Informatics 1: Object Oriented Programming

Assignment 3 - Report

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Overview

- Appendix 1

This assignment is consist of three-part including building a zoo, mapping a zoo, and the ticket machine which will be used for a zoo. Building a zoo is related to a class hierarchy design. An effective class hierarchy design is required. Mapping a zoo problem, subsequently, is about data representation so that the effective usage of data structure is required. Finally, the creation of a ticket machine is accustomed to a search issue. The point of this section is to separate corner cases, so returns values matched with conditions given by the specification.

Basic Features

Basic features require to build a zoo. To build a zoo, several factors that need for zoo are required. A zoo needs animals, and a place for animals, or people. When it comes to adding animals, I used a hierarchy system, which means I divided several classes into two sections. One is for the general features of animals and the other is for specific features of each animal. The animal class in the animals package is a parent class and the other 8 classes in the same package extend Animal class. The animals have common features such as checking compatibility, checking inhabitation in a certain area, and nickname. But, each animal has different features respectively. Due to that, I used a hierarchy system for avoiding code duplications. 8 kinds of animal are made as each class under the given condition. 8 animals can be divided into three groups based on the given areas. For example, buzzard and parrot is one group. Lion and zebra are other groups. Seal, shark, and starfish are the other group. However, I did not separate these animals into three groups. This is because I think the number of animals class is not that many, and each animal has their features such as compatibility in a certain place.

In terms of designing areas, on the other hand, I created an Area class which is extended by Aquarium, Cage, Enclosure, Entrance, and PicnicArea. Like the Animal class in the animals package, 5 kinds of areas have common features, thus the Area class can be the parent class of these classes. Furthermore, I should have separated 5 kinds of area classes into two sections. One group contains an aquarium, cage, and enclosure. The other group includes Entrance and PicnicArea. Because the latter group does not need to have animals, it would be more effective to

manage classes when there is a group separation. Also, the instruction requires not to modify IArea interface class such that the Area class is required.

Intermediate features

About modelling the zoo's areas and connections

Areas in the zoo I created used the ArrayList data structure to manage areas. ArrayList may be an appropriate data structure for creating a large and complex zoo. This representation makes areas to be easily managed. ArrayList is a resizable array so that a programmer can easily insert or delete areas in a particular element from a certain position as much as they want. Furthermore, ArrayList can offer several methods to manage the stored objects such that this can be proper for a zoo that needs a variety of objects such as areas and animals.

In the code related to areas, a zoo roughly has three big concepts; creation area, input animals, and area connections. Regarding the creation area, ArrayList<Area> areas is a necessary field. This refers to a list of areas created in a zoo. Whenever a programmer needs to call an area created, ArrayList areas will provide an element that indicates a certain area in a zoo. Also, since all area created is unique, a programmer can assign a unique number to an area by using static int lastID in the field. In the case of an entrance, the zoo can have an entrance with ID zero by setting static final int entranceID = 0 and initialising it at Zoo constructor. Inputting animals into a certain area, secondly, can be easily achieved by setting ArrayList<Animal> listOfInhabitants in the field of Area class. With the aids of listOfInhabitants state, adding animals to a particular area and searching each animals' name can be easily achieved.

When it comes to area connections, finally, each area needs to know what is an adjacent area around themselves. To figure out an adjacent area, ArrayList<Area> nextAreas needs to be defined in the field of Area class. The field refers to a list of the adjacent area so that this tells what areas a certain area has adjacently. For example, if we connect area A with area B and area C, then B, C is the adjacent area of area A. In other words, nextAreas of area A contains B and C. By setting a nextAreas in the field, we can easily manage connections between areas.

An alternative data representation

For the assignment, I used ArrayList data representation. However, there are several alternative data structures such as Array or Hashset.

<Array vs ArrayList>

Array can represent the same type of multiple data items in a single name. For example, several areas having a custom-type Area can be stored in an array. Furthermore, the index number of an array can make an access to a certain element randomly such that the acceptability of data increases. However, due to the complexity of creating a zoo, Array may not be an appropriate choice. Array can not change length so that the size of the arrays is fixed once they are created. In the case of adding a particular area, there are restrictions to create a new place

once a zoo with a fixed size is created. Also, a new element can not be inserted or deleted in an array because the elements are save in consecutive memory positions so that shifting the whole elements can be costly. When a zoo needs to add a place between areas created already, for instance, an array data representation can not add a new place. This is the same as above when we need to delete a certain place in an array.

<Hashset vs ArrayList>

When it comes to add, remove, and connect areas, Hashset can be an alternative data representation especially for under the instruction which needs to add a unique area. This is because Hashset includes unique elements only so that this may be the best way for search operations. However, I used ArrayList since a unique area can also be added, removed, and connected with ArrayList data structure by using static int lastID in the field. Whenever a new area is created, we can create a new id by increasing the global id such that an area can get a unique ID. Therefore, I used ArrayList instead of Hashset.

Advance Features

Representation of money and its reason

When representing money in a zoo, there are important two fields that need to be defined. The first point is to set int entraceFee field. What this means is that all money can be expressed with one denomination, which is pence. In other words, £1 is 100 pence and the denomination used in this assignment just has pound and pence. £17.8, for instance, can be expressed in 1780 pence. As using one denomination, the pence can have an integer type so that a programmer can easily manage money. It may be true that using only pence can be much easier than using both int pounds and int pence. The second is CashCount cashCount. The cashCount field has CashCount type and it can refer to the total money that Zoo has. CashCount class or type implements ICashCount interface so that the abstract class can achieve security. The CashCount class has a general feature of money such as denomination field and several methods related to money calculation. With the aids of two essential field defined, a programmer can easily calculate money or manage money.

