Astronomical Database

Java Project

Mentor - Kalyani Kadam

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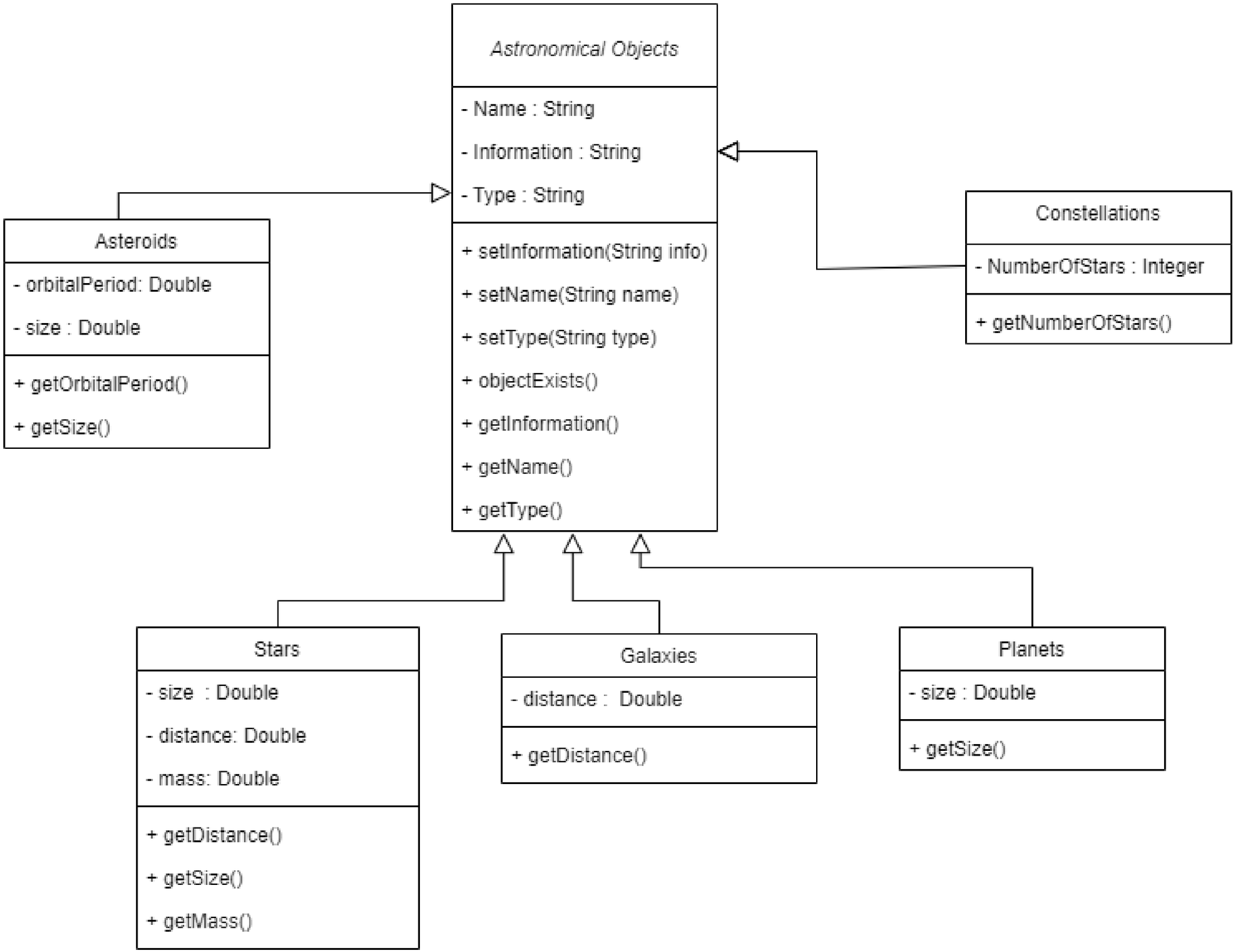
Problem Statement

This project aims to store and retrieve information about various astronomical objects from a database and display it to the user using a java application.

