end. The answer shall be given in the form "The bat reaches step *n*" or "The bat reaches step *n* and gets the diamond", respectively. *n* stands for the actual number of steps the bat gets into the cave without crashing into a wall. Independent of getting to the goal the level ends when the bat reaches the last defined cave step.

Sample Input 1

```
8
0,0
0,2
0,0
2,3
0,0
```

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

Sample Output 1

```
The bat reaches step 12 and gets the diamond
```

Sample Input 2

```
8
0,0
0,2
0,0
2,3
0,0
5,1
0,3
2,4
0,3
3,2
0,1
0,0
3
```

Sample Output 2

```
The bat reaches step 6
```

Problem F: Snow Tunnel (medium)

Snow has fallen so many meters high that it is now only possible to move through tunnels in the snow. So you started digging a tunnel when suddenly your light breaks. Now you need help to find back from where you started digging.

Problem

You will be given a map of the tunnel in the snow. Write a program that reads from standard input the dimension of the map, your position, and the layout of the tunnel. The dimension specifies how many cells in x and y direction are there (0 < dimension < 100). The position is given in (x,y) coordinates counted from the top left corner of the map (which has the coordinates (0,0)). x increases to the right, y downwards. The map is given by the characters 'X' (capital x) and ' ' (space) where 'X' marks occupied cells and ' ' marks free cells. There is exactly one route to escape the tunnel, all other cells are blocked. Output the directions to escape the tunnel: straight, left, or right. Assume you are facing the right direction at the beginning, i.e. start with going straight. Each word should be printed in a separate line. If you reached the edge of the map (e.g. cell (5,0)) you are free and the program should just exit. The input will be given in multiple lines following this format:

```
dimensions
x,y
map line 1
map line 2
...
```

Sample Input

```
10
1,2
XXXXXXXXXX
X   XXXXXX
X X XXXXXX
XXX   XXXX
XXXXX   XX
X    XX XX
X XX    XX
  XXXXXXXX
XXXXXXXXXX
XXXXXXXXXX
```

Sample Output

```
straight
right
straight
right
straight
left
straight
right
left
straight
right
straight
right
straight
straight
right
left
```

```
straight
straight
left
straight
right
```

Problem G: Weather Forecast (medium)

Last year in December Santa Claus measured the weather every day to create a weather diary. This year he wants to use it as a forecast. He used six distinct weather types to describe the overall situation of one day:

- sun
- clouds
- overcast
- fog
- rain
- snow

The diary is given in the following table:

1.12.	**2.12.**	**3.12.**	**4.12.**	**5.12.**	**6.12.**	**7.12.**	**8.12.**	**9.12.**
sun	sun	clouds	overcast	rain	snow	snow	overcast	overcast
10.12.	**11.12.**	**12.12.**	**13.12.**	**14.12.**	**15.12.**	**16.12.**	**17.12.**	**18.12.**
fog	clouds	sun	clouds	clouds	sun	sun	sun	sun
19.12.	**20.12.**	**21.12.**	**22.12.**	**23.12.**	**24.12.**	**25.12.**	**26.12.**	**27.12.**
clouds	snow	snow	snow	overcast	clouds	sun	clouds	sun
28.12.	**29.12.**	**30.12.**	**31.12.**					
fog	clouds	sun	clouds					

Problem

You will be given the weather of the day before yesterday, yesterday, and today (in that order, comma separated). Assume the weather of a day is fully defined by the three preceding days. Write a program that outputs the weather forecast for tomorrow having the highest probability based only on the diary data. If multiple forecasts are possible (i.e. there are multiple matches for the given pattern), output all of them, separated by comma (sorted in the order they are listed above). In case there is no match for the given pattern, the default is to output all possibilities (just to be on the save side).

Sample Input 1

```
sun,sun,sun
```

Sample Output 1

```
sun,clouds
```

Sample Input 2

```
rain,rain,rain
```

Sample Output 2

```
sun,clouds,overcast,fog,rain,snow
```

Problem H: Wrapping Paper (easy)

The mathematician Sara Santos does not only have a name with some similarity to Santa's but also provided us a formula for efficiently wrapping and taping presents. For a square box present (side*side*height), take the flat diagonal of the box and add one and a half times the height of the box.

See also Santos' work on popularizing math at http://www.mathsbusking.com/.

Problem

Write a program that reads two integer numbers from standard input separated by a space, which are side length and height of a square box. Calculate the size of wrapping paper and output the result (rounded up to next integer, for example 12.1 becomes 13). Write the answer in the form "You need a paper of size *n* times *n*."

