420-201-VA | Final Project Assignment | Due Date: 30 April 2020

Putting it all in ZoosЯus

1 Purpose

The purpose of the final project is to summarize A3a&b and A4a&b into an application that showcases OOP concepts of abstraction, inheritance, polymorphism as well as Java concepts of interfaces and abstract classes, text file processing and exception handling.

2 Your Task

Pete Pettington lives in a farm taking care of his pets, which consists of a number of dogs, cats, and ducks. He owns a startup named ZoosЯus that specializes in renting out petting zoos to the local shopping malls.

In this assignment, you will write a program to help Pete with his tedious and time consuming task of keeping track of his pets and the shopping malls that host them.

3 Input

Your program will allow the user to build a database of text files, each storing records for the pets in a particular petting zoo, and each named after the shopping mall hosting the petting zoo.

The database files are comma-separated values (CSV) files, using exact same format your are already familiar with from assignments 3 and 4.

For example, contents of a database file named `Quartier_Cavendish.txt`[1] may look like this:

```
cat, yes  , Alex ,  5  ,  M
duck,  1, Munchkin, 5 ,f
Cat,no,Sam ,  7  , m
dog  ,Yorkshire Terrier , Luna  ,  11 ,  f
Cat  , yes , PreciousMissy,11,F
Duck ,  4  ,Eggbert,4 , F
Dog,  Bernese Mountain   ,Jack , 7, m
```

Each line in the file represents a pet record, where the first value indicates the pet type and the second value is specific to that type, such as `breed` for dog, `yes` or `no` for cat being neutered, or an integer for duck eggs. The last three values list the name, age, and gender of the pet, in that order.

[1] The file extension may be anything other that `txt` such as `pet`, `zoo`, etc. The only reason we use `txt` for file extension is that most of us use Windows OS, where the default file name extension for a text file is `txt`.

4 Output

Your program should present the user with a neatly formatted output as shown below:

```
------------------------------------------------------------------
                 Quartier Cavendish Petting Zoo
------------------------------------------------------------------
ID  Pet Type         Name         Age Gender     Specifics
------------------------------------------------------------------
 1    Cat            Alex          5     M          neutered
 2    Duck         Munchkin        5     F           1 egg
 3    Cat            Sam           7     M        not neutered
 4    Dog            Luna         11     F     Yorkshire Terrier
 5    Cat       PreciousMissy     11     F          neutered
 6    Duck         Eggbert         4     F           4 eggs
 7    Dog            Jack          7     M      Bernese Mountain
------------------------------------------------------------------
dogs: 2,  cats: 3,  ducks: 2
------------------------------------------------------------------
```

The ID numbers are unique integers that are generated and assigned as the input pet records are each processed (see Step 4.)

5 User Interface

To manage the database, your program must present the user with the following menu of operations, read the user's choice of operation, and perform that operation.

```
Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit

Your choice?
```

Your program will repeat this text-based menu-driven interactive process until the user chooses to quit.

