Exercise: Objects and Classes

Problems for exercises and homework for the "Python Fundamentals" course @ SoftUni.

Check your solutions here:https://judge.softuni.bg/Contests/950.

1. Distance Between Points

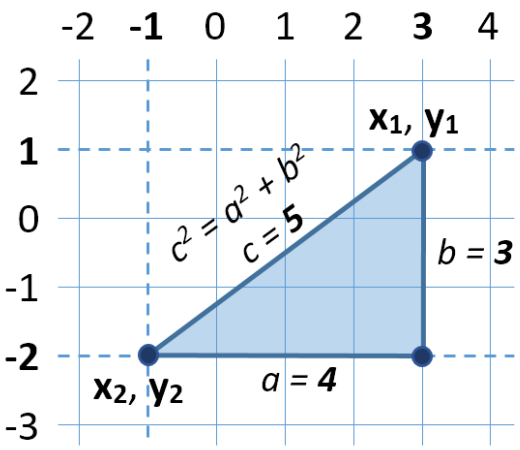
Write a method to calculate the distance between two points $\mathbf{p_1}$ {$\mathbf{x_1}$, $\mathbf{y_1}$} and $\mathbf{p_2}$ {$\mathbf{x_2}$, $\mathbf{y_2}$}. Write a program to read **two points** (given as two integers) and print the **Euclidean distance** between them.

Examples

Input	Output
3 4 6 8	5.000
3 4 5 4	2.000
8 -2 -1 5	11.402

Hints

- Create a **class `Point`** holding properties **X** and **Y**.
- Write a method **`CalcDistance(p1, p2)`** that returns the distance between the given points – a number.
- Use this formula to calculate the distance between two points. How it works?
  - Let's have two points $\mathbf{p_1}$ {$\mathbf{x_1}$, $\mathbf{y_1}$} and $\mathbf{p_2}$ {$\mathbf{x_2}$, $\mathbf{y_2}$}
  - Draw a right-angled triangle
  - Side **a** = $|\mathbf{x_1} - \mathbf{x_2}|$
  - Side **b** = $|\mathbf{y_1} - \mathbf{y_2}|$
  - Distance == side **c** (hypotenuse)
  - $\mathbf{c^2} = \mathbf{a^2} + \mathbf{b^2}$ (Pythagorean theorem)
  - Distance = **c** = $\sqrt{\mathbf{a}^2 + \mathbf{b}^2}$



- You can use **`math.sqrt(number)`** method for calculating a square root.
- Print the distance **formatted to the 3rd decimal point**.

2. Closest Two Points

Write a program to read **n** points and find the **closest two** of them.

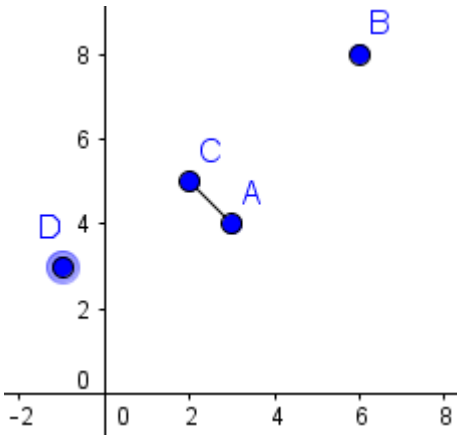
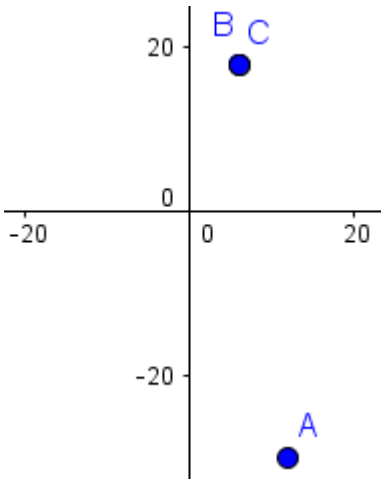
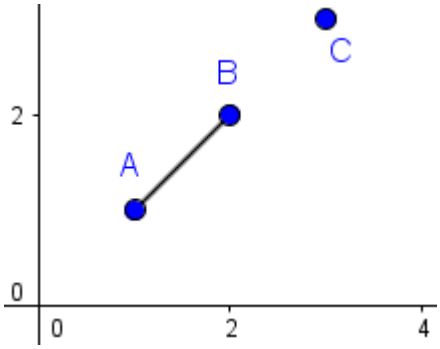
Input