Sample Input 1

```
8 12
```

Sample Output 1

```
You need a paper of size 30 times 30.
```

Sample Input 2

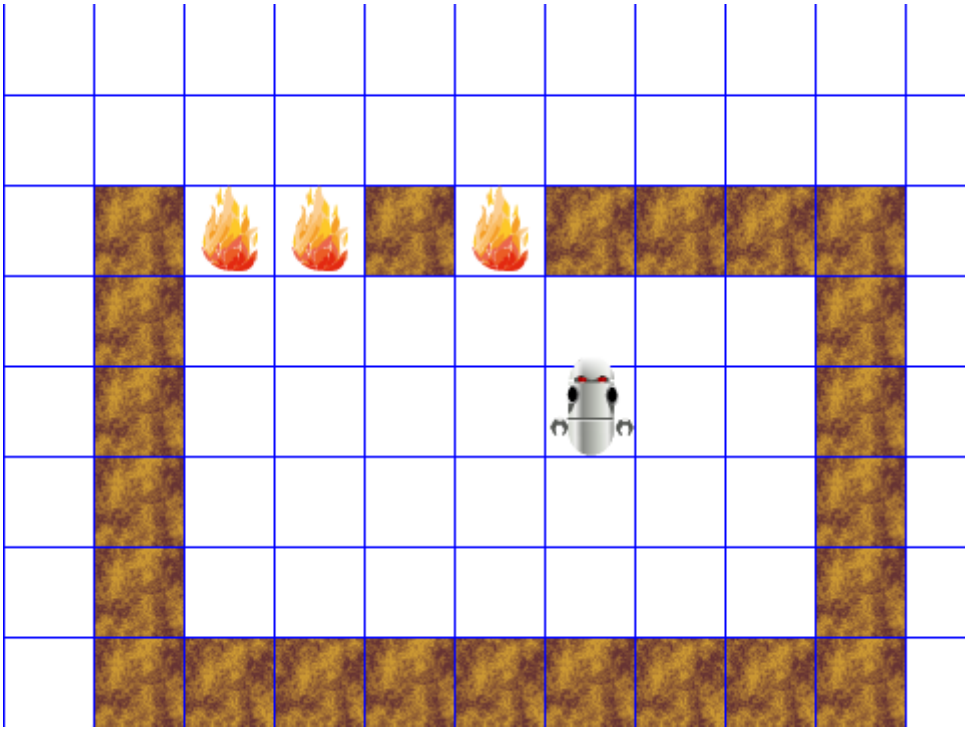
```
100 20
```

Sample Output 2

```
You need a paper of size 172 times 172.
```

Problem I: Fire Alert (very hard)

Suddenly a fire starts in the wooden barracks housing Santa's workshops at the north pole! The only hope is a fire extinguishing robot which now has to move quickly to provide the fire from spreading. Help the robot find the best strategy to extinguish the fire.



Problem

Write a program that first reads the map size *height*,*width* followed by the actual map consisting of "." for an empty field, an "X" for a part of a building, or an "f" for a part that is on fire. The maximum map size is 50x50 patches. Each map contains exactly one "R" which indicates the position of the fire extinguisher robot. Simulate the fire spreading and movement of the robot: The robot can move one step to a neighboring field that is either an empty field or a field on fire. The robot can also make diagonal steps, so it can choose from 8 directions or stay at its place. The robot cannot move onto a building part. When robot moves onto a fire, the fire at this spot is immediately extinguished and cannot spread anymore. When the robot goes on, it leaves an empty field.

After each move of the robot, every patch of fire spreads east, north, south and west, if there is flammable material in that direction. The fire on its original spot goes out automatically and is replaced by an empty field in the next time step.

Calculate the best case scenario where most building parts remain after all fires are out. Write the number of remaining building parts as "*n* buildings remaining" to standard output.

Sample Input

```
8,11
...........
...........
.XffXfXXXX.
.X.......X.
```

```
.X....R..X.
.X.......X.
.X.......X.
.XXXXXXXXX.
```

Sample Output

```
15 buildings remaining
```

Problem J: Unshredding (medium)

What Santa thought to be the fax machine was actually the new paper shredder. So Santa accidently shredded a sheet with important notes into small stripes of 1 character width.

The shredding process works like this: Santa's text is given in word-wrapped form (columnwidth is 40 characters), for example

```
Maulana Karenga created Kwanzaa in 1965
as the first specifically African-
American holiday. According to Karenga,
the name Kwanzaa derives from the
Swahili phrase matunda ya kwanza,
meaning "first fruits of the harvest".
The choice of Swahili, an East African
language, reflects its status as a
symbol of Pan-Africanism, especially in
the 1960s, although most East African
nations were not involved in the
Atlantic slave trade that brought
African people to America. Kwanzaa is a
celebration that has its roots in the
black nationalist movement of the 1960s,
and was established as a means to help
African Americans reconnect with their
African cultural and historical heritage
by uniting in meditation and study of
African traditions and Nguzo Saba, the
"seven principles of African Heritage"
which Karenga said "is a communitarian
African philosophy". During the early
years of Kwanzaa, Karenga said that it
was meant to be an "oppositional
```

```
alternative" to Christmas. However, as
Kwanzaa gained mainstream adherents,
Karenga altered his position so that
practicing Christians would not be
alienated, then stating in the 1997
Kwanzaa: A Celebration of Family,
Community, and Culture, "Kwanzaa was not
created to give people an alternative to
their own religion or religious
holiday." Many African Americans who
celebrate Kwanzaa do so in addition to
observing Christmas. (Text from
Wikipedia under CC-BY-SA)
```

After slicing through the paper, we get 40 strips, where, for example the first strip contains the first letters of every line:

```
MaAtSmTlstnAAcbaAAbA"wAywaKKpaKCcthcoW
```

followed by a strip with the second position letters, the third position letters and so on:

```
asmhwehayhatfelnffyfshfealwarlworhoebi
u eeaaenmetlrladrr reirastaraiameellsk
ltr hn gb iaiec iiuivcir enecenmaiieei
ahiniicuo1oncbkwccncehcsmrzntnzutrdbrp
necalnhal9ntar aaaian a enagiaane arve
a amigog 6sinansnntn Knoaaaactaidoyaid
 fne  ieo0 c ta   i pa fnt  ie:t w.tni
Ki  p"c,fsw piteAcntrrp tigand ytn"ega
arhKhfe  ,eseoismugriehK valg,A,o
rsowri rP rlonotel anniwteit     rMKCu
etlaaroeaaeap nartidcglao"neCtCageawhn
n inssffnl vltabiuniiaon  erhhenilnard
gsdzet l-tneehllcr tp szbtdereldviynie
apaa  SeAho  aiiaamilsoaeo dine eg zsr
 eyamfwcfotttssnleoeapa  m s bC iAat
cc. aratru ro ths dnsih,aCahtsrupofamC
ri dtuhsigia h e ais dy nhiiitalenr aC
efAeuii chndAamdrnt o "K rnsaatto ids-
aicrntlia vemso edaaf".a"is ntiupoco.B
tccidsitnmo e vac tn i rostpsiorlra  Y
eaova ,sioltriesohidAsDeptro nnee ns(-
dlre o  ssvhitm nio f unpmeswg , r oTS
 ldsyfasmteacseansnNrargoaaio o aeA eA
Kyi a nt, dta n et gi iassmtuif"nlmix)
w nf t a E  .rtmcoauccn i. iln K ient
aAgrkhEteaib o etrnzaogst aod Fwagr
nf oweaussnrKooa idonm aiHdn taaliiaf
zrtma sspt owtfnwc   mtiooh nhmntocdr
aio nht e tuas siasSHuhdnwesoeizeuado
ac tza acAhgn t tltaene aerot larsnim
 aKharAsifehzihth ubri tlve  1yan st
inae,vf ar taneo hdaiteh entb9, a  i
n-r  erali  a   tey,taaa rthe9 wt wo
  e  si lc   t1hhr  arrt ,sa 7 ai hn
1 n  tc ya  ih9eeiotgil   ,t   sv o
9 g  "a  n  se6litfheayi a      e  t
6 a  .n i     0pra e"n t s     n   o
5 ,     n   a s  g            ot
              ,  e            to
```

