ECOO 2014

Programming Contest Questions

Local Competition (Round 1)

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Sheridan | Get Creative

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Problem 1: Martian Time

A day on Mars is just a little bit longer than a day on Earth. One day on Mars lasts 24 hours 37 minutes and 22.663 seconds in Earth time. To make sure they can get the most out of the daylight hours on Mars, when NASA plans a Mars Rover mission, they put all of their employees on "Martian Time".

Martian time uses a 24-hour clock divided into minutes and seconds just like Earth time. But every Martian hour, minute and second has to be just a little bit longer than its Earth counterpart.

It just so happens that at 12:00 AM on January 1st, 2015 (aka Day 1) on Earth it will also be exactly 12:00 AM of Day 1 in Martian time at the place where the next Mars rover will touch down. So NASA has issued its employees Martian digital watches, synchronized so that Day 1 at midnight matches Day 1 at midnight on Earth. These watches report the day, hour and minute of the current time (they keep track of seconds as well, but don't report that number on the face of the watch).

DATA11.txt (DATA12.txt for the second try) will contain 10 test cases. Each test case will consist of three integers D, H, and M representing the Day, Hour and Minute of an exact time on Earth, where Day 1 is January 1st, 2015 ($1 \le D \le 1000$, $0 \le H \le 23$ and $0 \le M \le 59$). Your job is to output the current time on Mars as it would be shown on the Martian digital watch described above. Each time should be on a single line and formatted exactly as shown in the sample output below.

Sample Input

```
346 12 28
393 06 40
390 19 50
984 02 25
674 21 29
435 13 07
15 04 12
539 00 50
40 01 20
69 03 11
```

Sample Output

```
Day 337, 18:40
Day 383, 08:28
Day 380, 23:07
Day 959, 05:28
Day 657, 20:17
Day 424, 13:15
Day 14, 19:35
Day 525, 10:08
Day 39, 01:37
Day 67, 09:48
```

Problem 2: Orphan Black

In the season finale of the Canadian TV show *Orphan Black*, the main characters discover a message written into their DNA using binary coded ASCII (pronounced "ASKee"). ASCII is a system for numbering letters and other printable characters. Binary coded ASCII uses 8-bit binary integers instead of regular decimal integers. The table below shows the decimal and binary ASCII codes for uppercase letters and the space character.

Space	32	00100000
A	65	01000001
B	66	01000010
C	67	01000011
D	68	01000100
E	69	01000101
F	70	01000110
G	71	01000111
H	72	01001000

I	73	01001001
J	74	01001010
K	75	01001011
L	76	01001100
M	77	01001101
N	78	01001110
O	79	01001111
P	80	01010000
Q	81	01010001

R	82	01010010
S	83	01010011
T	84	01010100
U	85	01010101
V	86	01010110
W	87	01010111
X	88	01011000
Y	89	01011001
Z	90	01011010

Binary integers are just like regular decimal integers except that the only digits allowed are 1 and 0 and instead of place values rising by 10s they rise by 2s. In decimal integers, the rightmost digit is the 1's place, then 10's then 100's and so on. In binary the rightmost digit (bit) is the 1's place, then the next is 2's, then 4's and so on.

DNA comes in a double strand made up of four bases (A, C, G, and T). A pairs with T and C pairs with G so that in a double strand, A's and T's are always across from each other and so are C's and G's, like this:

```
CAACACGTGGCGTGCCAGTGACCTTGGCAGGTTGCGTCGAAATCCC
GTTGTGCACCGCACGGTCACTGGAACCGTCCAACGCAGCTTTAGGG
```

To turn the above DNA into a binary string, just assign one of the base pairs (AT or CG) to be a 1 and the other to be a 0. So the above DNA string might represent this binary number:

```
10010110111101110101011001110110011101101000111
```

Or it might represent this one:

```
01101001000010001010100110001001100010011111000
```

In this case, the correct one is the second one and the message starts at the fourth position with a few bits left over at the end:

```
011 01001000 01000101 01001100 01001100 01001111 000
       H        E        L        L        O
```

DATA11.txt (DATA12.txt for the second try) will contain 10 test cases. Each test case will consist of two lines representing a pair of chromosomes. Each pair contains a coded message as described above, with from 0 to 7 extra bits on the beginning and another 0 to 7 extra bits at the end (the chemists who read the DNA weren't exactly sure where the message was). The messages themselves consist entirely of the capital letters A through Z and space characters.