Class Diagram



Class Description

Astronomical Objects

The astronomical objects class is an abstract class which consists of methods like getInformation(), getType() and getName() which are implemented by every class inheriting from astronomical objects.

Galaxies

This class consists of methods inherited from astronomical objects and an additional method getDistance(), which returns the distance of the galaxy from Milky way in terms of light years.

Constellations

This class contains the information about the constellations and includes getNumberOfStars() method, which returns the number of stars in the consetllation.

Stars

This class contains methods like getDistance(), getMass(), getSize(), which gives information about the size of the star, the distance of the star from the Milky Way and the mass of the star.

Planets

It contains methods like getSize() which returns the radius of the planet along with the methods that are inherited from the astronomical objects super class.

Asteroids

It contains methods like getSize() which returns the radius of the planet along with the methods that are inherited from the astronomical objects super class.

Exceptions

The exception class consists of a constructor which accepts a string argument to set the error message for the exception. In the SqlQueries class, in the entryExists() function, an object of the ExceptionClass is thrown when the result set is empty. The code is inserted into a try catch block, wherein the ExceptionClass object is caught and a JOptionPane dialog is displayed indicating that the entry does not exist in the database.

Inbuilt Exceptions

In the SqlQueries class, try catch blocks have been used to handle exceptions and print error messages.

Database

```
mysql> select*from asteroids;
+-----------+--------+---------------+------+-----------------------------------------------------------------------------------------------------------
| name      | size   | orbitalperiod | type | information
+-----------+--------+---------------+------+-----------------------------------------------------------------------------------------------------------
| 433Eros   |  16.84 |        643.00 | S    | Eros is a s type asteroid of the Amor group and the first discovered and second-largest near-Earth object with an elongated
| 2340Hathor|   0.21 |        283.00 | S    | It belongs to the Aten group of asteroids and is classified as near-Earth and potentially hazardous asteroid.
| 7Iris     | 199.00 |       1346.49 | S    | Iris is a large main-belt asteroid and perhaps remnant planetesimal orbiting the Sun between Mars and Jupiter.
| 8Flora    | 146.00 |       1193.19 | S    | It is a large, bright main-belt asteroid. It is named after Flora, the latin goddess of flowers and gardens.
| 5Astraea  | 119.00 |       1508.00 | S    | Astraea was the fifth asteroid discovered. It is named after Astraea, a goddess of justice named after the stars.
+-----------+--------+---------------+------+-----------------------------------------------------------------------------------------------------------
5 rows in set (0.00 sec)
```

```
mysql> select*from constellations;
+-------------+---------------+------------+-------------------------------------------------------------------------------------------------------------------------
| name        | numberofstars | type       | information
+-------------+---------------+------------+-------------------------------------------------------------------------------------------------------------------------
| Cassiopeia  |             5 | Circumpolar | Cassiopeia is a constellation in the northern sky named after the Greek queen Cassiopeia, which is widely recognised because of its distincti
| Ursa Major  |             7 | Circumpolar | It is also known as the Big Dipper. It is often considered the symbol of north.
| Orion       |             7 | Seasonal    | Orion is one of the most conspicuous and recognizable constellations in the sky. It is named after Orion, a hunter in Greek mythology.
| Canis Major |             8 | Seasonal    | Canis Major is Latin for "greater dog". It contains Sirius, the brightest star in the sky, known as the "dog star".
| Ursa Minor  |             7 | Circumpolar | Ursa Minor is also known as the "Little Bear". It is a part of the list of 88 modern constellations.
+-------------+---------------+------------+-------------------------------------------------------------------------------------------------------------------------
5 rows in set (0.00 sec)
```

```
mysql> select*from planets;
+---------+----------+------------------+-------------------------------------------------------------------------------------------------------------
| name    | size     | type             | information
+---------+----------+------------------+-------------------------------------------------------------------------------------------------------------
| Earth   |  6371.00 | Terrestrial      | Earth is the only planet in the solar system to have water and life on it.
| Venus   |  6051.80 | Terrestrial      | It is the second planet from the sun. It is named after the Roman Goddess of beauty.
| Mars    |  3389.50 | Terrestrial      | Mars is the second largest planet in the solar system. It is often called the "Red Planet" because of its reddish appearance in
| Mercury |  2439.70 | Terrestrial      | Mercury is the smallest planet in the Solar System and the closest to the Sun. It is named after the Roman god Mercurius.
| Jupiter | 69911.00 | Gas giant planet | Jupiter is the fifth largest planet in the Solar System. It is named after the Roman god Jupiter, the king of the gods.
+---------+----------+------------------+-------------------------------------------------------------------------------------------------------------
5 rows in set (0.00 sec)
```

