The Goat Problem

a question of probability (in Python)

Why? During my education I've been working as a bartender to earn a living and one day a guest asked me the following question:

Image that you are in a game show. There are three doors. One of them is hiding an awesome sports car which we assume you really want to have but behind the other two doors a goat would be the price. So, you pick one door. Now the game show master says: "Ok, you've made your choice. I am going to open one of the other doors and we'll see what's behind it". No sooner said than done. One of the other doors opens and it reveals a goat. Now the talk show master asks you: "Do you want to stick to your choice or do you pick the third door?"

Now the big question is: Does the probability to win the car changes with your decision?

The guest who served me that little problem did not dissolved it that evening and after I had a lot of discussions with several friends and couldn't come to a satisfying conclusion I decided to write a little program to simulate the whole thing.

I wrote the little program in two different versions. The first one lets you manually make the decision and the second one simulates the scenario and lets the candidate always choose to change his first decision.

First Step: Building a door class

```
class door:
    def __init__(self, number, price ):
        self.__number = number
        self.__price = price

    def getNumber(self):
        return self.__number
    def getPrice(self):
        return self.__price
    def openDoor(self):
        print("Door #{} opened. It is ..... a {}.".format(self.__number, self.__price))
```

Second Step: Instantiate the doors via function

```
# randomly puts two goats and one car behind the doors
def fillDoors(prices):
    doors = []

    counter = 1
    while(len(prices) != 0):
        ranIndex = random.randrange(0, len(prices))
        doors.append(door(counter, prices[ranIndex]))
        del prices[ranIndex]
        counter += 1

    return doors
```

```
#  Instantiation of the prices to get
prices = ["Goat", "Goat", "Car"]
doors = fillDoors(prices)
```

Third Step: Let the user choose the door

```
  # lets the player choose his door
def chooseDoor(array):
    chosenIndex = None
    while(True):

        try: # the input must be an int and > 0 and < 4
            chosenIndex = int(input("\nYou see three doors. One is hiding a car " +
                                    "but behind the other two a goat is" +
                                     "waiting for you. Choose. 1, 2 or 3: "))
        except:
            print("Oops. Invalid value. Please try again.")
            continue
        if(0 < chosenIndex < 4):
            break
        else:
            print("Your number has to be 1, 2 or 3. Please try again")
            continue
    return array[chosenIndex - 1]
```

```
chosenDoor = chooseDoor(doors) # lets the player choose a door
```

Forth Step: One of the other doors gets opened

```
 input("\nOk. You've made your choice. Now I'm gonna open one of the other doors to see " +
         "what's behind. \nPress enter to continue")

 otherDoors = [] #One of the other two doors gets opened which is suppost to hide a goat
for element in doors:
    if(element.getNumber != chosenDoor.getNumber):
        otherDoors.append(element)

for element in otherDoors:
    if(element.getPrice() != "Car"):
        element.openDoor()
        otherDoors.remove(element)
```

Fifth Step: User chooses if he sticks to his choice and the result

```
#lets the player dicide weather to stick to his choice or not
def keepOrChange(chosenDoorNr, otherDoorNr):
    choice = None
    chosenNr = chosenDoorNr
    otherNr = otherDoorNr

    while(True):
        choice = input("\nDo you want to stick to door #{} or change to door #{} ? {}: Stay {}: Change : ".format(chosenDoorNr, otherNr, chosenDoorNr, otherNr))
        try:
            choice = int(choice)
        except:
            print("Oops. Invalid value. Please try again.")
            continue
        if(choice == chosenDoorNr or choice == otherDoorNr):
            break
        else:
            print("Your number has to be {} or {}. Please try again".format(chosenDoorNr, otherDoorNr))
            continue
        return choice
```

```
choice = keepOrChange(chosenDoor.getNumber(), otherDoors[0].getNumber()) # the user has the chance to change his decision


if (choice == chosenDoor.getNumber()):
    chosenDoor.openDoor()
else:
    otherDoors[0].openDoor()

input("Press Enter to exit....")
```

The automatic version basically works the same but it always decides to change the door.

Both programs can be found in the project folder.