The **input** holds the number of points **n** and **n** lines, each holding a point {**X** and **Y** coordinate}.

Output

- The **output** holds the shortest distance and the closest two points.
- If several pairs of points are equally close, print **the first** of them (from top to bottom).

Examples

Input	Output	Visualization	Comments
4 3 4 6 8 2 5 -1 3	1.414 (3, 4) (2, 5)		The closest two points are **{3, 4}** and **{2, 5}** at distance 1.4142135623731 ≈ **1.414**.
3 12 -30 6 18 6 18	0.000 (6, 18) (6, 18)		Two of the points have the same coordinates **{6, 18}**, so the distance between them is **0**.
3 1 1 2 2 3 3	1.414 (1, 1) (2, 2)		The pairs of points {{1, 1}, {2, 2}} and {{2,2}, {3,3}} stay at the same distance, but the first pair is {**{1, 1}**, **{2, 2}**}. The distance between them is 1.4142135623731 ≈ **1.414**.

Hints

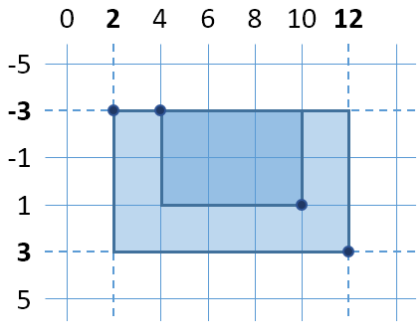
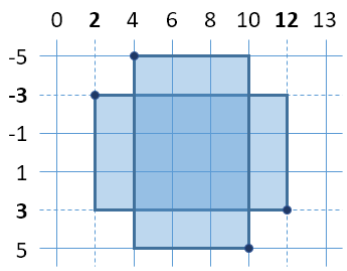
- Use the **class `Point`** you created in the previous task.
- Create an array **`points`** that will keep all points.
- Create a method **`find_closest_points(points)`** that will check distance **between every two pairs** from the array of points and returns the two closest points in a new array.
- Print the **closest distance** and the **coordinates** of the two closest points.

3. Rectangle Position

Write a program to **read two rectangles** {left, top, width, height} and print whether the first is inside the second.

The input is given as two lines, each holding a rectangle, described by 4 integers: **left**, **top**, **width** and **height**.

Examples

Input	Output	Visualization	Comments
`4 -3 6 4` `2 -3 10 6`	`Inside`		The first rectangle stays **inside** the second.
`2 -3 10 6` `4 -5 6 10`	`Not inside`		The rectangles intersect, no the first is **not inside** the second.

Hints

- Create a class **`Rectangle`** holding properties **`Top`**, **`Left`**, **`Width`** and **`Height`**.
- Define calculated properties **`Right`** and **`Bottom`**.
- Define a method **`is_inside(rectangle)`**. A rectangle **`r1`** is inside another rectangle **`r2`** when:
  - **`r1.left ≥ r2.left`**
  - **`r1.right ≤ r2.right`**
  - **`r1.top ≤ r2.top`**
  - **`r1.bottom ≤ r2.bottom`**
- Create a method to **read** a **`Rectangle`**.
- Combine all methods into a single program.

4. Exercises

Exercises are fun … Especially when they represent a problem from your exercises.