Problem

Write a program that restores the original text by putting the strips together and printing the original text. Each line should be followed by a newline. Trailing spaces of a line and empty lines at the end of the text should not be printed.

Sample Input

```
MaAtSmTlstnAAcbaAAbA"wAywaKKpaKCcthcoW
asmhwehayhatfelnffyfshfealwarlworhoebi
u eeaaenmetlrladrr reirastaraiameellsk
ltr hn gb iaiec iiuivcir enecenmaiieei
ahiniicuo1oncbkwccncehcsmrzntnzutrdbrp
necalnhal9ntar aaaian a enagiaane arve
a amigog 6sinansnntn Knoaaaactaidoyaid
 fne  ieo0 c ta   i pa fnt  ie:t w.tni
Ki  p"c,fsw piteAcntrrp tigand ytn"ega
arhKhfe  ,eseoismugriehK valg,A,o
rsowri rP rlonotel anniwteit     rMKCu
etlaaroeaaeap nartidcglao"neCtCageawhn
n inssffnl vltabiuniiaon  erhhenilnard
gsdzet l-tneehllcr tp szbtdereldviynie
apaa  SeAho  aiiaamilsoaeo dine eg zsr
 eyamfwcfottttssnleoeapa  m s bC iAat
cc. aratru ro ths dnsih,aCahtsrupofamC
ri dtuhsigia h e ais dy nhiiitalenr aC
efAeuii chndAamdrnt o "K rnsaatto ids-
aicrntlia vemso edaaf".a"is ntiupoco.B
tccidsitnmo e vac tn i rostpsiorlra  Y
eaova ,sioltriesohidAsDeptro nnee ns(-
dlre o  ssvhitm nio f unpmeswg , r oTS
 ldsyfasmteacseansnNrargoaaio o aeA eA
Kyi a nt, dta n et gi iassmtuif"nlmix)
w nf t a E  .rtmcoauccn i. iln K ient
aAgrkhEteaib o etrnzaogst aod Fwagr
nf oweaussnrKooa idonm aiHdn taaliiaf
zrtma sspt owtfnwc   mtiooh nhmntocdr
aio nht e tuas siasSHuhdnwesoeizeuado
ac tza acAhgn t tltaene aerot larsnim
 aKharAsifehzihth ubri tlve  1yan st
inae,vf ar taneo hdaiteh entb9, a  i
n-r  erali  a   tey,taaa rthe9 wt wo
  e  si lc   t1hhr  arrt ,sa 7 ai hn
1 n  tc ya  ih9eeiotgil   ,t   sv o
9 g  "a  n  se6litfheayi a      e  t
6 a  .n i     0pra e"n t s     n   o
5 ,     n   a s  g            ot
              ,  e            to
```

Sample Output

```
Maulana Karenga created Kwanzaa in 1965
as the first specifically African-
American holiday. According to Karenga,
the name Kwanzaa derives from the
Swahili phrase matunda ya kwanza,
meaning "first fruits of the harvest".
The choice of Swahili, an East African
language, reflects its status as a
symbol of Pan-Africanism, especially in
the 1960s, although most East African
nations were not involved in the
Atlantic slave trade that brought
```

African people to America. Kwanzaa is a celebration that has its roots in the black nationalist movement of the 1960s, and was established as a means to help African Americans reconnect with their African cultural and historical heritage by uniting in meditation and study of African traditions and Nguzo Saba, the "seven principles of African Heritage" which Karenga said "is a communitarian African philosophy". During the early years of Kwanzaa, Karenga said that it was meant to be an "oppositional alternative" to Christmas. However, as Kwanzaa gained mainstream adherents, Karenga altered his position so that practicing Christians would not be alienated, then stating in the 1997 Kwanzaa: A Celebration of Family, Community, and Culture, "Kwanzaa was not created to give people an alternative to their own religion or religious holiday." Many African Americans who celebrate Kwanzaa do so in addition to observing Christmas. (Text from Wikipedia under CC-BY-SA)

Problem K: Message Decoding (hard)

For communication between the Christmas factories at the north pole an encoding is used. Due to a misfortune the method how to decode the messages was lost. Luckily part of an encrypted message was still existent as clear text. It is given below where ... mark lost parts. Using this piece of information, infer the method that was used to encode the message. Your task is to decode the messages that are being transmitted on the channel.

Encoded message:

```
Z[hi#$qrhihigh#$wxrs#$rsuvghhiuv#$pqrsuvhi#$z{rsrsgh12#$STophidevwhi#$jkhiw
x#$deqr#$rsijijhiuv#$ijrsuv#$458934#$stdeqrhiopvw#$rsij#$stop|}z{rsrsgh#$rs
ij#$567834{|673434{|45#$fghiqrwxlmpqhiwxhiuvvw#$hidefgkl12
```

Clear text message:

```
We need to ... get an offer for 150 panels of plywood of ..00x1 centimeters
...
```

Problem

Write a program that reads an encoded message as one line from stdin and outputs the decoded message to stdout. Use all methods that where applied to the above message example.

