1 Understanding Data

Simple classes

1.1 Problem (2.1.1)

Translate the three examples of information from the GPS problem into instances of *GPSLocation*.

Copy the class definitions from the textbook and show the examples as data in the Examples class.

What is the meaning of **new** *GPSLocation*(50.288,0.11) in this context? Include your answer as a block comment in the file that holds the rest of the problem answers.∎

1.2 Problem (2.1.2)

Take a look at this problem statement:

> Develop a program that assists a bookstore manager. The program should keep a record for each book. The record must include its book, the author's name, its price, and its publication year.

Develop an appropriate class diagram and implement it with a class. Create instances of the class to represent these three books:

1. Daniel Defoe, *Robinson Crusoe*, $15.50, 1719;
2. Joseph Conrad, *Heart of Darkness*, $12.80, 1902;
3. Pat Conroy, *Beach Music*, $9.50, 1996∎

1.3 Problem (2.1.4)

Translate the class diagram in figure 1 into a class definition. Also create instances of the class. ∎

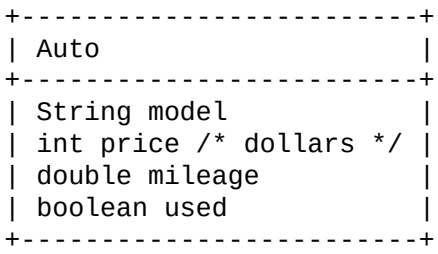


Figure 1: A class diagram for automobiles

Classes with Containment

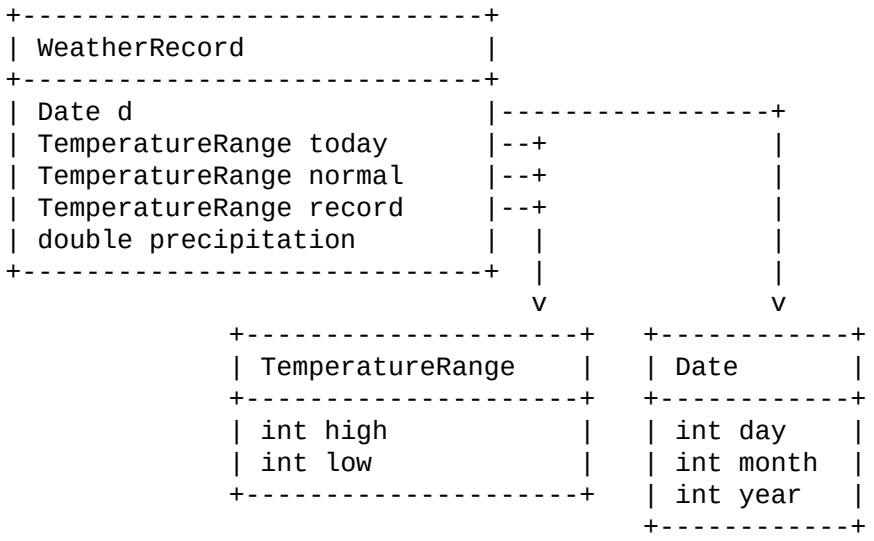


Figure 2: A class diagram for weather records

1.4 Problem (3.1.2)

Take a look at the data definition in figure 2. Translate it into a collection of classes. Also create examples of weather record information and translate them into instances of the matching class.∎

1.5 Problem (3.1.3)

Revise the data representation for the book store assistant in problem 1.2 so that the program keeps track of an author's year of birth and the author's name. Modify the class diagram, the class definition, and the examples.∎

Unions

1.6 Problem (4.3.2)

Consider this the following problem:

> Develop a program that creates a gallery from three different kinds of media: images (gif), texts (txt), and sounds (mp3). All have names for source files and sizes (number of bytes). Images also include information about the height, the width, and the quality of the image. Texts specify the number of lines needed for visual representation. Sounds include information about the playing time of the recording, given in seconds.