6 Sample Program Run

User input is highlighted in yellow.

```
Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit

Your choice? 2
Enter 5 comma-separated values: pet type, specific pet info, name, age, gender
Dog,Jack Russell Terrier ,Coco, 7 ,f
Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit
```

```

Your choice? 2
Enter 5 comma-separated values: pet type, specific pet info, name, age, gender
Duck , 6 ,Nibbles , 3, F
Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit
```

```
Your choice? 1
-----------------------------------------------------------------
                 Quartier Cavendish Petting Zoo
-----------------------------------------------------------------
ID  Pet Type         Name         Age Gender     Specifics
-----------------------------------------------------------------
 1    Dog            Coco          7     F    Jack Russell Terrier
 2    Duck         Nibbles         3     F           6 eggs
-----------------------------------------------------------------
dogs: 1,  cats: 0,  ducks: 1
-----------------------------------------------------------------

Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit
```

```
Your choice? 3
Enter the ID number of the pet to remove: 1

Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit

Your choice? 1
```

```
-------------------------------------------------------------------
                  Quartier Cavendish Petting Zoo
-------------------------------------------------------------------
ID  Pet Type         Name         Age Gender     Specifics
-------------------------------------------------------------------
 2    Duck          Nibbles        3     F           6 eggs
-------------------------------------------------------------------
dogs: 0,  cats: 0,  ducks: 1
-------------------------------------------------------------------

Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit
```

```
Your choice? 3
Enter the ID number of the pet to remove: 1
Error: no pet with ID number 1

Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit

Your choice? 2
```

```
Enter 5 comma-separated values: pet type, specific pet info, name, age, gender
Duck , 3,Wiggles , 10,F
Choose from these options
------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit

Your choice? 1
---------------------------------------------------------------------
                 Quartier Cavendish Petting Zoo
---------------------------------------------------------------------
ID  Pet Type         Name         Age Gender     Specifics
---------------------------------------------------------------------
 2    Duck         Nibbles         3     F           6 eggs
 3    Duck         Wiggles        10     F           3 eggs
---------------------------------------------------------------------
dogs: 0,  cats: 0,  ducks: 2
---------------------------------------------------------------------

Choose from these options
------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit
```

```
159
160 Your choice? 3
161 Enter the ID number of the pet to remove: 2
162
163 Choose from these options
164 -------------------------
165  1 - Print pet list
166  2 - Add a new pet record
167  3 - Remove a pet record
168  4 - Sort pet list by name
169  5 - Sort pet list by age
170  6 - Sort pet list by gender
171  7 - Load database from file
172  8 - Save database to file
173  9 - Quit
174
175 Your choice? 1
176 ---------------------------------------------------------------------
177                   Quartier Cavendish Petting Zoo
178 ---------------------------------------------------------------------
179 ID  Pet Type          Name          Age Gender     Specifics
180 ---------------------------------------------------------------------
181  3    Duck          Wiggles         10     F           3 eggs
182 ---------------------------------------------------------------------
183 dogs: 0,  cats: 0,  ducks: 1
184 ---------------------------------------------------------------------
185
186 Choose from these options
187 -------------------------
188  1 - Print pet list
189  2 - Add a new pet record
190  3 - Remove a pet record
191  4 - Sort pet list by name
192  5 - Sort pet list by age
193  6 - Sort pet list by gender
194  7 - Load database from file
195  8 - Save database to file
196  9 - Quit
```

```
Your choice? 7
Enter input file name: Quartier_Cavendish.txt
Completed processing 7 pet records
Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit

Your choice? 1
---------------------------------------------------------------------
                  Quartier Cavendish Petting Zoo
---------------------------------------------------------------------
ID  Pet Type         Name          Age Gender     Specifics
---------------------------------------------------------------------
 3    Duck         Wiggles         10     F           3 eggs
 4    Cat            Alex           5     M         neutered
 5    Duck         Munchkin         5     F           1 egg
 6    Cat              Sam          7     M       not neutered
 7    Dog              Luna        11     F     Yorkshire Terrier
 8    Cat       PreciousMissy      11     F          neutered
 9    Duck          Eggbert         4     F           4 eggs
10    Dog              Jack         7     M      Bernese Mountain
---------------------------------------------------------------------
dogs: 2,  cats: 3,  ducks: 3
---------------------------------------------------------------------

Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit
```

```
Your choice? 4
Database is now sorted by name
Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit

Your choice? 1
---------------------------------------------------------------------
                 Quartier Cavendish Petting Zoo
---------------------------------------------------------------------
ID  Pet Type         Name          Age Gender     Specifics
---------------------------------------------------------------------
 4    Cat            Alex           5     M          neutered
 9    Duck         Eggbert          4     F           4 eggs
10    Dog            Jack           7     M      Bernese Mountain
 7    Dog            Luna          11     F     Yorkshire Terrier
 5    Duck         Munchkin         5     F           1 egg
 8    Cat       PreciousMissy      11     F          neutered
 6    Cat            Sam            7     M        not neutered
 3    Duck         Wiggles         10     F           3 eggs
---------------------------------------------------------------------
dogs: 2,  cats: 3,  ducks: 3
---------------------------------------------------------------------

Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit
```

```
Your choice? 5
Database is now sorted by age
Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit

Your choice? 1
---------------------------------------------------------------------
                 Quartier Cavendish Petting Zoo
---------------------------------------------------------------------
ID  Pet Type         Name          Age Gender     Specifics
---------------------------------------------------------------------
 9    Duck         Eggbert          4     F           4 eggs
 4    Cat            Alex           5     M         neutered
 5    Duck         Munchkin         5     F           1 egg
10    Dog            Jack           7     M      Bernese Mountain
 6    Cat            Sam            7     M        not neutered
 3    Duck         Wiggles         10     F           3 eggs
 7    Dog            Luna          11     F     Yorkshire Terrier
 8    Cat       PreciousMissy      11     F          neutered
---------------------------------------------------------------------
dogs: 2,  cats: 3,  ducks: 3
---------------------------------------------------------------------

Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit
```

```
Your choice? 6
Database is now sorted by gender
Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit

Your choice? 1
---------------------------------------------------------------------
                 Quartier Cavendish Petting Zoo
---------------------------------------------------------------------
ID  Pet Type         Name          Age Gender     Specifics
---------------------------------------------------------------------
 9    Duck         Eggbert          4     F           4 eggs
 5    Duck         Munchkin         5     F           1 egg
 3    Duck         Wiggles         10     F           3 eggs
 7    Dog            Luna          11     F     Yorkshire Terrier
 8    Cat       PreciousMissy      11     F          neutered
 4    Cat            Alex           5     M          neutered
10    Dog            Jack           7     M      Bernese Mountain
 6    Cat            Sam            7     M        not neutered
---------------------------------------------------------------------
dogs: 2,  cats: 3,  ducks: 3
---------------------------------------------------------------------

Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit
```

```

Your choice? 8
Enter output file name: Quartier_Cavendish_out.txt
Choose from these options
-------------------------
 1 - Print pet list
 2 - Add a new pet record
 3 - Remove a pet record
 4 - Sort pet list by name
 5 - Sort pet list by age
 6 - Sort pet list by gender
 7 - Load database from file
 8 - Save database to file
 9 - Quit
```

```

Your choice? 9
goodbye!
```

