PLU February 2020 Programming Contest

Advanced Division

I. General Notes

1. Do the problems in any order you like. They do not have to be done in order from 1 to 12.

2. Problems will have either no input or will read input from a specified file. All output should be to standard output (the monitor).

3. All input is as specified in the problem. Unless specified by the problem, integer inputs will not have leading zeros.

4. Your program should not print extraneous output. Follow the form exactly as given in the problem.

II. Names of Problems

Number	Name
Problem 1	Scale
Problem 2	Playtime
Problem 3	Floor Cleaner
Problem 4	Feed Store
Problem 5	Reverse
Problem 6	Pegs
Problem 7	Demo Clean Up
Problem 8	Rook
Problem 9	Word Mix
Problem 10	Rain Boots
Problem 11	Triangle Height
Problem 12	Best Seller

1. Scale

Input File: scale.dat

Write a program that takes in a list of integers and produces a new list of scaled integer values. The value of each will be the original value multiplied by its neighbors.

Input
There will be an unknown number of inputs each on its own line. Each input will contain an unknown number of values separated by spaces.

Output
Display the result of each input on its own line, with each value separated by a single space.

Example Input File
```
1 1 1 1 1
2 3 1 4 5 3
7 4 18 5 2 6
```

Example Output to Screen
```
1 1 1 1 1
6 6 12 20 60 15
28 504 360 180 60 12
```

2. Playtime

Input File: playtime.dat

All your games track your time played in minutes. You have decided to create a program that will convert the minutes into years, days, hours and minutes.

Notes:

- Years will be treated as 365 days.
- Playtime will never be 0 minutes

Input
The first line will contain the number of inputs that follow. Each input will consist of a game title and the number of minutes played, in the following format:

```
gameTitle,minutesPlayed
```

Output
For each input display the game title followed by how long it has been played in years, days, hours and minutes. Each unit of time is only printed if it has a value is greater than 0. All the text on the same line is separated by a single space.

Result Format:
```
GameTitle - # year(s) # day(s) # hour(s) # minute(s)
```

Example Input File
```
5
2048,800
Halo,1097578
Heroes of the Storm,6736732
Infinity Blade,78
Xcom,43
```

Example Output to Screen
```
2048 - 13 hour(s) 20 minute(s)
Halo - 2 year(s) 32 day(s) 4 hour(s) 58 minute(s)
Heroes of the Storm - 12 year(s) 298 day(s) 6 hour(s) 52 minute(s)
Infinity Blade - 1 hour(s) 18 minute(s)
Xcom - 43 minute(s)
```

3. Floor Cleaner

Input File: floor_cleaner.dat

You have built a floor cleaning robot and now you are writing an algorithm that will report all the locations of the house it could not clean. The robot has layout of the house that includes where the walls, furniture and flooring are. When it cleans it will log locations where it finds unexpected obstructions.

Key:

- 'W' – Wall
- 'F' – Furniture
- '-' – Flooring
- 'B' – Base

Input
The input will start with a 10 by 10 grid that describes the house with columns and rows numbered 0 to 9. The grid will be followed by an unknown number of locations where obstructions were found, in the following format:
`(column,row)`

Output
Display all the locations that were **not** able to be cleaned in the following format:
`(column,row)`

Display each location on its own line. Locations must be displayed in ascending order first by row and then by column.

Example Input File
```
WWWWWWWWWW
W-------BW
WF--FW---W
W---FW--FW
WWWWW---FW
W--WW---WW
W-FW----FW
W-WWWF---W
W--------W
WWWWWWWWWW
(2,1)
(1,8)
```