Implement a **class Exercise**, which has a **topic** (**string**), a **course_name** (**string**), a **judge_contest_link** (**string**), and **problems** (**collection** of **strings**).

You will receive several input lines containing information about a single exercise in the following format:

{topic} -> {course_name} -> {judge_contest_link} -> {problem1}, {problem2}. . .

You need to store every exercise in a **Collection** of **Exercises**. When you receive the command "**go go go**", you end the input sequence.

You must print every exercise, in the following format:

"Exercises: {topic}

Problems for exercises and homework for the "{course_name}" course @ SoftUni.

Check your solutions here: {judge_contest_link}

1. {problem1}

2. {problem2}

. . ."

Examples

Input	Output
ObjectsAndSimpleClasses -> ProgrammingFundamentalsExtended -> https://judge.softuni.bg/Contests/439 -> Exercises, OptimizedBankingSystem, Animals, Websites, Boxes, BoxIntersection, Messages go go go	Exercises: ObjectsAndSimpleClasses Problems for exercises and homework for the "ProgrammingFundamentalsExtended" course @ SoftUni. Check your solutions here: https://judge.softuni.bg/Contests/439 1. Exercises 2. OptimizedBankingSystem 3. Animals 4. Websites 5. Boxes 6. BoxIntersection 7. Messages

5. Optimized Banking System

Create a **class BankAccount** which has a **Name** (**string**), **Bank** (**string**) and **Balance** (**decimal**).

You will receive several input lines, containing information in the following way:

{bank} | {accountName} | {accountBalance}

You need to store every given Account. When you receive the command "**end**" you must **stop** the input sequence.

Then you must print all **Accounts**, **ordered** by their **balance**, in **descending order**, and then by **length** of the **bank name**, in **ascending order**.

The accounts must be printed in the following way "**{accountName} -> {balance} ({bank})**".

Note: **Numbers** must be printed rounded to the **2nd** decimal digit.

Examples

Input	Output
DSK | Ivan | 504.403 DSK | Pesho | 2000.4031 DSK | Aleksander | 20000.0001 Piraeus | Ivan | 504.403 Piraeus | Aleksander | 20000.0001 end	Aleksander -> 20000.00 (DSK) Aleksander -> 20000.00 (Piraeus) Pesho -> 2000.40 (DSK) Ivan -> 504.40 (DSK) Ivan -> 504.40 (Piraeus)

6. Animals *

You have been given the task to create classes for several sophisticated animals.

Create a **class Dog** which has a **name** (**string**), **age** (**int**) and **number_of_legs** (**int**).

Create a **class Cat** which has a **name** (**string**), **age** (**int**) and **intelligence_quotient** (**int**).

Create a **class Snake** which has a **name** (**string**), **age**(**int**) and **cruelty_coefficient** (**int**).

Create a **method** in **each class** which is called **`produce_sound()`**. The method should print on the console a string depending on the class:

- If it's a **Dog**, you should print "**I'm a Distinguishedog, and I will now produce a distinguished sound! Bau Bau.**"
- It it's a **Cat**, you should print "**I'm an Aristocat, and I will now produce an aristocratic sound! Myau Myau.**"
- If it's a **Snake**, you should print "**I'm a Sophistisnake, and I will now produce a sophisticated sound! Honey, I'm home.**"

Now for the real deal. You will receive several input commands, which will register animals or make them produce sounds, until you receive the command "**I'm your Huckleberry**".

The commands will be in the following format:

`{class} {name} {age} {parameter}`

The **class** will be either "**Dog**", "**Cat**" or "**Snake**". The **name** will be a simple **string**, which can contain **any** ASCII character BUT **space**. The **age** will be an **integer**. The **parameter**, will be an **integer**. **Depending** on the **class** it would either be **number of legs**, **IQ**, or **cruelty coefficient**.

Register each animal, and keep them in **collections**, by your **choice**, so that you can **ACCESS THEM BY NAME**. You will most likely need 3 collections, to store the different animals inside them.