Database

```
mysql> select* from galaxies;
+-------------+----------+------------+------------------------------------------------------------------------------------------------------------------------
| name        | distance | type       | information
+-------------+----------+------------+------------------------------------------------------------------------------------------------------------------------
| Andromeda   |   752.00 | Spiral     | The Andromeda galaxy is the nearest largest galaxy to the Milky Way. The galaxy is named after Andromeda, the Ethiopian princess, the wife of Pe
| Cygnus A    |   232.00 | Radio      | It is one of the strongest radio sources in the sky.
| Triangulam  |   970.00 | Spiral     | Triangulam galaxy is the smallest spiral galaxy in the Local Group and is believed to be a satellite of the Andromeda galaxy.
| Messier 87  |    16.40 | Elliptical | This galaxy was discovered in 1781 by the French astronomer, Charles Messier and cataloged as a nebula.
| NGC 4414    |    62.30 | Spiral     | It is an unbarred spiral galaxy in the constellation Coma Berencies. It was imaged by Hubble Space Telescope in 1995.
+-------------+----------+------------+------------------------------------------------------------------------------------------------------------------------
5 rows in set (0.00 sec)
```

```
mysql> select*from stars;
+------------------+--------+----------+-------+-----------------+------------------------------------------------------------------------------------------
| name             | size   | distance | mass  | type            | information
+------------------+--------+----------+-------+-----------------+------------------------------------------------------------------------------------------
| Sirius           |   1.71 |     8.71 |  2.06 | White dwarf     | Sirius is the brightest star in the night sky. It is known as the "Dog Star" because of it's prominence in the Cani
| Alpha Centauri   |   1.22 |     4.37 |  1.08 | Yellow          | It is the closest star to our Solar System after sun.
| Proxima Centauri |   0.15 |     4.25 |  0.12 | Red dwarf       | It is a flare star that randomly undergoes dramatic increases in brightness because of magnetic activity.
| Rigel            |  78.90 |   863.00 | 21.00 | Blue supergiant | Rigel is a blue supergiant star in the constellation of Orion. Its intrinsic variability is caused by pulsations in
| Betelguese       | 764.00 |   548.00 | 16.50 | Red supergiant  | Betelguese is usually the tenth-brightest star in the night sky and the second brightest star in the Orion constell
+------------------+--------+----------+-------+-----------------+------------------------------------------------------------------------------------------
5 rows in set (0.00 sec)
```

Code Snippets

App.java | SqlQueries.java | Asteroids.java

JavaMiniProject > src > App.java

```java
import javax.swing.*;
import java.util.Objects;


public class App {
    private JPanel panel1;
    private JButton SearchButton;
    private JButton AddButton;
    private JButton RemoveButton;
    private JButton Exit;


    public App() {
        SearchButton.addActionListener(e -> {
            JDialog searchInformationDialog = new JDialog();
            searchInformationDialog.setVisible( b: true);
            searchInformationDialog.setSize( width: 300,  height: 200);

            JPanel informationPanel = new JPanel();
            informationPanel.setLayout( mgr: null);

            JButton search = new JButton( text: "Search");
            JButton cancel = new JButton( text: "Cancel");
            JTextField objectNameField = new JTextField();
            JLabel objectName = new JLabel( text: "Name: -");
            JLabel header = new JLabel( text: "Enter the details of the object: -");
            JLabel typeLabel = new JLabel( text: "Type: -");
            String[] types = {"Asteroid", "Constellation", "Galaxy", "Planet", "Star"};

            JComboBox<String> typesList = new JComboBox<>(types);

            informationPanel.add(header);
            informationPanel.add(objectName);
            informationPanel.add(search);
            informationPanel.add(cancel);
            informationPanel.add(objectNameField);
            informationPanel.add(typeLabel);
            informationPanel.add(typesList);
```

