



Class:

S6 ICT

Date:

Tuesday, May the 4th, 2021

Teacher:

Mr Barsamian

B Test — With computer

Family name: _____

First name: _____

Grade: ___ / 10

Duration: 45 minutes.

This test has to be done on computer; it is a follow-up from the previous work without computer. At the end of the period, make sure to upload the python files on the Teams assignment.

The subject consists of two independent parts. Some questions are bonuses, and it is highly advised to do them only at the end, when everything else has been done.

If needed, the candidate can also handle some comments inside the code or on a separate document.

Please keep track of the clock, and avoid spending too much time on a question. Stay focused, and May the 4th... be with you !



Short description of this work (already given in the previous work):

At Bertrand's local store, there is a special offer: each time he goes and buy something, they give him a figurine. The figurine earned is given at random each time, among 10 different ones (it is thus possible that Bertrand earns a figurine he already has). Each figurine represents a different animal, and he would like to collect them all.

We will simulate how Bertrand's collection grows, and how he can keep track of it.

We start by giving an identifier to each of the 10 different figurines. These identifiers are the numbers between 0 and 9: {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}.

Each part of this work shows a different way to manage this collection. The two parts are independent, and you may work on them in any order.

1 Algorithms

5 points

For this section, please start by downloading the following file, that contains the python implementation of the algorithms in the previous work:

http://www.barsamian.am/2020-2021/S6ICT/BTest_Figurines_algorithms.py

Recall from previous work: Bertrand's collection is stored in an array `collection`. This array is an array of 10 integers. The cell `collection[i]` holds the number of figurines with identifier i he has in his collection.

For instance, if `collection` is the array `[2, 4, 0, 0, 1, 3, 2, 0, 1, 1]`, it means that Bertrand has 2 figurines with identifier 0, 4 figurines with identifier 1, 0 figurine with identifier 2, etc.

New situation: Bertrand now wants to make exchanges with his friends to finish his collection.

1. Write a function `nb_extras` that takes as input an array of length 10 representing Bertrand's collection, and telling how many extra figurines he owns, i.e., how many figurines are in his collection that he can exchange with his friends while keeping one figurine of each he already has. For example:
 - the call `nb_extras([2,4,0,0,1,3,2,0,1,1])` must return 7 (he has 1 extra figurine with id 0, 3 extra figurines with id 1, 2 extra figurines with id 5 and 1 extra figurine with id 6)
 - the call `nb_extras([2,4,2,1,1,3,2,5,1,1])` must return 12

In the following question, Bertrand is willing to finish his collection by going to the store as many time as needed.

2. Complete the function `finish_collection`. The purpose of this function is to count how many extra times Bertrand needs to go to the store to finish his collection. Of course, this function won't return the same number at each call, because of the random nature of the figurines Bertrand receives each time.

In this last question, instead of going back to the store, Bertrand wants to trade figurines with his friend Charles.

BONUS Charles can guarantee to give any figurine Bertrand needs, but he asks for 2 figurines in exchange. Write a function `can_trade_with_Charles` that takes as input an array of size 10 representing Bertrand's collection, and returns `True` if Bertrand has a collection which enables him to finish it using only trades with Charles, and returns `False` otherwise.

- the call `can_trade_with_Charles([2,4,0,0,1,3,2,0,1,1])` must return `True` (he has 7 extra figurines and needs 3 other ones)
- the call `can_trade_with_Charles([2,1,0,0,1,3,2,0,1,1])` must return `False` (he has 4 extra figurines and needs 3 other ones)
- the call `can_trade_with_Charles([2,4,2,1,1,3,2,5,1,1])` must return `True` (the collection is already finished)

2 SQL

5 points

You will need the two following files (make sure to put them in the same folder; as usual, you can download them from <http://www.barsamian.am/2020-2021/S6ICT/>, at the bottom of the page):

http://www.barsamian.am/2020-2021/S6ICT/BTest_Figurines_database.py
http://www.barsamian.am/2020-2021/S6ICT/BTest_Figurines_database.sql

Recall from previous work: we recall that Bertrand’s collection is now managed thanks to a database. Each figurine represents a fictional animal with a name, a color and a number of legs, e.g. one of the figurines is a red bird with 2 legs. The primary key for a figurine is its identifier (id, a number between 0 and 9).

Bertrand stores his collection in different drawers. Each week, he changes the drawer in which he puts his new figurines, to avoid losing all of them if something bad happens. Each drawer has a color and is located in a room (no room have two drawers of the same color).

The big picture of the database is the following:

- figurines: `id`, `name`, `color`, `nb_legs`
- collection: `#figurine_id`, `drawer_color`, `drawer_room`

We give in Table 1 the full table of the different figurines, and in Table 2 an excerpt from Bertrand’s collection (this is not the full table).

id	name	color	nb_legs
0	bird	red	2
1	bird	green	3
2	bird	green	2
3	cat	black	4
4	cat	white	3
5	cat	red	4
6	snake	green	0
7	fox	red	4
8	fox	black	4
9	centipede	white	10

Table 1: The 10 figurines.

figurine_id	drawer_color	drawer_room
7	red	living_room
0	red	living_room
2	black	kitchen
3	black	kitchen
0	black	kitchen
4	red	bedroom
5	red	bedroom
4	black	bedroom
5	black	bedroom

Table 2: An excerpt from Bertrand’s collection.

New questions: for each question, you must write a Python code that answers the question in the Python file http://www.barsamian.am/2020-2021/S6ICT/BTest_Figurines_database.py. The code is not required to consist only of SQL requests: additional Python manipulation may be done on the answers you get from SQL requests.

1. In which rooms did Bertrand put figurines with id 0? (fill the function `doQuestionOne`)
2. Which animals are represented on figurines that Bertrand put in the living room? (fill the function `doQuestionTwo`)
3. How many extra figurines with id 0 does Bertrand own? With id 1? With id 2? In total? (fill the function `doQuestionThree`)

Remark: the number of extra figurines with a given `id` is the number of figurines with this `id` Bertrand has minus 1 (or 0 if he does not have this figurine), see the section “Algorithms”.

BONUS Which of the 10 figurines represents an animal with the correct, realistic number of legs?