Sample Input 1

```
WXklhi#$vwxyqr#$lmvw#$vwkllmqrlmqrjk12
```

Sample Output 1

```
The sun is shining.
```

Problem L: Please improve my program (hard)

Santa has written a Python program for doing some calculations. However, he has poorly implemented the algorithm so that the program runs painfully slow.

Problem

Optimize the following program so that it runs with reasonable speed. You can reimplement the program in your preferred programming language. The range for the input values is between 0 and 10000.

```
import sys

def magic(a,b):
    if a<b:
        a,b=b,a #swap a and b
    e=0
    c=[0]*a #create zero-filled array of size a
    while a>0:
        for d in range(len(c)): # d iterates from 0 to length of c-1
            if c[d]==1:
              c[d]=0
            else:
              c[d]=1
              break
        a=0
        for d in c: # d iterates over all elements of c
          a=a+d
        if a!=b and c[int(b/2)]==1:
          e=e+1
    return e

a=int(sys.stdin.readline()) # read integer number a from stdin
b=int(sys.stdin.readline()) # read integer number b from stdin
print (magic(a,b))
```

Tipp: if you don't have Python, you can experiment with this program online by pasting it into repl.it.

Example

Sample Input 1

```
7
19
```

Sample Output 1

```
243580
```

Sample Input 2

```
376
128
```

Sample Output 2

```
769570433445148964217046653331123227821885322357132497706293545112822698220
143560201214491308504567206220578095 68
```

Testcase 2 took Santa's program a Googol years to calculate :-/

Problem L: Rail fence cipher (easy)

In the rail fence cipher, the plaintext is written downwards and diagonally on successive "rails" of an imaginary fence, then moving up when we reach the bottom rail. When we reach the top rail, the message is written downwards again until the whole plaintext is written out. The message is then read off in rows. For example, if we have 3 "rails" and a message of 'WE ARE DISCOVERED. FLEE AT ONCE', the cipherer writes out:

```
W . . . E . . . C . . . R . . . L . . . T . . . E
. E . R . D . S . O . E . E . F . E . A . O . C .
. . A . . . I . . . V . . . D . . . E . . . N . .
```

Then reads off to get the ciphertext:

```
WECRLTEERDSOEEFEAOCAIVDEN
```

(from Wikipedia.org Rail Fence Cipher, text under CC BY-SA)

Problem

Implement a program that reads one line of text from standard input, removes all non-alphabetic characters and applies a rail fence encoding with a fence height of **4** rails. The output message should be converted to all uppercase letters and then written out.

Example

Sample Input

```
We are discovered! Flee at once!
```

Sample Output

```
WIREEEDSEEEACAECVDLTNROFO
```

Problem N: Spell Check (easy)

Santa Claus loves to write letters but he has trouble with his spelling. To help Santa check the spelling of his letters. Consider the following rules:

- Words should not contain capital letters except as the first character.
- Each sentence should begin with a capital letter.

A word is a sequence of characters. Each character must be neither a space nor a punctuation character. A sentence is a group of words preceded by a punctuation character or the beginning of the text. A punctuation character is a full stop, a question mark, or an exclamation mark. As input there are only lower case letters, uppercase letters, the space character, and punctuation characters.

Problem

Write a program that reads a text as one line from stdin and outputs the number of errors according to the given rules above.

Sample Input 1

```
This sentence has ONe error. this sentence as well! How many errors do we have?
```

Sample Output 1

```
2
```

Problem O: Snow Tunnel (hard)

Remember the snow tunnel from problem F. Now consider that there are multiple tunnels in the snow and you should find the shortest way out.

Problem

You will be given a map of the tunnels in the snow. Write a program that reads from standard input the dimension of the map, your position, and the layout of the tunnels. The dimension specifies how many cells in x and y direction are there (0 < dimension < 100). The position is given in (x,y) coordinates counted from the top left corner of the map (which has the coordinates (0,0)). x increases to the right, y downwards. The map is given by the characters 'X' (capital x) and ' ' (space) where 'X' marks occupied cells and ' ' marks free cells. There are multiple routes to escape the tunnel, but there are no loops. Output the directions to escape the tunnels on the shortest path: straight, left, or right. Assume you are facing the right direction at the beginning, i.e. start with going straight. Each word should be printed in a separate line. If you reached the edge of the map (e.g. cell (5,0)) you are free and the program should just exit. The input will be given in multiple lines following this format:

```
dimensions
x,y
map line 1
map line 2
...
```

Sample Input

```
10
1,2
XXXXXXXXXX
X   XXXXXX
X X XXXXXX
XXX   XXXX
XXXXX   XX
X    XX XX
X XX    XX
  XXXXX XX
XXXXXXX
XXXXXXXXXX
```

Sample Output

```
straight
right
straight
right
straight
left
straight
right
left
straight
right
straight
straight
straight
left
straight
```

Problem P: Unshredding (very hard)

Santa is very greatful for the program you provided him to cover up his fax/shredder-machine accident (see Problem L). However, Santa found out that he cannot provide the sliced strips in the proper order. Instead they are coming in a random order.

Problem

Write a program that reads the shreddered strips, determines their proper order and restores the original text by putting the strips together and printing the original English text. Each line should be followed by a newline. Trailing spaces of a line and empty lines at the end of the text should not be printed. This problem is very similar to Problem L, the only difference is that the input lines come in a randomized order.