App.java | SqlQueries.java | Asteroids.java

JavaMiniProject > src > App.java

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```

App.java

SqlQueries.java

Code Snippets

App.java | SqlQueries.java | Asteroids.java

JavaMiniProject > src > Asteroids.java > ...

```java
import java.util.Map;

public class Asteroids extends AstronomicalObjects{

    private Double orbitalPeriod = null;
    private Double size = null;

    public void setSize(Double size) {
        this.size = size;
    }

    public void setOrbitalPeriod(Double orbitalPeriod) {
        this.orbitalPeriod = orbitalPeriod;
    }

    @Override
    public String getInformation(){
        SqlQueries queryObject = new SqlQueries("Select information from asteroids where name = '" + super.getName() + "
        Map<String, Object> row = queryObject.getResult();
        for(String object: row.keySet()){
            if("information".equals(object)){
                super.setInformation("" + row.get(object));
            }
        }
        return super.getInformation();
    }

    @Override
    public String getName() {
            return super.getName();
    }

    @Override
    public String getType() {

        SqlQueries queryObject = new SqlQueries("Select type from asteroids where name = '" + super.getName() +"';");
        Map<String, Object> row = queryObject.getResult();
        for(String object: row.keySet()){
            if("type".equals(object)){
                super.setType("" + row.get(object));
            }
        }
        return super.getType();
    }
```

[Asteroids.java]

AstronomicalObjects.java

JavaMiniProject > src > AstronomicalObjects.java > AstronomicalObjects

```java
public abstract class AstronomicalObjects{
    private String name = null;
    private String information = null;
    private String type = null;

    public void setName(String name) {
        this.name = name;
    }

    public void setInformation(String information) {
        this.information = information;
    }

    public void setType(String type) {
        this.type = type;
    }

    String getInformation(){
        return information;
    }
    String getName(){
        return name;
    }
    String getType(){
        return type;
    }

    public abstract boolean objectExists(String name);
}
```

[AstronomicalObjects.java]

Code Snippets

Galaxies.java | Constellations.java

JavaMiniProject > src > Galaxies.java > ...

```java
import java.util.Map;

public class Galaxies extends AstronomicalObjects{
    private Double distance = null;

    @Override
    public String getInformation() {
        SqlQueries queryObject = new SqlQueries("Select information from galaxies where name = '" + super.getName() + "';");
        Map<String, Object> row = queryObject.getResult();
        for(String object: row.keySet()){
            if("information".equals(object)){
                super.setInformation("" + row.get(object));
            }
        }
        return super.getInformation();
    }

    @Override
    public String getName() {
        return super.getName();
    }

    @Override
    public String getType() {

        SqlQueries queryObject = new SqlQueries("Select type from galaxies where name = '" + super.getName() +"';");
        Map<String, Object> row = queryObject.getResult();
        for(String object: row.keySet()){
            if("type".equals(object)){
                super.setType("" + row.get(object));
            }
        }
        return super.getType();
    }
```

[Galaxies.java]