Sample Input

```
ACCAATGTAGATATCATACTCTCTTGCTATGTTCGTTACATGCCCAA
TGGTTACATCTATAGTATGAGAGAACGATACAAGCAATGTACGGGTT
ACACTTTTGGTGTTCGTATCAACCGCAGATCCGATGTTACACTTCATATTTGATCGTCACTATCTC
TGTGAAAACCACAAGCATAGTTGGCGTCTAGGCTACAATGTGAAGTATAAACTAGCAGTGATAGAG
CCAGACGAGTAGTCCGACAGAGCCTGTGAGAGGGGCGTCGGGGGTGCCGTAGTCCGGCTGAGCAAGCCAGGTTCACC
GGTCTGCTCATCAGGCTGTCTCGGACACTCTCCCCGCAGCCCCCACGGCATCAGGCCGACTCGTTCGGTCCAAGTGG
AACCCCACTAATCCTGAAATTCTGTGTAGTTGTGAACATGTCCTAGATCATATTTGTTGCGGTCAAGCCTAAA
TTGGGGTGATTAGGACTTTAAGACACATCAACACTTGTACAGGATCTAGTATAAACAACGCCAGTTCGGATTT
ACCAGTTATACTACATAAAAGATTACTTACTTTAATCTTTAGCTTGTTTTATGTTAGTTA
TGGTCAATATGATGTATTTTCTAATGAATGAAATTAGAAATCGAACAAAATACAATCAAT
ACGACGCAGTCGACCGCCGAGGCTTCCCACGCCCGTGGCTTTCGACGGCGGAGGAGCCCC
TGCTGCGTCAGCTGGCGGCTCCGAAGGGTGCGGGCACCGAAAGCTGCCGCCTCCTCGGGG
AACCTGGTGGTCCACCGGGCTCCACTCCCAGGCGGCTCGAGTAGGTGGCCGGAGGATGG
TTGGACCACCAGGTGGCCCGAGGTGAGGGTCCGCCGAGCTCATCCACCGGCCTCCTACC
ACAGTGGTACTGGTGCCCGGTCCATACGCAGCGCGCTGGAATACGAGGGCCCTGTGGGCA
TGTCACCATGACCACGGGCCAGGTATGCGTCGCGCGACCTTATGCTCCCGGGACACCCGT
CACTGGCTGGAGCCCGGTGAGCACGCTCCGCCGACACCTAGCAGGCGCCTCTCTGGCAACAC
GTGACCGACCTCGGGCCACTCGTGCGAGGCGGCTGTGGATCGTCCGCGGAGAGACCGTTGTG
CACCCACACACTCTCGACGCCGGACTCTACGCTCCGGGGACAGTAAGCACGCGGGTGATGGCC
GTGGGTGTGTGAGAGCTGCGGCCTGAGATGCGAGGCCCCTGTCATTCGTGCGCCCACTACCGG
```

Sample Output

```
HELLO
CLONE ME
KEEP CALM
CARRY ON
A B C D
E F G H
I J K L
M N O P
Q R S T
U V W X
```

Problem 3: Word Search

The word search puzzle below contains a secret message. To get this message, you have to find all the clue words in the puzzle (the words shown beside it) and circle them. Then you read any un-circled letters that remain from top left to bottom right to get the secret message. The clue words might appear horizontally, vertically, or diagonally. They might read forwards, backwards, downwards or upwards. Clue words can share any number of letters. Each clue word appears exactly once in the puzzle.

The Puzzle

K L I M T S E I N W O R B C H O C
C G O L Y N A S E M I S W E E T T
E H N C S D E N E T E E W S N U O
R C I I O E N I I G F I L L I N G
S I O P K C L A D N A B F T E S E
K F R N S A O F C E I O O M C T V
N R H E F D B A F T R S O E H E I
I C A T A E R T T U I G D D O G T
R O R D S N C E C C R O N S C N C
D O W E F T R T E U T T U I O I I
G K H T A S P C I R P O H F L D D
N I I E W M R U E O I C O T A D D
I E T E S E P S R C N N A H T U A
C S E S A E S I I Y D E B K I P O
I T I M B E R L E U S A R O E A M
A W F U D D G E C E A R C A Y R S O
S U G A R D T E S S U O M R S E E

The Clue Words

ADDICTIVE
BAKING
BARS
BITTERSWEET
BROWNIES
CAKES
CANDY
CHIPS
CHOCOLATIERS
COCOA
CONFECTIONERY
COOKIES
CREAM PIE
CUPCAKE
DARK
DECADENT
DELICIOUS
DESSERT
DRINKS
FILLING
FONDUE
FOOD
FUDGE
ICE CREAM
ICING
INGREDIENT
MILK
MOUSSE
PUDDING
SEMISWEET
SUGAR
SWISS
SYRUP
TREAT
TRUFFLES
UNSWEETENED
WHITE

In this case, the secret message is “CHOCOLATE ORIGINATES FROM THE SEEDS OF THE THEOBROAMA CACAO TREE”. The locations of the words in the puzzle are shown on the next page.