Between the register commands you might receive a command in the following format:

`talk {name}`

You must then make the **animal** with the **given name**, **produce a sound**.

When you receive the ending command, you should print every animal in the following format:

- If it's a **Dog**, you should print "**Dog: {name}, Age: {age}, Number Of Legs: {numberOfLegs}**"
- It it's a **Cat**, you should print "**Cat: {name}, Age: {age}, IQ: {intelligenceQuotient}**"
- If it's a **Snake**, you should print "**Snake: {name}, Age: {age}, Cruelty: {crueltyCoefficient}**"

Print first the **Dogs**, then the **Cats**, and lastly – **The Snakes**.

Constraints

- You can assume that there will be **no duplicate** names (**even** in **different animals**).
- All input data will be **valid**. There will be **no invalid** input lines.
- The **name** in the **`talk`** command, will **always** be **existent**.

Examples

Input	Output
Dog Sharo 3 4 Cat Garfield 5 200 Snake Alex 25 1000 talk Sharo talk Garfield talk Alex I'm your Huckleberry	I'm a Distinguishedog, and I will now produce a distinguished sound! Bau Bau. I'm an Aristocat, and I will now produce an aristocratic sound! Myau Myau. I'm a Sophistisnake, and I will now produce a sophisticated sound! Honey, I'm home. Dog: Sharo, Age: 3, Number Of Legs: 4 Cat: Garfield, Age: 5, IQ: 200 Snake: Alex, Age: 25, Cruelty: 1000
Dog Bau 5 10 Cat Myau 5 100 Dog Georgi 20 1000 Cat Bojo 4 20 talk Bojo I'm your Huckleberry	I'm an Aristocat, and I will now produce an aristocratic sound! Myau Myau. Dog: Bau, Age: 5, Number Of Legs: 10 Dog: Georgi, Age: 20, Number Of Legs: 1000 Cat: Myau, Age: 5, IQ: 100 Cat: Bojo, Age: 4, IQ: 20

7. Websites

You have been tasked to create an ordered database of websites. For the task you will need to create a **class Website**, which will have a **Host**, a **Domain** and **Queries**.

The **Host** and the **Domain** are simple **strings**.
The **Queries**, is **Collections** of **strings**.

You will be given several input lines in the following format:

`{host} | {domain} | {query1,query2. . .}`

Note: There will **always** be a **host** and a **domain**, but there **might NOT** be **ANY queries**.

The input sequence ends, when you receive the command "**end**". Then you must print **all websites** in the following format:

`https://www.{host}.{domain}/query?=[{query1]&[{query2}]&[query3]. . .`

In case there are **NO queries**, just print:

`https://www.{host}.{domain}`

Examples

Input	Output
softuni | bg | user,course,homework judge.softuni | bg | contest,bg	https://www.softuni.bg/query?=[user]&[course]&[homework] https://www.judge.softuni.bg/query?=[contest]&[bg] https://www.google.bg/query?=[search]&[query]

`google | bg | search,query`
`zamunda | net`
`end`
	`https://www.zamunda.net`

8. Boxes

Create a **class Box**, which will represent a **rectangular box**. The Box should have **UpperLeft** (**Point**), **UpperRight** (**Point**), **BottomLeft** (**Point**), **BottomRight** (**Point**).

Create, or use from the Lab, the **class Point** which has **X** (**int**) and **Y** (**int**) – coordinates in **2D space**. Move the **`CalculateDistance()`** method in the **Point class**, exactly as it is. Then use "**`Point.CalculateDistance(point1, point2)`**" signature, to **use** the **method**.

Create **2 methods** in the **Box class**:
`CalculatePerimeter(width, height)`
`CalculateArea(width, height)`.

Make them **return integers**, representing the **perimeter** and **area** of the **box**.

The formulas are respectively – (**`2 * Width + 2 * Height`**) and (**`Width * Height`**).