Constellations.java

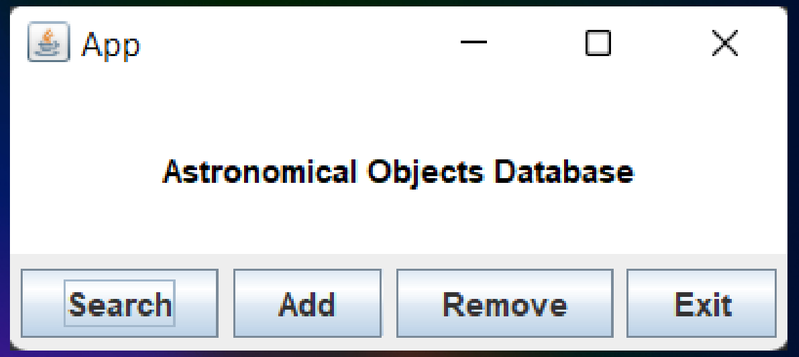
JavaMiniProject > src > Constellations.java > Constellations > getInformation()

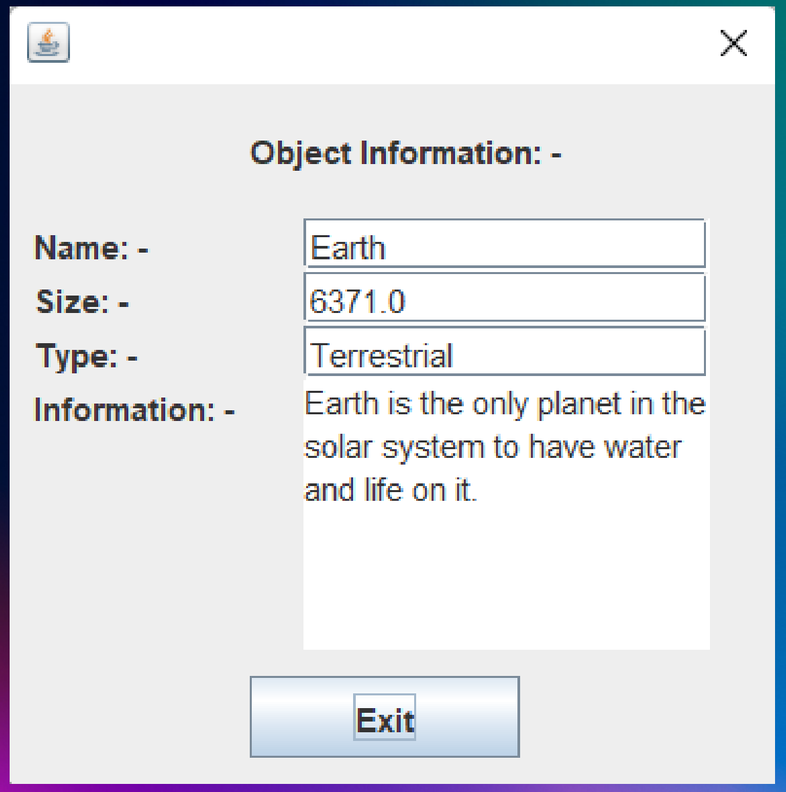
```java
import java.util.Map;

public class Constellations extends AstronomicalObjects{
    private Integer numberOfStars;
    @Override
    public String getInformation() {
        SqlQueries queryObject = new SqlQueries("Select information from constellations where name = '" + super.getName() + "';
        Map<String, Object> row = queryObject.getResult();
        for(String object: row.keySet()){
            if("information".equals(object)){
                super.setInformation("" + row.get(object));
            }
        }
        return super.getInformation();
    }

    @Override
    public String getName() {
        return super.getName();
    }

    @Override
    public String getType() {

        SqlQueries queryObject = new SqlQueries("Select type from constellations where name = '" + super.getName() +"';");
        Map<String, Object> row = queryObject.getResult();
        for(String object: row.keySet()){
            if("type".equals(object)){
                super.setType("" + row.get(object));
            }
        }
        return super.getType();
    }

    @Override
    public boolean objectExists(String name) {
        SqlQueries sqlQueries = new SqlQueries("Select * from constellations where name = '" + name + "';");
        return sqlQueries.entryExists();
    }
```