Key algorithm idea

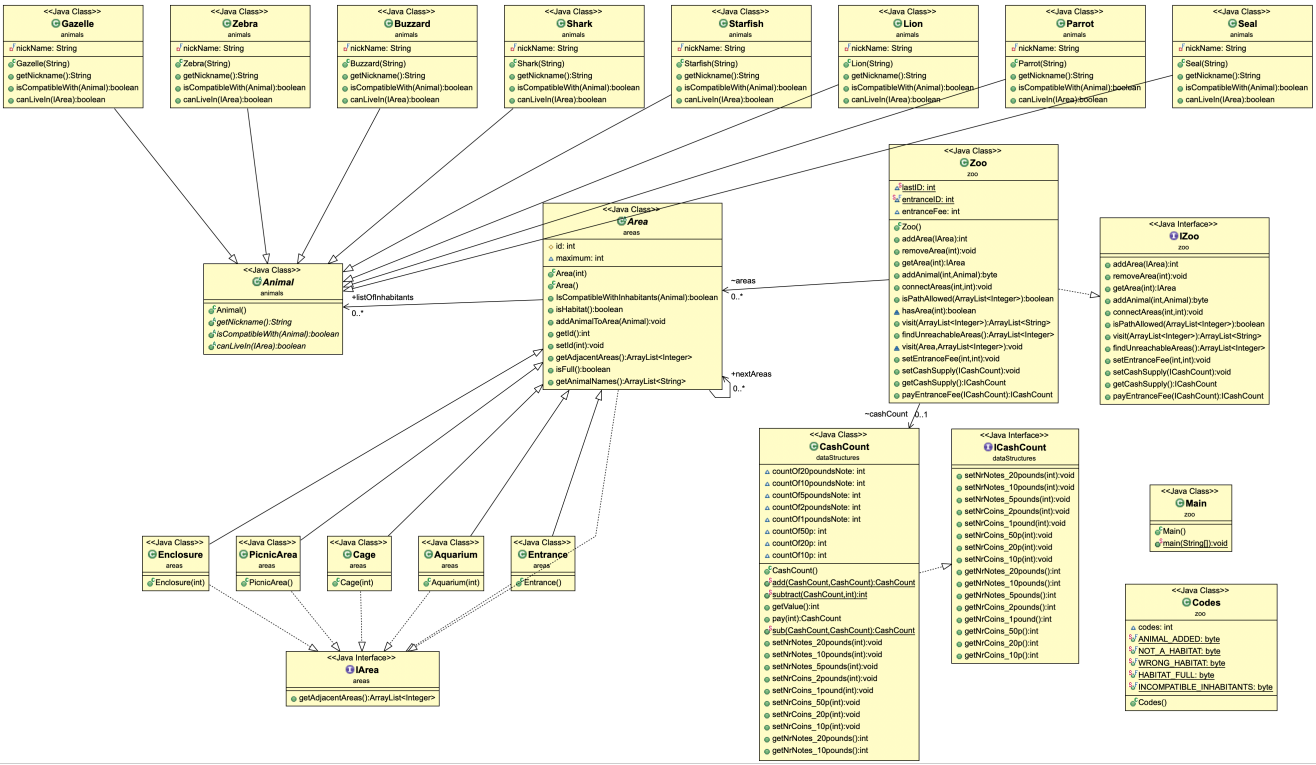
When it comes to key algorithm ideas, my algorithm is consist of a big two axle. One axle is for the easier calculation of money as illustrated above. Unlike setting entrance fee with both int pounds and int pence, we can set this with only one integer pence denomination. The other axle is to convert between one integer type and CashCount type under necessity when calculating change or corner cases. If I elaborate more on that, the payEntranceFee method contains a key algorithm, and the ticket machine needs to return the change after completing corner cases' calculations of the change. Therefore, to return the right change under the instruction, the machine needs to manage corner cases by converting types between one integer type and CashCount type.

As has illustrated in the specification, there are 4 corner cases. For the first corner case, the machine returns no change when the inserted money is the same as entranceFee. In this case, the case does not have a thing to exclude so that only a basic calculation is carried out which is commonly used in all other cases. An inserted money from a visitor needs to be added into total money in the form of each denomination. For instance, if an inserted money is £15, this can be one £5 note and ten £ 1 note, or this can be fifty £1 note. And then, the machine needs to have an integer value of the change by subtracting an inserted money with an entrance fee. Subsequently, update the total money that Zoo has by subtracting the integer change value from it, and then return final the change.

Unlike case 1, the other 3 cases require an additional calculation to return the change. Case 2 refers to the case when an inserted money is smaller than the entrance fee. If an entrance

fee is larger than cash inserted, the machine returns the money that was inserted. Next, the machine in case 3 much gives exact change when the inserted cash is too much and the machine can give the change. The key algorithm, in this case, is that the machine returns the change which is supposed to return from a large denomination by using quotient and remainder mathematical concept. In CashCount pay(int value) method, for example, when the machine receives 1200 int value and the machine has £10, £1 notes but they does not have £ 2 note, the machine can return two £ 1 instead of one £ 2. So the 'pay' method in CashCount class can check the number of a certain note which the machine has and if not enough, the machine hands over the remainder value to the next denomination to return the exact change under the available situation. Furthermore, what if there is no enough the required notes or coins so that the machine cannot return the exact change, they return the cash which was inserted. This is case 4 and a machine needs to restore the original money to the total money in this case.

Appendix 1



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