Sample Input

```
u eeaaenmetlrladrr reirastaraiameellsk
rsowri rP rlonotel anniwteit     rMKCu
ahiniicuo1oncbkwccncehcsmrzntnzutrdbrp
arhKhfe  ,eseoismugriehK valg,A,o
asmhwehayhatfelnffyfshfealwarlworhoebi
gsdzet l-tneehllcr tp szbtdereldviynie
Ki  p"c,fsw piteAcntrrp tigand ytn"ega
ltr hn gb iaiec iiuivcir enecenmaiieei
MaAtSmTlstnAAcbaAAbA"wAywaKKpaKCcthcoW
n inssffnl vltabiuniiaon  erhhenilnard
necalnhal9ntar aaaian a enagiaane arve
a amigog 6sinansnntn Knoaaaactaidoyaid
 fne  ieo0 c ta   i pa fnt  ie:t w.tni
etlaaroeaaeap nartidcglao"neCtCageawhn
apaa  SeAho  aiiaamilsoaeo dine eg zsr
9 g  "a  n  se6litfheayi a      e  t
6 a  .n i     0pra e"n t s     n   o
5 ,     n   a s  g            ot
1 n  tc ya  ih9eeiotgil   ,t   sv o
 ldsyfasmteacseansnNrargoaaio o aeA eA
 eyamfwcfottttssnleoeapa  m s bC iAat
 aKharAsifehzihth ubri tlve  1yan st
  e  si lc   t1hhr  arrt ,sa 7 ai hn
             ,  e            to
aAgrkhEteaib o etrnzaogst aod Fwagr
ac tza acAhgn t tltaene aerot larsnim
aicrntlia vemso edaaf".a"is ntiupoco.B
aio nht e tuas siasSHuhdnwesoeizeuado
cc. aratru ro ths dnsih,aCahtsrupofamC
dlre o  ssvhitm nio f unpmeswg , r oTS
eaova ,sioltriesohidAsDeptro nnee ns(-
inae,vf ar taneo hdaiteh entb9, a  i
efAeuii chndAamdrnt o "K rnsaatto ids-
Kyi a nt, dta n et gi iassmtuif"nlmix)
nf oweaussnrKooa idonm aiHdn taaliiaf
n-r  erali  a   tey,taaa rthe9 wt wo
ri dtuhsigia h e ais dy nhiiitalenr aC
tccidsitnmo e vac tn i rostpsiorlra  Y
w nf t a E  .rtmcoauccn i. iln K ient
zrtma sspt owtfnwc   mtiooh nhmntocdr
```

Sample Output

```
Maulana Karenga created Kwanzaa in 1965
```

as the first specifically African-American holiday. According to Karenga, the name Kwanzaa derives from the Swahili phrase matunda ya kwanza, meaning "first fruits of the harvest". The choice of Swahili, an East African language, reflects its status as a symbol of Pan-Africanism, especially in the 1960s, although most East African nations were not involved in the Atlantic slave trade that brought African people to America. Kwanzaa is a celebration that has its roots in the black nationalist movement of the 1960s, and was established as a means to help African Americans reconnect with their African cultural and historical heritage by uniting in meditation and study of African traditions and Nguzo Saba, the "seven principles of African Heritage" which Karenga said "is a communitarian African philosophy". During the early years of Kwanzaa, Karenga said that it was meant to be an "oppositional alternative" to Christmas. However, as Kwanzaa gained mainstream adherents, Karenga altered his position so that practicing Christians would not be alienated, then stating in the 1997 Kwanzaa: A Celebration of Family, Community, and Culture, "Kwanzaa was not created to give people an alternative to their own religion or religious holiday." Many African Americans who celebrate Kwanzaa do so in addition to observing Christmas. (Text from Wikipedia under CC-BY-SA)

Problem Q: Bunnies and Foxes (medium)

In a field near Santa's home there is an interesting ecosystem with a population of bunnies and foxes. Adult bunnies create offspring (one per adult) in the morning of every 15th day. The newborn bunnies mature in the morning of the 31st day after they were born. While the bunnies have infinite grass to eat, every fox needs to catch bunnys for eating. Once they have eaten, foxes are fed for 10 days, on the 10th day they need to catch one bunny per fox again and therefore foxes organize a hunt in the afternoon of that day. Since the young bunnies are well hidden, only the adult bunnies can be caught. At one hunt, foxes can catch at most half (rounded down) of the adult bunny population and they never catch more bunnies than needed for eating. Foxes that fail to catch a bunny die of hunger the next day. Every 20 days, there is a new fox born for every non-starving fox.

Problem

Write a program that calculates the number of bunnies and foxes alive after a given time. The program shall read a line with the initial number of bunnies, the initial number of foxes and the number of days to simulate, all numbers are integers separated by spaces. In the beginning, all bunnies are adults and all foxes are fed. Thus, the first hunt is on day 10, the first bunnies will be born on day 15. As result, the number of remaining bunnies and foxes at the end of the given day should be written as two integers separated by space.

Example 1

Input

```
10 5 15
```

Output

```
10 5
```

Example 2

Input

```
10 5 365
```

Output

```
19 4
```

Problem R: Cracking the rail fence (hard)

As we know from Problem M, in the rail fence cipher, the plaintext is written downwards and diagonally on successive "rails" of an imaginary fence, then moving up when we reach the bottom rail. When we reach the top rail, the message is written downwards again until the whole plaintext is written out. The message is then read off in rows. For example, if we have 3 "rails" and a message of 'WE ARE DISCOVERED. FLEE AT ONCE', the cipherer writes out:

```
W . . . E . . . C . . . R . . . L . . . T . . . E
. E . R . D . S . O . E . E . F . E . A . O . C .
. . A . . . I . . . V . . . D . . . E . . . N . .
```

Then reads off to get the ciphertext:

```
WECRLTEERDSOEEFEAOCAIVDEN
```

With 4 rails, the encoding of the message works as follows:

```
W . . . . . I . . . . . R . . . . . E . . . . . E
. E . . . D . S . . . E . E . . . E . A . . . C .
. . A . E . . . C . V . . . D . L . . . T . N . .
. . . R . . . . . O . . . . . F . . . . . O . . .
```

Leading to the ciphertext

```
WIREEEDSEEEACAECVDLTNROFO
```

(based on Wikipedia.org Rail Fence Cipher, text under CC BY-SA)

So Santa decides to use the Railfence as safe encoding for his secret messages. He will use a secret number between 2 and 10 as the numer of rails to avoid having his messages decoded by the wrong people. But Rudolph, the red-nosed reindeer ojects: "Santa this is not a secure code. Given a longer message, I can write a program that decodes it without even knowing the number of rails!"