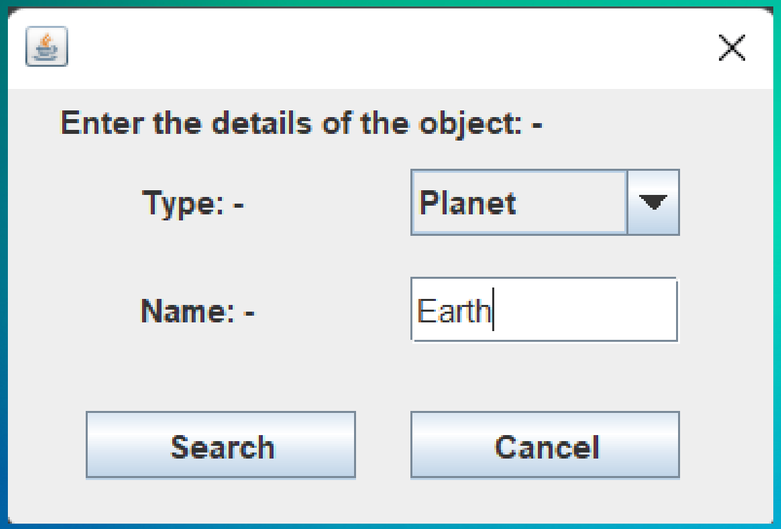
[Constellations.java]