Saved database Quartier_Cavendish_out.txt

```
Duck, 4, Eggbert, 4, F
Duck, 1, Munchkin, 5, F
Duck, 3, Wiggles, 10, F
Dog, Yorkshire Terrier, Luna, 11, F
Cat, yes, PreciousMissy, 11, F
Cat, yes, Alex, 5, M
Dog, Bernese Mountain, Jack, 7, M
Cat, no, Sam, 7, M
```

Notice that the id numbers are not written to the output file.

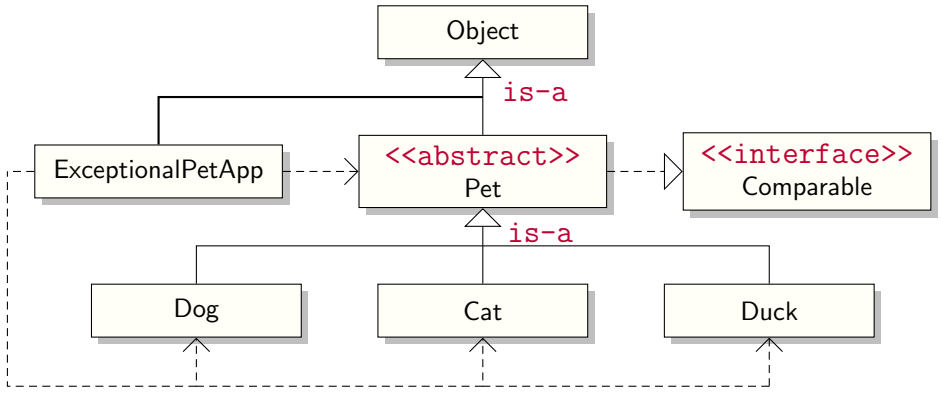
7 Database Storage

Your program must use an `ArrayList<Pet>` to store the database, which is empty at the start of the program.