Example Output to Screen
```
(1,1)
(2,1)
(1,5)
(2,5)
(1,6)
(1,7)
(1,8)
```

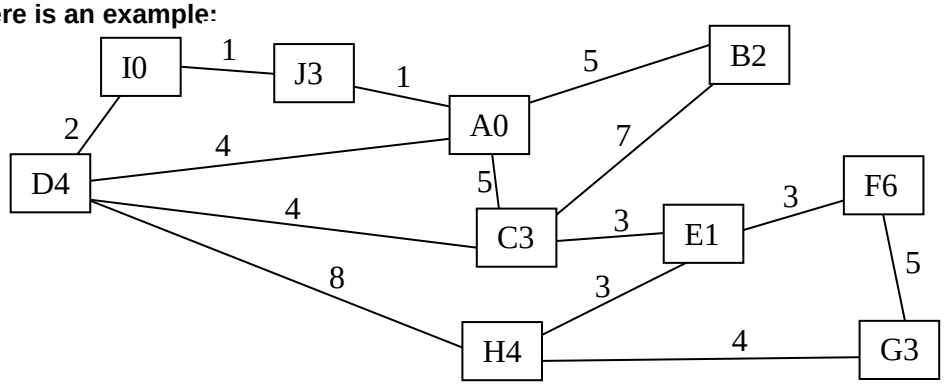
4. Feed Store

Input File: feed_store.dat

You work at a feed store and want to make your delivery routes more efficient. You have a list of how much feed each nearby farm needs, a map of the roads and the total amount of feed your truck can carry. Write a program that will take in all that data and give you the shortest number of miles for completing your first delivery and the path for the route. A delivery route will always start and end with 'A'. 'A' will always be the store you are delivering from.

Note: There may be several best paths with the same distance, so you may not get the same exact path as the sample data, but your solution needs to be correct and be of the shortest distance.

Here is an example:



Input
The first line will contain a number that indicates how much feed your truck can carry.

The second line will contain how much feed each farm wants. A farm name will always be a single uppercase letter. Each farm will list how much feed they want as 0 to 9 units of feed. The data for each farm will be a single letter followed immediately by a single digit. Each farm's data will be separated by a single space.

Finally, there will be an unknown number of lines defining the connections between farms and the store / other farms. Connections will be in the following format:

```
locationA/locationB-distanceApart
```

Output
Output the distance of the shortest solution and the path for that solution. The format will for the solution will be:

```
(distance) - path
```

with a single space on each side of the dash.

Example Input File

```
10
B2 C3 D4 E1 F6 G3 H4 I0 J3
A/C-5
A/B-5
A/J-1
A/D-4
I/J-1
I/D-2
C/B-7
C/D-4
C/E-3
H/D-8
H/E-3
H/G-4
E/F-3
F/G-5
```

Example Output to Screen

```
(13) - ACDIJA
```

5. Reverse

Input File: reverse.dat

At a contest you have been asked to write a program that reads in a line of text and reverses the order of all words that begin with vowels. Words that begin with consonants will keep their position in the line of text. You are not sure why you would ever need this, but hey it's worth points.

Input
There will be an unknown number of lines to process and each line will only contain words that are each separated with a single space.

Output
For each input, display the converted line on its own line.

Example Input File
```
apple
Eat apples
snakes are coming into Your house
Axe hat bat other toy octagon me I love oranges
```

Example Output to Screen
```
apple
apples Eat
snakes into coming are Your house
oranges hat bat I toy octagon me other love Axe
```

6. Pegs

Input File: pegs.dat

There is a game called peg solitaire that requires the player to remove all of the pegs from the game board except for one. A peg can be removed by moving a peg from one side of it to the opposite side, but there must be an open space to move the peg to. When the outside peg is moved, the peg that it 'hopped' over is removed (similar to checkers). If the hops and removals are done correctly, there should be only one peg remaining at the end of the game. This game is very difficult, but you decide that you can use your computer to solve it for you! Given a peg solitaire board, write a program to tell you if it is possible to solve the game of peg solitaire.

Input
The first line will contain a single integer `n` that indicates the number of data sets that follow. Each data set will start with two integers, `r c` representing the number of rows and columns in each board, respectively. The next `r` lines will represent the map. The character `'.'` denotes a blank space on the board and `'@'` is a peg. Pegs can only be moved over another peg and into the blank space next to it.

Output
If the board is solvable, print `Solvable!`
If the board is not solvable, print `Impossible.`
The board is solvable if it is possible to get down to only one peg remaining on the board.

Example Input File
```
2
7 7
  ...
  .@.
.@@.@..
...@.@.
....@..
  ...
  ...
6 6
  @@
  ..
@....@
@....@
  ..
  @@
```

Example Output to Screen
```
Solvable!
Impossible.
```

7. Demo Clean Up

Input File: demo_clean_up.dat

A demolitions company has hired you to write a program. After every project they have to move away all the debris and they want to know how many truck loads that it will take. Write a program that given the amount of weight the company truck can hold and how much every piece of debris weighs, it will find the minimum number of truck loads to clear the site of debris.

Input
There will be an unknown number of inputs, each on its own line. Each input will start with how much the truck can transport in a single load, followed by the weight of each piece of debris at the site. Each value will be separated by a single space.

Output
Display the minimum number of loads needed to clear the site for each input. Each result should be on its own line.

Example Input File
```
100 75 75 50
50 25 26 12 12 18
17 2 12 15 16 8 8 8
```

Example Output to Screen
```
3
2
5
```

8. Rook

Input File: none

You have just learned how to output text to the screen and your teacher has challenged you to create an ASCII art of a chess piece. You have decided to make your favorite piece, the rook.