"Let's see if this is true", replies Santa, "if I see this program in existence, I will use RSA instead!"

Problem

Implement a program that supports Rudolph's statement. The input is a single line containing the encoded message, all uppercase letters. The output should contain the deciphered code. The message consists of english text without spaces or punctuation.

Example

Sample Input (Santa used 4 rails here btw)

```
SHOUEARGWPMEIONNUFATINTCRDGNLEMAENRARATDCSTHUEKIGNMORSNASSAEEOIEOGESIAIEORH
TOEWTTVNWTEBRALTISCVNSCTGADIEOHEI
```

Sample Output

```
SANTATHISISNOTASECURECODEGIVENALONGERMESSAGEICANWRITEAPROGRAMTHATDECODESITW
ITHOUTEVENKNOWINGTHENUMBEROFRAILS
```

Problem S: Recover my keys (very hard)

Somebody cracked the railfence code, so Santa uses the public-key cryptosystem RSA to communicate securely with his elves. Accidently, Santa has teared his notes with his RSA key apart and threw it away. Luckily, he became aware of his mistake and recovered the paper scraps and could glue them back together. However, some of the characters on the paper are unreadable due to the tearing. Can you help Santa to recover the full RSA key? Hint: Look for information about the RSA system and find out where there is redundancy in RSA-keys.

Problem

Write a program that reads Santa's RSA key in PEM format from standard input, analyzes it and writes back the repaired key. Missing characters are shown as space.

Example 1

Input

```
-----BEGIN RSA PRIVATE KEY-----
MIICWwIBAAKBgHLOprnOp/Hl6hNr5Kw7cWC3dozL8L/ObY3E6NAXZ ihwJ+yleB7
n90AktDxHiBV+6/hC22qNZ7kr4wthXWtbstC/qzmEOFgB2q3SmU1 K/UKXxmSefn
O3wWGE0jTQYQdBvJvZk3mFyoHCspiyHd8BnnW70lCA2H6vd/QLX WbrxAgMBAAEC
gYBO5T5kH+T/8hzq3dFWnr7qVQmN9jRqy0Q0EaZgIkT3BJln5Y jsHEKofNCzQAD
/rKoigGdikOw/ry4myvE07t33F7VxT12vhX7sD5w8NKTL4ZHfzlH74lK50CG2z+d
LnxmzusGR4CedFesLKCFJpFivCyIpEZTeLjg4Sazwy4cQQJBAL/19QgnZbwczjfx
aeOayprWBKeddhrZ2+thJiCTGPh9aYe8Sj+07/CGn3d4fd7DR+b55hdUeKR41g9W
7K4/dEkCQQCZG4smEO54PZFq6X8DyGHvXyvi1/HmHMx1+km8nsO3txgN+++ORrd/
tpomGz9uX1Exqa2fU1lqC8ngmXgFaMFpAkEAj7mrTgCZhoAW0wIZI0YpfkbR02Ht
 OuLYrApaOhaIOtdkTikaxChOfjB+ySnMZwLAOCIq10eux6SP4f4y/pMqQJAM/zL
Q Cr+H4HW4MPUsx+nJX3Q95JT/ZlYoXq9bX/BOmRrGXoUKoocqAhNWE5J5QL8M4J
mz k+oIoOTBDNar9SQJAW4Ky7N3K35NLEuX5UWGwdJAsRfuZwrdMqMKQFuFN6h56
Vlq 4vI+jadHzXyzJG8lFLa0YaewPMbO8+m/TgFMlQ==
-----END RSA PRIVATE KEY-----
```

Output

```
-----BEGIN RSA PRIVATE KEY-----
MIICWwIBAAKBgHLOprnOp/Hl6hNr5Kw7cWC3dozL8L/ObY3E6NAXZwihwJ+yleB7
n90AktDxHiBV+6/hC22qNZ7kr4wthXWtbstC/qzmEOFgB2q3SmU1MK/UKXxmSefn
O3wWGE0jTQYQdBvJvZk3mFyoHCspiyHd8BnnW70lCA2H6vd/QLX5WbrxAgMBAAEC
gYBO5T5kH+T/8hzq3dFWnr7qVQmN9jRqy0Q0EaZgIkT3BJln5YTjsHEKofNCzQAD
/rKoigGdikOw/ry4myvE07t33F7VxT12vhX7sD5w8NKTL4ZHfzlH74lK50CG2z+d
LnxmzusGR4CedFesLKCFJpFivCyIpEZTeLjg4Sazwy4cQQJBAL/19QgnZbwczjfx
aeOayprWBKeddhrZ2+thJiCTGPh9aYe8Sj+07/CGn3d4fd7DR+b55hdUeKR41g9W
7K4/dEkCQQCZG4smEO54PZFq6X8DyGHvXyvi1/HmHMx1+km8nsO3txgN+++ORrd/
tpomGz9uX1Exqa2fU1lqC8ngmXgFaMFpAkEAj7mrTgCZhoAW0wIZI0YpfkbR02Ht
JOuLYrApaOhaIOtdkTikaxChOfjB+ySnMZwLAOCIq10eux6SP4f4y/pMqQJAM/zL
QdCr+H4HW4MPUsx+nJX3Q95JT/ZlYoXq9bX/BOmRrGXoUKoocqAhNWE5J5QL8M4J
mzjk+oIoOTBDNar9SQJAW4Ky7N3K35NLEuX5UWGwdJAsRfuZwrdMqMKQFuFN6h56
Vlq64vI+jadHzXyzJG8lFLa0YaewPMbO8+m/TgFMlQ==
-----END RSA PRIVATE KEY-----
```