8 Hints

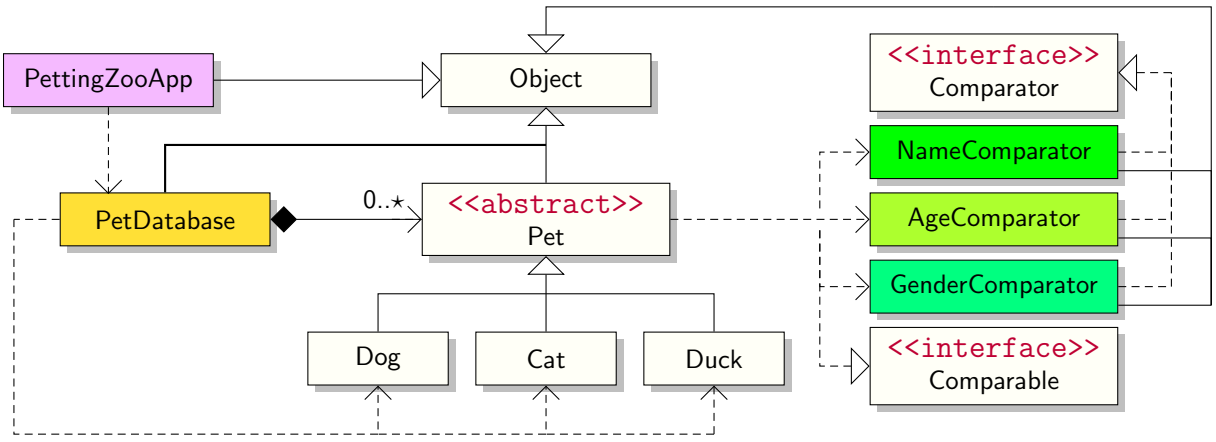
Step 1. Prepare Your Existing Pet Inheritance Hierarchy from 4B

Here is the collapsed version of the UML diagram given on page 6 of assignment 4B, with yellow and green highlights removed:



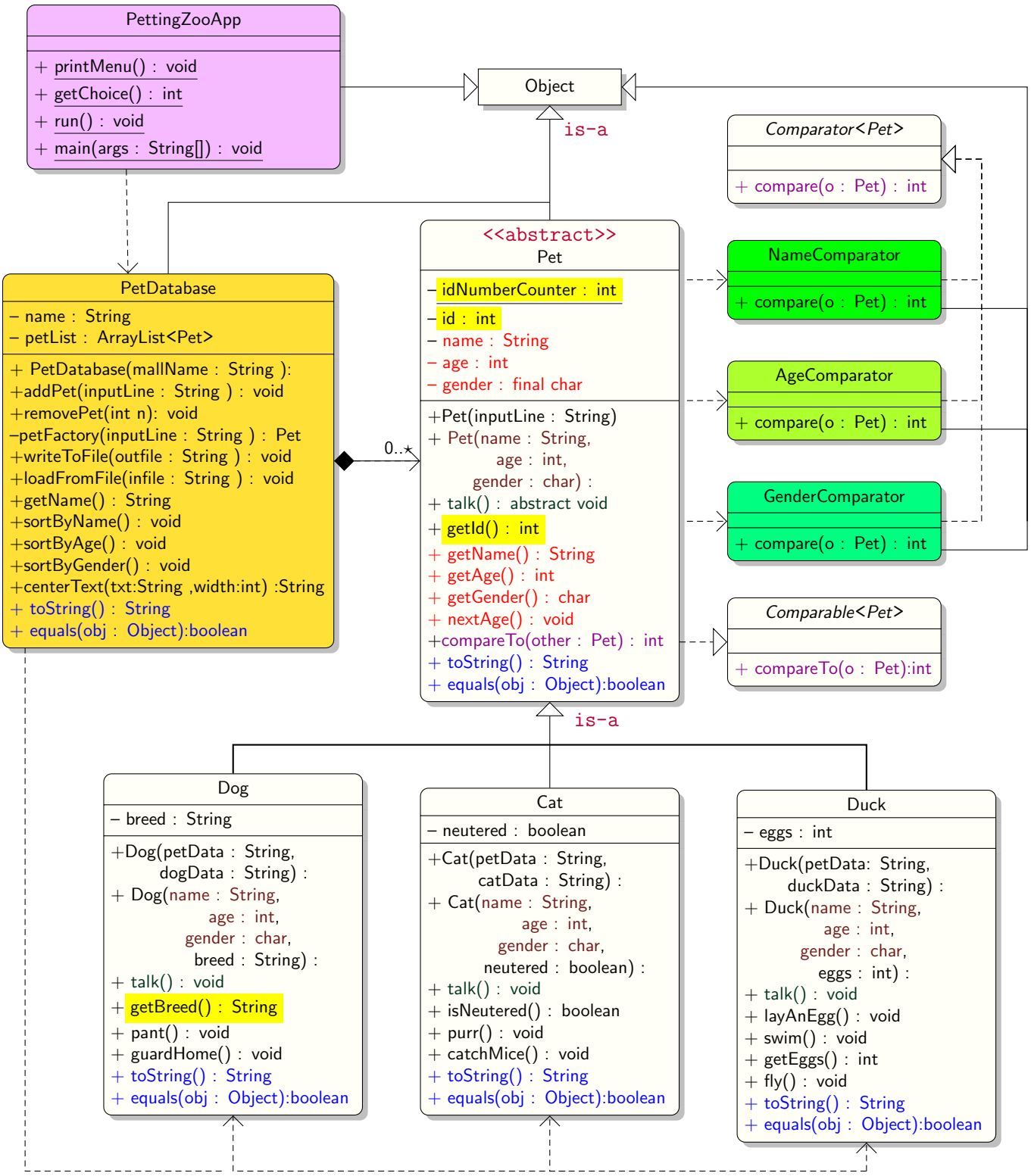
Step 2. Modify the UML diagram from step 1