Output Snippets

Searching an object in the database







Output Snippets

Adding an object into the database

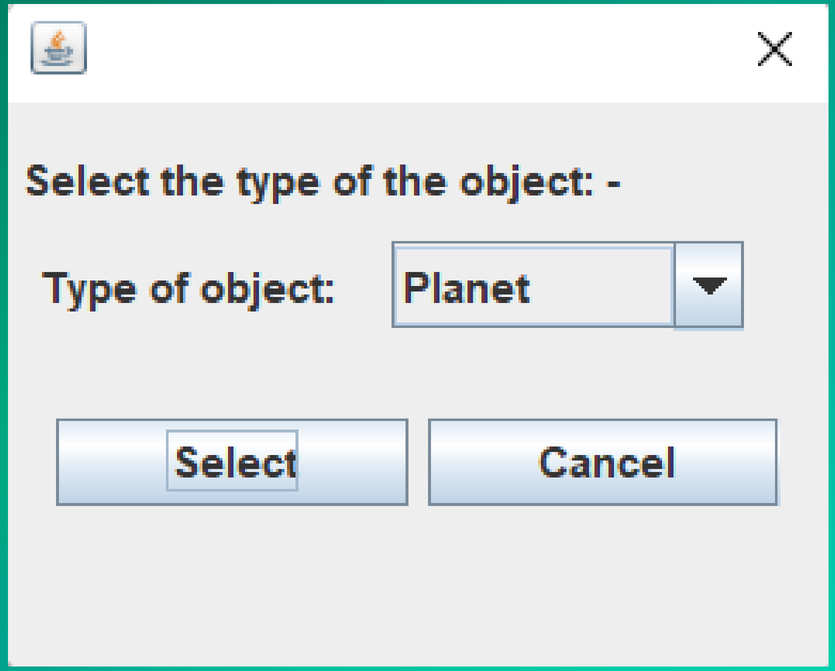
Table before insertion

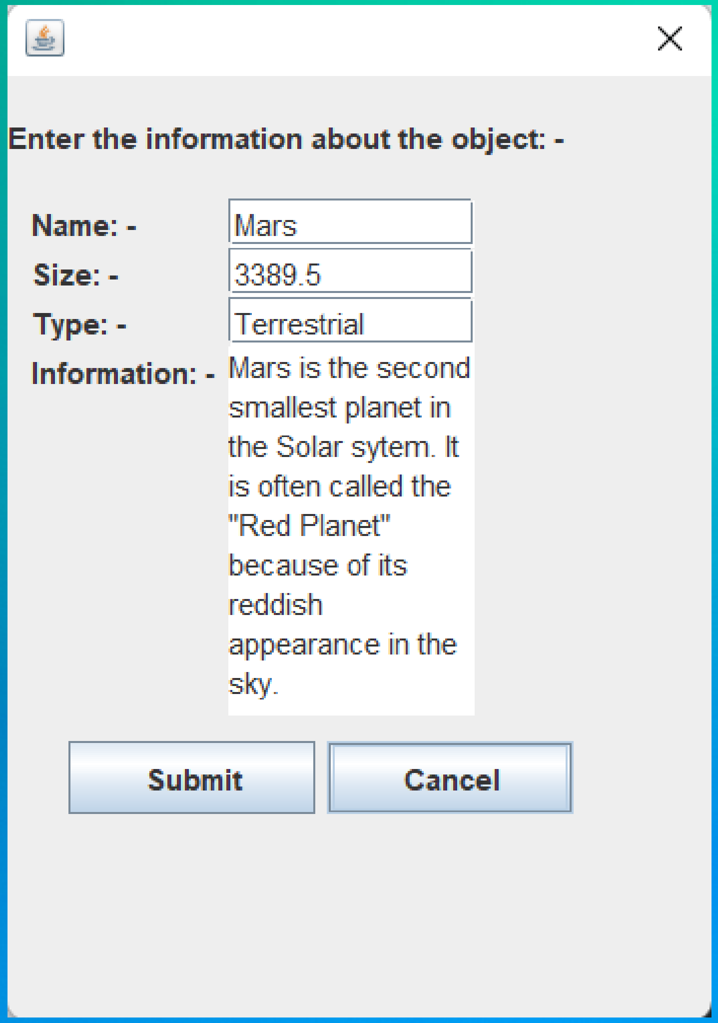
```
mysql> select*from planets;
+---------+---------+-------------+---------------------------------------------------------------------------------------+
| name    | size    | type        | information                                                                           |
+---------+---------+-------------+---------------------------------------------------------------------------------------+
| Earth   | 6371.00 | Terrestrial | Earth is the only planet in the solar system to have water and life on it.            |
| Mercury | 2439.70 | Terrestrial | Mercury is the closest planet to the sun. It is the warmest planet.                   |
| Venus   | 6051.80 | Terrestrial | It is the second planet from the sun. It is named after the Roman Goddess of  beuaty.
 |
+---------+---------+-------------+---------------------------------------------------------------------------------------+
```

Table after insertion

```
mysql> select * from planets;
+---------+---------+-------------+----------------------------------------------------------------------------------------------------------------+
| name    | size    | type        | information
+---------+---------+-------------+----------------------------------------------------------------------------------------------------------------+
| Earth   | 6371.00 | Terrestrial | Earth is the only planet in the solar system to have water and life on it.
| Mercury | 2439.70 | Terrestrial | Mercury is the closest planet to the sun. It is the warmest planet.
| Venus   | 6051.80 | Terrestrial | It is the second planet from the sun. It is named after the Roman Goddess of  beuaty.
                                                    |
| Mars    | 3389.50 | Terrestrial | Mars is the second largest planet in the solar system. It is often called the "Red Plante" because of its reddish appearance in the sky.
+---------+---------+-------------+----------------------------------------------------------------------------------------------------------------+
4 rows in set (0.00 sec)
```

GUI





Output Snippets

Removing an object from the database

GUI

Table before deletion

```
mysql> select * from planets;
+---------+---------+-------------+-----------------------------------------------------------------------------------------------------------------------------------------+
| name    | size    | type        | information                                                                                                                             |
+---------+---------+-------------+-----------------------------------------------------------------------------------------------------------------------------------------+
| Earth   | 6371.00 | Terrestrial | Earth is the only planet in the solar system to have water and life on it.                                                              |
| Mercury | 2439.70 | Terrestrial | Mercury is the closest planet to the sun. It is the warmest planet.                                                                     |
| Venus   | 6051.80 | Terrestrial | It is the second planet from the sun. It is named after the Roman Goddess of  beuaty.
                                    |
| Mars    | 3389.50 | Terrestrial | Mars is the second largest planet in the solar system. It is often called the "Red Plante" because of its reddish appearance in the sky. |
+---------+---------+-------------+-----------------------------------------------------------------------------------------------------------------------------------------+
4 rows in set (0.00 sec)
```