DATA31.txt (DATA32.txt for the second try) will contain 5 test cases. Each test case starts with a line containing two integers R and C separated by a space character. R and C represent the number of rows and columns in the board ($1 \leq R, C \leq 30$). This is followed by R lines, each containing C uppercase letters. This is the puzzle board. The next line contains an integer M representing the number of clue words ($M < 100$) and then the next M lines contain one clue word each. Clue words will be written in uppercase and will contain fewer than 100 characters, but they might contain spaces, apostrophes or other punctuation, all of which should be ignored when searching for the words on the board.

Note that the sample input on the next page contains only a single test case, but the real data files will contain 5 test cases, one after another, with no blank lines in between.

Word Search puzzles courtesy of Livewire Puzzles (http://www.puzzles.ca)

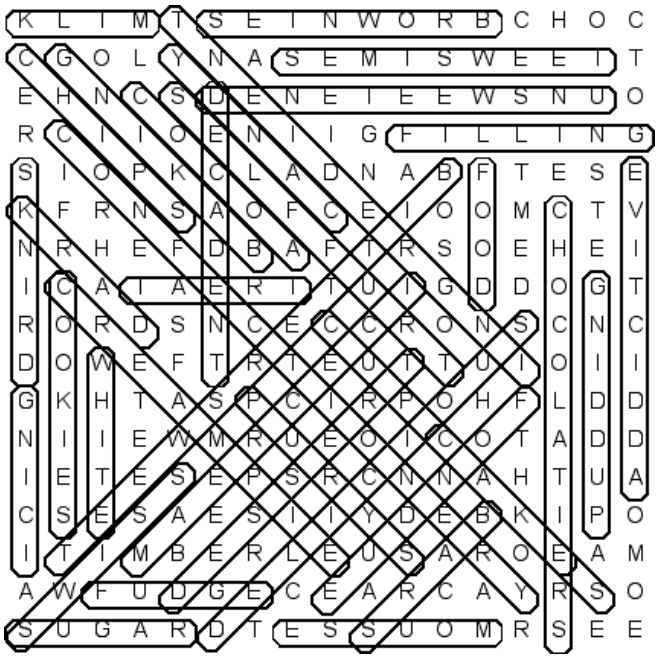
Sample Input

```
17 17
KLIMTSEINWORBCHOC
CGOLYNASEMISWEETT
EHNCSDENETEEWSNUO
RCIIOENIIGFILLING
SIOPKCLADNABFTESE
KFRNSAOFCEIOOMCTV
NRHEFDBAFTRSOEHEI
ICATAERTTUIGDDOGT
RORDSNCECCRONSCNC
DOWEFTRTEUTTUIOII
GKHTASPCIRPOHFLDD
NIIEWMRUEOICOTADD
IETESEPSRCNNAHTUA
CSESAESIIYDEBKIPO
ITIMBERLEUSAROEAM
AWFUDGECEARCAYRSO
SUGARDTESSUOMRSEE
37
ADDICTIVE
BAKING
BARS
BITTERSWEET
BROWNIES
CAKES
CANDY
CHIPS
CHOCOLATIERS
COCOA
CONFECTIONERY
COOKIES
CREAM PIE
CUPCAKE
DARK
DECADENT
DELICIOUS
DESSERT
DRINKS
FILLING
FONDUE
FOOD
FUDGE
ICE CREAM
ICING
INGREDIENT
MILK
MOUSSE
PUDDING
SEMISWEET
SUGAR
SWISS
SYRUP
TREAT
TRUFFLES
UNSWEETENED
WHITE
```

Sample Output

```
CHOCOLATEORIGINATESFROMTHESEEDSOFTHETHEOBROAMACACAOTREE
```

Locations of the Words (Shown for Reference Only)



Problem 4: Fischer Random Chess

Fischer Random Chess is just like regular chess except that the starting positions of the pieces are randomized. The game was proposed by grand master Bobby Fischer to make it virtually impossible for players to memorize a set of opening moves.

In Fischer Random Chess, the back row of 8 pieces (two Bishops, two Knights, two Rooks, a King and a Queen) can be placed in any order as long as the King is between the two Rooks (to enable the castling move) and the Bishops are on opposite colors.

In the boards below, K=King, Q=Queen, R=Rook, B=Bishop and N=Knight. The first arrangement is legal. The second two are not.

Of course any arrangement that contains the wrong mix of pieces (e.g. three bishops and one knight) is also illegal.

DATA41.txt (DATA42.txt for the second try) will contain 10 test cases. Each test case consists of a single line of 8 characters, representing a partially constructed back row. Pieces that have been filled in are represented with one of the capital letters K, Q, R, B or N (see the key above) and spaces that have not been filled are represented with the underscore character (ASCII code 95).

Your job is to output a single number representing the number of legal Fischer Random Chess arrangements that can be created by filling in the blanks with the remaining pieces.

Sample Input

```
NR_____RN
___BB___
_R_____R_
___KQ___
___QK___
NBRK____
__Q___B_
__Q___NN
_RKR____
RKRBN__Q
```

Sample Output

```
8
60
72
32
32
12
40
6
18
1
```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