Example 2

Input

```
-----BEGIN RSA PRIVATE KEY-----
MIICWwIBAAKBgHLOprnOp/Hl6hNr5Kw7cWC3dozL8L/ObY3E6NAXZwihwJ+yl
n90AktDxHiBV+6/hC22qNZ7kr4wthXWtbstC/qzmEOFgB2q3SmU1MK/UKXxmSe
O3wWGE0jTQYQdBvJvZk3mFyoHCspiyHd8BnnW70lCA2H6vd/QLX5WbrxAgMBAAE
gYBO5T5kH+T/8hzq3dFWnr7qVQmN9jRqy0Q0EaZgIkT3BJln5YTjsHEKofNCzQA
/rKoigGdikOw/ry4myvE07t33F7VxT12vhX7sD5w8NKTL4ZHfzlH74lK50CG2z+d
LnxmzusGR4CedFesLKCFJpFivCyIpEZTeLjg4Sazwy4cQQJBAL/19QgnZbwczjfx
```

```
aeOayprWBKeddhrZ2+thJiCTGPh9aYe8Sj+07/CGn3d4fd7DR+b55hdUeKR41g9W
7K4/dEkCQQCZG4smEO54PZFq6X8DyGHvXyvi1/HmHMx1+km8nsO3txgN+++ORrd/
tpomGz9uX1Exqa2fU1lqC8ngmXgFaMFpAkEAj7mrTgCZhoAW0wIZI0YpfkbR02Ht
JOuLYrApaOhaIOtdkTikaxChOfjB+ySnMZwLAOCIq10eux6SP4f4y/pMqQJAM/zL
QdCr+H4HW4MPUsx+nJX3Q95JT/ZlYoXq9bX/BOmRrGXoUKoocqAhNWE5J5QL8M4J
mzjk+oIoOTBDNar9SQJAW4Ky7N3K35NLEuX5UWGwdJAsRfuZwrdMqMKQFuFN6h56
Vlq64vI+jadHzXyzJG8lFLa0YaewPMbO8+m/TgFMlQ==
-----END RSA PRIVATE KEY-----
```

Output

```
-----BEGIN RSA PRIVATE KEY-----
MIICWwIBAAKBgHLOprnOp/Hl6hNr5Kw7cWC3dozL8L/ObY3E6NAXZwihwJ+yleB7
n90AktDxHiBV+6/hC22qNZ7kr4wthXWtbstC/qzmEOFgB2q3SmU1MK/UKXxmSefn
O3wWGE0jTQYQdBvJvZk3mFyoHCspiyHd8BnnW70lCA2H6vd/QLX5WbrxAgMBAAEC
gYBO5T5kH+T/8hzq3dFWnr7qVQmN9jRqy0Q0EaZgIkT3BJln5YTjsHEKofNCzQAD
/rKoigGdikOw/ry4myvE07t33F7VxT12vhX7sD5w8NKTL4ZHfzlH74lK50CG2z+d
LnxmzusGR4CedFesLKCFJpFivCyIpEZTeLjg4Sazwy4cQQJBAL/19QgnZbwczjfx
aeOayprWBKeddhrZ2+thJiCTGPh9aYe8Sj+07/CGn3d4fd7DR+b55hdUeKR41g9W
7K4/dEkCQQCZG4smEO54PZFq6X8DyGHvXyvi1/HmHMx1+km8nsO3txgN+++ORrd/
tpomGz9uX1Exqa2fU1lqC8ngmXgFaMFpAkEAj7mrTgCZhoAW0wIZI0YpfkbR02Ht
JOuLYrApaOhaIOtdkTikaxChOfjB+ySnMZwLAOCIq10eux6SP4f4y/pMqQJAM/zL
QdCr+H4HW4MPUsx+nJX3Q95JT/ZlYoXq9bX/BOmRrGXoUKoocqAhNWE5J5QL8M4J
mzjk+oIoOTBDNar9SQJAW4Ky7N3K35NLEuX5UWGwdJAsRfuZwrdMqMKQFuFN6h56
Vlq64vI+jadHzXyzJG8lFLa0YaewPMbO8+m/TgFMlQ==
-----END RSA PRIVATE KEY-----
```

Problem T: Thimblerig (easy)

In the thimblerig game, three identical containers are placed face-down on a surface. A small ball is initially placed beneath one of these containers. Then the cups are then shuffled in plain sight. Players are invited to bet on which container holds the ball.

Problem

Write a program that tracks the position of the ball in a thimblerig game. The program shall read from standard input the initial position of the ball ("left", "middle", "right"), followed by description of the cup movements, which can be of type "swap *A* with *B*", where *A* and *B* are either "left", "middle", or "right" or of type "move *A* to the *B*" where *A* can be "left" or "right" and *B* can be "left", "middle", or "right". The swap action exchanges the places of two cups, while the move action moves one cup into a new place pushing the other two cups to the left or right. After the last move, the question from the game master "Where is it?" is read. Then the program has to answer with "left", "middle", or "right" (no quotes).

Sample Input

```
middle
swap right with left
move left to the middle
swap right with right
move right to the left
swap middle with left
Where is it?
```

Sample Output

```
left
```

Problem U: Working hard (medium)

Before christmas, the elves in the workshop have to work hard to produce all the presents in time. Luckily not all items need to be finished on the same day. However, there is one central machine in the workshop that is needed for all toys, thus creating a bottleneck in the production. Help Santa and the elves to schedule their production efficiently by processing the tasks in an earliest deadline first policy, that is, among all the tasks to be done at one instant, the one with the earliest deadline is done first. If there are multiple tasks with the same deadline, the task that was posted earlier comes first. The production process cannot be interrupted, once a task has started, it runs until all items of this task are made.