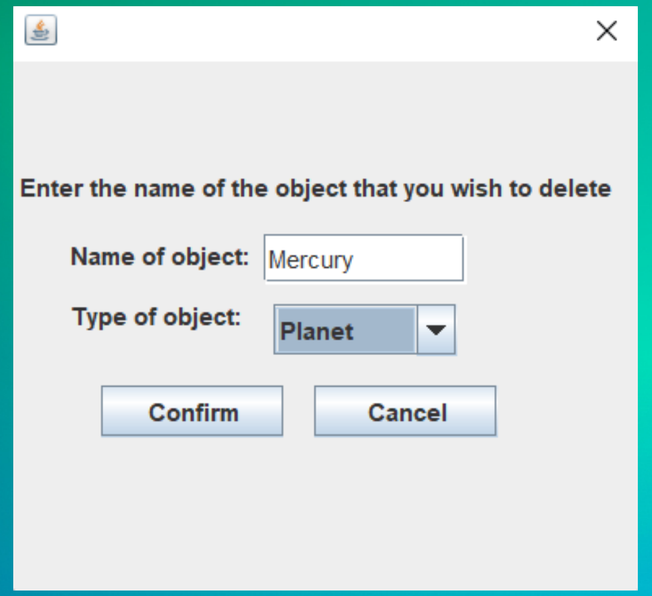
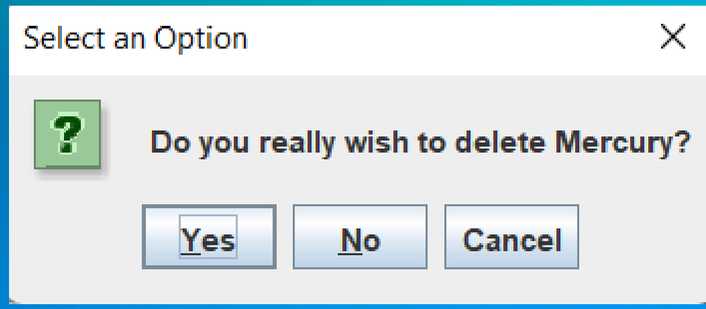


Table after deletion

```
mysql> select * from planets;
+-------+---------+-------------+-----------------------------------------------------------------------------------------------------------------------------------------+
| name  | size    | type        | information                                                                                                                             |
+-------+---------+-------------+-----------------------------------------------------------------------------------------------------------------------------------------+
| Earth | 6371.00 | Terrestrial | Earth is the only planet in the solar system to have water and life on it.                                                              |
| Venus | 6051.80 | Terrestrial | It is the second planet from the sun. It is named after the Roman Goddess of  beuaty.
                                  |
| Mars  | 3389.50 | Terrestrial | Mars is the second largest planet in the solar system. It is often called the "Red Plante" because of its reddish appearance in the sky. |
+-------+---------+-------------+-----------------------------------------------------------------------------------------------------------------------------------------+
3 rows in set (0.00 sec)
```



Conclusion

The concepts of inheritance, encapsulation, abstraction, use of abstract classes and functions, use of collections and generics, storing, organizing and retrieving information from a database have been studied and implemented.

Refrences

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3. https://alvinalexander.com/java/java-mysql-delete-query-example/
4. https://www.javatpoint.com/try-catch-block
5. https://www.learnthesky.com/blog/types-of-constellations
6. https://alvinalexander.com/java/java-mysql-update-query-example/

Made By:

Md Asad Ansari (20070122075)
Prakhar Trivedi (20070122097)
Pranav Prasanth Naranatt (20070122098)
Siddhanth Pinak Shah (20070122122)

Thank you!