The **Width** is the **distance between** the **UpperLeft** and the **UpperRight** Points, and **ALSO** – the **Bottomleft** and the **BottomRight** Points.

The **Height** is the **distance between** the **UpperLeft** and the **BottomLeft** Points, and **ALSO** – the **UpperRight** and the **BottomRight** Points.

You will receive several input lines in the following format:

`{X1}:{Y1} | {X2}:{Y2} | {X3}:{Y3} | {X4}:{Y4}`

Those will be the coordinates to **UpperLeft**, **UpperRight**, **BottomLeft** and **BottomRight** (**IN THE SAME ORDER**).

When you receive the command "**end**". You must print **all Boxes** in the following format:

`"Box: {width}, {height}`

`Perimeter: {perimeter}`

`Area: {area}"`

Examples

Input	Output

`0:2 | 2:2 | 0:0 | 2:0`
`-3:0 | 0:0 | -3:-3 | 0:-3`
`-2:2 | 2:2 | -2:-2 | 2:-2`
`end`
	`Box: 2, 2`
	`Perimeter: 8`
	`Area: 4`
	`Box: 3, 3`
	`Perimeter: 12`
	`Area: 9`
	`Box: 4, 4`
	`Perimeter: 16`
	`Area: 16`

9. Messages *

Create a **class User**, which has a **Username** (**string**), and **ReceivedMessages** (**Collection** of **Messages)**.
Create a **class Message**, which has a **Content** (**string**) and a **Sender** (**User**).

You will have to store a messaging history for every user. The input consists of 2 commands:

"**`register {username}`**"

"**`{senderUsername} send {recipientUsername} {content}`**"

The **register command**, registers a **user** with the **given username**.

The **send command**, sends a **message**, from the **given sender**, to the **given recipient**, with the **given content**. That means that you must **add** the **message** to the **recipient's ReceivedMessages**.
If **even one** of the **given names** does **NOT** exist, **ignore** the command.

When you receive the command "**exit**" you must end the input sequence. After that you will receive **2 usernames**, **separated** by a **space**.

You must **print all messages**, sent, **between the two users**, corresponding to **the given usernames**. The messages should be printed in a specified way. You should print **first** a **message SENT** from the **first user**, **then** a **message SENT** from the **second user**, then a **message** from **the first user**, and **so on**. If one of the **collections** of **messages** has **more elements** than the **other**, just print the **remaining elements** from it.

The first user's messages must be printed in the following way:
"`{firstUser}: {content}`"

The second user's message must be printed in the following way:

"`{content} :{secondUser}`"

When you print the whole output, it should look like this:

`{firstUser}: {content1}`

`{content1} :{secondUser}`

`{firstUser}: {content2}`

`{content2} :{secondUser}`

`. . .`

In case there are **NO** messages **between** the two users, print "**No messages**".

Examples

Input	Output
register Ivan register Pesho Ivan send Pesho pesho Ivan send Pesho pesho_tam_li_si? Pesho send Ivan kaji_vanka Pesho send Ivan tuk_sum Pesho send Ivan chakai_che_bachkam Ivan send Pesho kvo_stava	Ivan: pesho kaji_vanka :Pesho Ivan: pesho_tam_li_si? tuk_sum :Pesho Ivan: kvo_stava chakai_che_bachkam :Pesho Ivan: kak_si Ivan: deka_izbega_be?

Ivan send Pesho kak_si Ivan send Pesho deka_izbega_be? Ivan send Pesho pecaaa!!! exit Ivan Pesho	Ivan: pecaaa!!!
register John John send Harry harry_you_there? register Harry John send Harry harry? register Donald Harry send John yeah_sorry_was_out... Harry send John wassup? Donald send John Yo_John? Donald send Jonh You_there? John send Harry thank_god!! John send Harry I_need_you! exit John Harry	John: harry? yeah_sorry_was_out... :Harry John: thank_god!! wassup? :Harry John: I_need_you!