Current list with time effort per item

Item	Production time on machine
Teddy Bear	1 day
LBGT Barbie	2 days
Train	5 days
OGLE (TM)	2 days
Star Trek Lightsaber	3 days

Problem

Write a program that reads from standard input first the number of orders in a single line followed by the orders in the form *day the order was given,amount item,deadline*. Values are separated by commas, except for *amount* and *item* which are separated by space. If the amount is higher than 1, the item name has a plural-"s" except for "OGLE (TM)". Then apply the scheduling policy described above. The input corresponds to the order of the requested items. Production of an item cannot start before the day the order was given.

The output of the program shall be *day the order was completed,amount item,note*, where note is a string "in time" or "belated" (if the completion date is past the deadline). Also here, values are separated by commas, except for *amount* and *item* which are separated by space. Except for "OGLE (TM)", items in a higher quantity than 1 should have a plural-"s". Days and deadlines are given as integer numbers. The production starts on day 1, so day 2 is the earliest date to finish a production.

Sample Input

```
3
1,1 Teddy Bear,7
1,2 LBGT Barbies,5
2,2 Star Trek Lightsabers,7
```

Sample Output

```
5,2 LBGT Barbies,in time
6,1 Teddy Bear,in time
12,2 Star Trek Lightsabers,belated
```

Problem V: Largest Island (easy)

Santa's home, the north pole, has been strongly affect by global warming. Many ice sheets have broken up into smaller pieces. Santa needs to replan where to place houses and workshops and therefore needs to identify the largest island.

Problem

Write a program that first reads the map size *height,width* followed by the actual map consisting of "." for a floating ice patch and "W" for water. An island consists of a number of connected ice sheets. Diagonally adjunct ice sheets are not considered connected. Calculate the size of the largest island and write the answer to the standard output. You can consider the area outside the map to be water. The maximum map size is 50x50 patches.

Sample Input

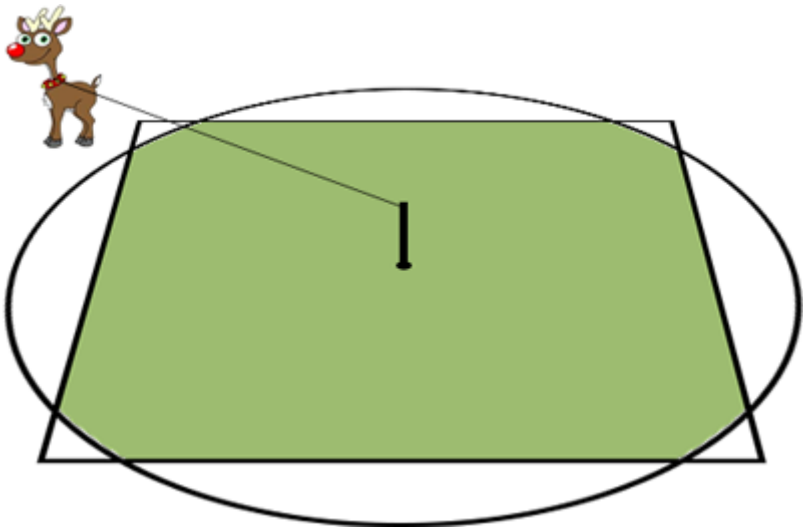
```
10,24
WW...WW.....W..W....W...
WW...WW.....WW.W....WW..
......WW......WW......W.
WW....WW......WW......WW
WWWWWW.........WWWWWWW..
.....WWWWWWWWWW.....W...
.....WW....WW.......W...
.....W......W......W....
.WWWWWWW.W..WW...WWW....
.....WW......WW..W...WWW
```

Sample Output

```
31
```

Problem W: Reindeer Meadow (hard)

Santa Claus keeps his reindeer in a fenced area at his barn. There is only one problem: his reindeer can fly! Therefore he additionally attaches them to a stake using a rope. The fenced area is square and the stake is driven into the ground in the middle of this area. Your task is to calculate the area that the reindeer can access for grazing. Assume that this area is the intersection of the circle with the radius defined by the rope length and the square fenced area (green area in figure).



Problem

Write a program that reads two integer values separated by a comma as the length of one side of the fenced area and the length of the rope. Both measures will be given in meters. Output the area in square meters rounded to two digits after the decimal point (also print zeros, e.g. 4.00)

Sample Input

```
10,6
```

Sample Output

```
95.09
```

Sample Input

```
23,10
```

Sample Output

```
314.16
```

Problem X: Bargaining (easy)

In the age with ever increasing pressure to produce with lowest cost, Santa Claus is especially keen to get the best offer when ordering new material. Therefore he bargains with his suppliers for the best price. The bargaining always follows the same scheme:

- I pay you 150 Dollars for the batch of plywood.
- No, I can't give it for 150. Lets go for 1000.
- Are you crazy? Thats way too much for me to afford. Let it be 200.
- Come on, you are Santa Claus, you must have quite some money. I agree to 900.
- Well, I'll give 250.
- Don't you know how much it cost me? Pay 800 and we have a deal!
- ...

Such a dialog continues until they agree on a price. Santa always increases his amount by the same number and the supplier decreases it in the same way. The supplier would not ask a sum that is less than that offered by Santa. In this case, he will agree with Santa's offer. Santa will act likewise.

Problem

Write a program that reads a single line containing four integer numbers divided by comma: Santa's initial offer a, Santa's raise to his offer b, the initial offer required by the supplier c, and the supplier's reduction d. $1 \leq a,b,c,d \leq 10000$. Output the amount of money that Santa will pay for the material.

Sample Input

```
150,50,1000,100
```

Sample Output

```
450
```