Exercise 1 (adapted from Computer Sciences exam 14/02/2020)

A text file contains informations on a group of people born in a given year. The format is the following:

`<name> <surname> <birthplace> <birthdate>`

The first three fields are strings (with no blanks), `<birthdate>` is a string with format DD/MM/YYYY/ Each line corresponds to a person, and births are not sorted. Write a program that computes

- The number of births for each city
- The number of births for each month
- The average number of births per city (number of births over number of cities)

Example:

```
Mario Rossi Torino 02/03/2019
Franca Valeri Asti 10/05/2019
Marco Verdi Torino 05/04/2019
Giancarlo Magalli Torino 01/06/2019
Giovanna Bianchi Asti 10/03/2019
```

The program should output (in no particular order)

```
Births per city:
  Torino: 3
  Asti: 3
Births per month:
  March: 2
  April: 1
  May: 1
  June: 1
Average number of births: 2.50
```

Exercise 2 (adapted from Computer Sciences exam 04/02/2013)

Write a program to track available copies and sales of a bookstore. Sales informations are provided in a file, with format

`<ISBN> <BUY/SELL> <DATE> <#-OF-COPIES> <PRICE-PER-COPY>`

The `<BUY/SELL>` filed contains either `B` (the books were bought) or `S` (the books were sold). `#-OF-COPIES` represents the number of bouth/sold copies for the transaction. Each line of the file contains one transaction. `<DATE>` is in the DD/MM/YYYY format.

The program should output

- The number of available and sold copies for each book (ISBN)
- The number of books sold for each month / year combination (print only months in which books were sold)
- The gain and average gain for sold books. The gain should be computed as

$$\frac{\text{price of sold copies}}{\text{average price of bought copies} \quad \times \quad \text{\# of sold copies}} = \frac{\text{price of sold copies}}{\text{price of bought copies}} \times \frac{\text{\# of bought copies}}{\text{\# of sold copies}}$$

Example:

```
978-1-932698-18-3 B 01/09/2012 3 34.56
988-1-942768-22-4 B 05/09/2012 5 56.12
956-2-123568-58-9 B 11/10/2012 7 22.12
945-5-896589-36-5 B 21/10/2012 6 12.56
988-1-942768-22-4 S 05/11/2012 1 76.12
978-1-932698-18-3 S 22/11/2012 1 44.86
956-2-123568-58-9 S 04/12/2012 4 32.52
945-5-896589-36-5 B 11/12/2012 8 16.78
945-5-896589-36-5 S 21/12/2012 3 24.66
988-1-942768-22-4 S 23/12/2012 1 76.12
```

The output should be:

```
Available Copies:
    945-5-896589-36-5: 11
    956-2-123568-58-9: 3
    988-1-942768-22-4: 3
    978-1-932698-18-3: 2
Sold books per month:
    November, 2012: 4
    December, 2012: 8
Gain per book:
    945-5-896589-36-5: 29.1 (avg 9.7, sold 3)
    956-2-123568-58-9: 41.6 (avg 10.4, sold 4)
    988-1-942768-22-4: 40.0 (avg 20.0, sold 2)
    978-1-932698-18-3: 10.3 (avg 10.3, sold 1)
```

Exercise 3 (adapted from Computer Sciences exam 23/06/2014)

A room is composed of $N \times N$ tiles (assume N is known and fixed). A file contains the coordinates of lightspots (one per line) that illuminate the room. Each lightspot illuminates the tile it's placed on with intesity 1, the eight adjacent tiles with intesity 1/2, and the 16 surrounding tiles with intesity 1/5, as:

0.2	0.2	0.2	0.2	0.2
0.2	0.5	0.5	0.5	0.2
0.2	0.5	1.0	0.5	0.2
0.2	0.5	0.5	0.5	0.2
0.2	0.2	0.2	0.2	0.2

Write a program that computes the light intensity of each tile.
Suggestion: you can implement the matrix that represents the room as a list of lists `[[v00, v01, v02],[v10, v11, v12], [v20,v21, v22]]` or as a dictionary of keys `{(0,0): v00, (0,1): v01 ...}`. Try both solutions.

Example ($N = 7$):

Spotlight file:

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

Output:

```
1.0  0.7  0.4  0.2  0.2  0.2  0.0
0.5  0.7  0.7  0.5  0.5  0.2  0.0
0.2  0.6  0.9  1.2  0.7  0.4  0.0
0.0  0.4  1.0  1.0  1.0  0.4  0.0
0.0  0.4  0.7  1.2  0.7  0.4  0.0
0.0  0.2  0.5  0.5  0.5  0.2  0.0
0.0  0.2  0.2  0.2  0.2  0.2  0.0
```