Notes:

- **3 underscores ___**
- **2 underscores __**

Input
None.

Output
The rook art, exactly as shown below, with no extra blank spaces. In particular, a line must not end with a blank space. The extra row of numbers at the top and bottom are added for your convenience, but these rows of numbers should **NOT** be included in your output.

Output to Screen

```
01234567890123456 7
  ___   ___   ___
  | |__|  |__|  |
  |              |
   \____________/
    \__________/
      |      |
      |      |
      |      |
      |      |
      |______|
   __/        \__
  /              \
 /                \
/__________________\
01234567890123456 7
```

9. Word Mix

Input File: word_mix.dat

Write a program that will combine two words into a new one. The length of the two words will be unknown. The new word will be the same length as the shorter word. The letters at even indexes will be taken from the first word at the corresponding indexes and the letters at odd indexes will be taken from the second word at the corresponding indexes.

Input
The input will contain two words on a single line, separated by a single space.

Output
Display the mixed word.

Example Input File
```
stat better
```

Example Output to Screen
```
seat
```

10. Rain Boots

Input File: rain_boots.dat

You love your new rain boots and want to keep them as clean as possible. Using satellite data you have gridded the area nearby as either muddy or not muddy. Write a program that will determine the fewest number of muddy puddles you must walk through to reach a destination.

Key:

- `'M'` – Muddy Puddle
- `'-'` – No Mud
- `'S'` – Start (No Mud)
- `'E'` – End (No Mud)

Input
There will be an unknown number of inputs. Each input will contain an 8 by 8 grid that represents the area nearby. There will be a single line containing a single '-' separating each input.

Output
For each input, display the fewest number of muddy puddles you must step through to reach the destination.

Example Input File

```
S-------
-M------
--M-----
---M----
----M-MM
-----M--
-----M--
-----ME-
-
SM------
MM------
--------
MMMMMMMM
--------
MMM-----
MEM-----
-----ME-
-
-------M
-MMMMM-M
-MS--M-M
-MMM-M-M
-----M-M
MMMMMM-M
-------M
EMMMMMMM
-
-M-MEM-M-
M-M-M-M-M
-M-M-M-M-
M-M-M-M-M
-M-M-M-M-
M-M-M-M-M
SM-M-M-M-
M-M-M-M-M
```

Example Output to Screen

```
1
2
0
5
```

11. Triangle Height

Input File: triangle_height.dat

Your Math teacher asked you to write a program to help him generate homework solutions. The program will need to find the height of a triangle given its area and its base length.

Formula:

a = (h*b)/2
(a – area, b – base length, h – height)

Input

The first line will contain a single integer `n` that indicates the number of lines that follow. Each line will include the area and base length of a triangle with the two values separated by a single space.

```
area base
```

Output

For each input display the height of the triangle with 2 decimal places, in the following format:

```
The height of the triangle is #.## units
```

Example Input File

```
4
200.533 40.5
10.6 1.11
30 30
3333 50.7
```

Example Output to Screen

```
The height of the triangle is 9.90 units
The height of the triangle is 19.10 units
The height of the triangle is 2.00 units
The height of the triangle is 131.48 units
```

12. Best Seller

Input File: best_seller.dat

You run a store and want to know where you make the most money and which items sell the most. You have a list of your items, how many times each has sold and how much profit you make each sale. Each item name is a single word. The total profit on an item is the number of sales times the profit of the item. Write a program that will take in this data and produce a sorted list using the following rules:

Sorting Rules:

- Sort items in descending order by total profit
- For items that have the same total profit, sort in descending order by number of sales
- For items that have the same total profit and number of sales, sort in ascending order by name

Input

There will be an unknown number of inputs that consist of the triple `itemName numberOfSales profitEachSale`, with each triple on its own line, and each value on a line is separated by a single space. The itemName is a single word and the format for each input line will be:

```
itemName numberOfSales profitEachSale
```

Output

Display the sorted list, with each item on its own line. The format for displaying the item will be:

```
$totalProfit – itemName/numberOfSales
```

There is a single space before and after the dash, and the profit value must have exactly two decimal places.

Example Input File

```
pens 120 .12
binders 120 1.15
hats 24 6.00
shoes 12 12.00
rings 44 22.86
coats 14 28.64
boots 12 12.00
```

Example Output to Screen

```
$1005.84 - rings/44
$400.96 - coats/14
$144.00 - hats/24
$144.00 - boots/12
$144.00 - shoes/12
$138.00 - binders/120
$14.40 - pens/120
```