Removing `ExceptionalPetApp` and replacing it with two new classes `PetDatabase` and `PettingZooApp`, you will implement the class diagram below, which is followed by a quick summary of its meaning:



- Zero or more `Pet` object references are owned by a `PetDatabase` object
- `PettingZooApp` uses `PetDatabase` and extends `Object`
- `NameComparator`, `AgeComparator`, and `GenderComparator` each implement the `Comparator` interface
- `Pet` uses `NameComparator`, `AgeComparator`, and `GenderComparator` .
- `Pet` extends `Object` and implements the `Comparable` interface
- Classes `Dog`, `Cat`, and `Duck` extend `Pet` into concrete classes, knowing absolutely nothing about their client `PetDatabase`
- A `PetDatabase` owns zero or more `Pet` object references and depends on `Dog`, `Cat`, and `Duck` objects

Step 3. Look at the big picture and plan the steps to get there



Step 4. Create unique ID for Pet objects

Add the following lines 3-5 to yout `Pet` class: (back to page 2)

```
1 public abstract class Pet implements  Comparable<Pet>
2 {
3     private static int idNumberCounter = 0; // all Pet objects can use this;
4     private int id = ++idNumberCounter;     // assign unique id to this object
5     public int getId() { return id; }
6    // remaining code not shown for brevity
7 }
```

Step 5. Class PetDatabase

	PetDatabase	The name of this class
–	name : String	stores the name of `this` pet database
–	petList : ArrayList<Pet>	stores records of all pets in `this` database
+	PetDatabase(name : String):	Initializes `this` name and creates an empty petList
–	petFactory(inputLine : String) : Pet	same as lines 117-159, page 14, assignment 4B (without the `static` keyword)
+	addPet(inputLine : String) : void	same as lines 38-78, page 12, assignment 4B
+	removePet(int id): void	searches petList for a pet record with the supplied id; if found, removes it; otherwise displays a message, changing nothing; see lines 67 (page 5), 105 (page 6), and 160 (page 8) on this assignment
+	writeToFile(outfile : String) : void	see page 17 on this assignment
+	loadFromFile(infile : String) : void	see lines 17-79, pages 11-12, assignment 4B
+	getName() : String	return `this` name
+	sortByName() : void	see assignment 3B, Step 1 on page 9, and Step 5 on page 10 (line 13)
+	sortByAge() : void	see assignment 3B, Step 2 on page 9, and Step 5 on page 10 (line 19)
+	sortByGender() : void	similar to sortByName() and sortByAge() above
+	centerText(txt:String,width:int):String	We wrote this method in class; see a version on page 18
+	toString() : String	returns a neatly formatted string representing `this` object; to get the names of the pet types use the `istanceof` operator similar to what `opertor` method on page 17 does the pet types
+	equals(obj : Object):boolean	returns true if `this` and `Pet` version of `obj` have exact same name and exact same petList records

