24 Flower classification

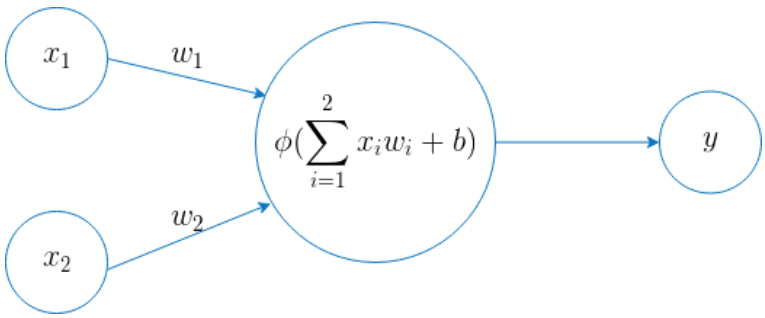
12 points

Introduction

Your parents have a beautiful garden full of flowers. Although there are only two types of flowers, red and blue, their color isn't strong enough to tell them apart. In order to classify them, you are given a spreadsheet containing information about the length and width of the petals of each flower. The spreadsheet is as follows:

length	width	type
3	1.5	red
2	1	blue
4	1.5	red
3	1	blue
3.5	0.5	red
5.5	1	?
1	1	?
2	1.4	?

Here, your parents have already filled in some values. Your job is to fill in the rest of the table. To speed up this process we can use machine learning algorithms such as neural networks!



This one is called a perceptron. It is the simplest type of neural network, but for our task it is enough. It can produce good results.

This neural network, has two inputs: *x1* and *x2*. In our case, they correspond to the length and width of the flower. The network performs a mathematical operation on those input values and gives you the answer *y*. In this case *y* can be "blue" or "red".

In order to implement this algorithm in code, you must follow these steps:

1. The formula inside the middle neuron can be written as:

$$\sum_{i=1}^{2} x_i w_i + b = x_1 w_1 + x_2 w_2 + b$$

Where *x1* is the length and *x2* is the width.

w1, *w2* and *b* are some magic values that the network learns by itself when it is trained and is told how to solve a given problem.

2. Next, once you have multiplied and added the values in the above formula, the result should be plugged into the next formula:

$$\phi(x) = \frac{1}{1 + e^{-x}}$$

3. Finally, if the result is smaller than 0.5, the flower is blue; otherwise the flower is red.

Getting the values of *w1*, *w2* and *b* is not an easy task. To make it simple someone already calculated those values for you:

```
w1 = 1.9116881315655996
w2 = 1.22872621999026
b = -7.119940111025795
```

If you don't remember Euler's number (*e*) by heart, here it is:

```
e = 2.718281828459045
```

Input

The input consists of:

- The first line is a positive integer, *N*, indicating the number of flowers.
- The following lines have the length and width of the *N* flowers, with this format: length width (separated by a space).

Output

For each flower length and width input, the output must be:

- If the flower is blue:

```
The flower (<length> <width>) is blue
```

- If the flower is red:

```
The flower (<length> <width>) is red
```

Example 1

Input

```
1
3 1.5
```

Output

```
The flower (3 1.5) is red
```

Example 2

Input

```
3
2 1
5.5 1
3.5 0.5
```

Output

```
The flower (2 1) is blue
The flower (5.5 1) is red
The flower (3.5 0.5) is red
```