Step 6. Class PettingZooApp

PettingZooApp	The name of this class
+ printMenu() : void	displays a menu of options; see page 2
+ getChoice() : int	reads and returns user's choice from the keyboard taking care of all potential input error
+ main(args : String[]) : void	calls run() below
+ run() : void	repeatedly displays the menu, reads user's choice of operation, and performs that operation

To see what method `run()` does for a given choice see

Choice	1	2	3	4	5	6	7	8	9
Page	4	4	5	9	10	11	8	12	13
Line #	43	28	67 or105	243	287	331	198	375	389

Step 7. Done!

8.1 void writeToFile(String infileName)

This is essentially the same as the `writeArrayListToTextFile` method in assignment 3A, page 4, lines 21-31. The only difference here is that we need to fill the first value in each output line with a pet type, namely, "dog", "cat", or "duck". See how the `instanceof` operator is used to make that determination.

```
1  public void writeToFile(String outfileName) throws FileNotFoundException
2  {
3      File file = new File(infileName);
4      PrintWriter printWriter = new PrintWriter(file);
5      String petType ="unknown type";
6      String petSpecificValue = "unknown specifics";
7      for (Pet pet : petList)
8      {
9          if (pet instanceof Dog)
10         {
11             Dog dog = (Dog) pet;
12             petSpecificValue = "Dog, " + dog.getBreed();
13         }
14         else if (pet instanceof Cat)
15         {
16             Cat cat = (Cat) pet;
17             petSpecificValue = "Cat, " +(cat.isNeutered() ? "yes" : "no");
18         }
19         else if (pet instanceof Duck)
20         {
21             Duck duck = (Duck) pet;
22             petSpecificValue =  "Duck, " + duck.getEggs() ;
23         }
24         printWriter.println(petSpecificValue + ", " + pet.getName() + ", "
25                                 + pet.getAge() + ", " + pet .getGender());
26     }
27     printWriter.close();
28 }
```

Food for thought: what if there were 30 pet types instead of 3?

8.2 static String centerText(String text, int width)

```
//   centers a given text within a field of width 'width'
//   centers a given text within a field of width 'width'
private static String centerText(String text, int width)
{
    if(width < text.length()) return text; // nothing to do; text is longer than width

    final String BALNK = " ";
    int total_lead_and_trail_spaces = width - text.length();
    int lead_spaces =(total_lead_and_trail_spaces)/2;
    // just in case the total number of leading and trailing spaces is odd
    int trail_spaces = (total_lead_and_trail_spaces % 2 == 1) ? lead_spaces + 1 :
                                                                lead_spaces;
    String result = "";
    // start with the leading spaces
    for (int i = 0; i < lead_spaces; i++) result += BALNK;
    result += text; // now the text
    // end with the trailing spaces
    for (int i = 0; i < trail_spaces; i++) result += BALNK;
    return result;
}
```

9 Evaluation Criteria

Evaluation Criteria

Functionality	Ability to perform as required, producing correct output for any set of input data, Proper implementation of all specified requirements, Efficiency	60%
Robustness	Ability to handle input data of wrong type or invalid value	10%
OOP style	Encapsulating only the necessary data inside objects, Information hiding, Proper use of Java constructs and facilities.	10%
Documentation	Description of purpose of program, Javadoc comment style for all methods and fields, comments on non-trivial steps in all methods	10%
Presentation	Format, clarity, completeness of output, user friendly interface	5%
Code readability	Meaningful identifiers, indentation, spacing, localizing variables	5%

This project is the last assignment of the semester.

Good luck in all your endeavors.