Develop a data representation for these media. Then represent these three examples with objects:

1. an image, stored in `flower.gif`; size: 57,234 bytes; width: 100 pixels; height: 50 pixels; quality: medium;
2. a text, stored in `welcome.txt`; size: 5,312 bytes; 830 lines;
3. a music piece, stored in `theme.mp3`; size: 40960 bytes, playing time 3 minutes and 20 seconds.∎

```
                        // representing museum tickets
                        abstract class AMuseTicket {
                        Date d;
                        int price;
                        }

// museum tickets
class MuseAdm
  extends AMuseTicket {
  MuseAdm(Date d,
          int price) {
    this.d = d;
    this.price = price;
  }
}

// to represent time
class ClockTime {
  int hour;
  int minute;

ClockTime(int hour,
          int minute) {
    this.hour = hour;
    this.minute = minute;
  }
}
```

```
// omnimax admission
class OmniMax
  extends AMuseTicket {
  ClockTime t;
  String title;

  OmniMax(Date d,
          int price,
          ClockTime t,
          String title) {
    this.d = d;
    this.price = price;
    this.t = t;
    this.title = title;
  }
}
```

```
// laser admission
class LaserShow
  extends AMuseTicket {
  ClockTime t;
  String row;
  int seat;

  LaserShow(Date d,
            int price,
            ClockTime t,
            String row,
            int seat) {
    this.d = d;
    this.price = price;
    this.t = t;
    this.row = row;
    this.seat = seat;
  }
}
```

Figure 3: Some classes

1.7 Problem (4.3.4)

Draw a diagram for the classes in figure 3.∎

Containment in Unions

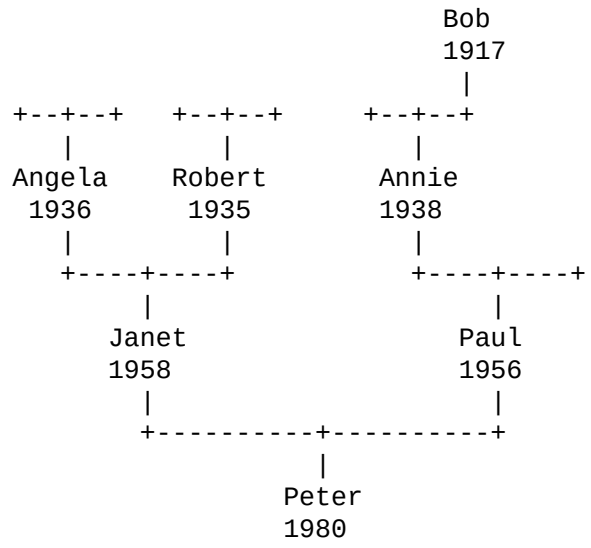


Figure 4: A family tree

1.8 Problem (5.3.1)

Consider the following problem:

> Develop a program that helps with recording a person's ancestor tree. Specifically, for each person we wish to remember the person's name and year of birth, in addition to the ancestry on the father's and the mother's side, if it is available.

See figure 4 for an example of the relevant information.

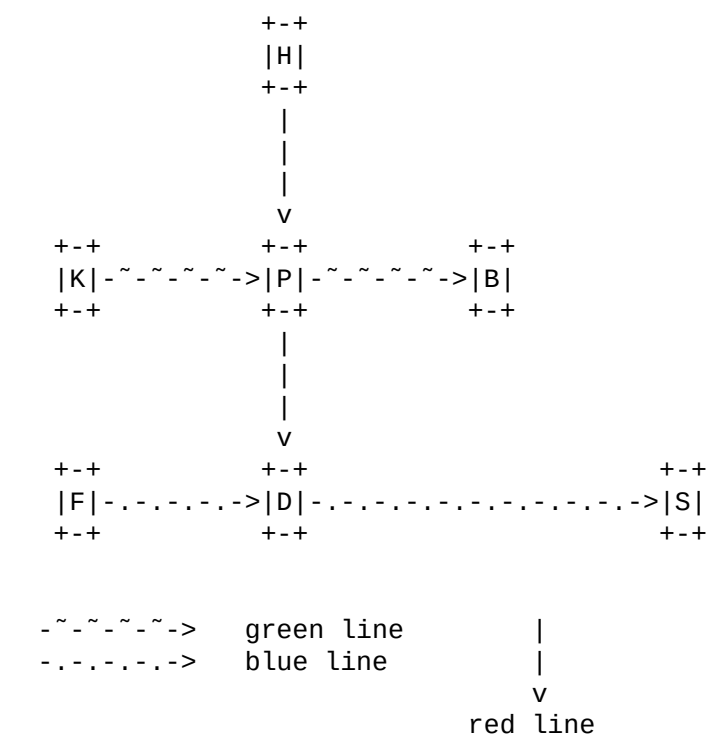
Develop the class diagram and the class definitions to represent ancestor family trees. Then translate the sample tree into an object. Also draw your family's ancestor tree as far as known and represent it as an object.∎

1.9 Challenge Problem

The figure 5 and figure 6 represent parts of two different transit systems. The system is designed so that the traveler cannot travel through a station

more than once.

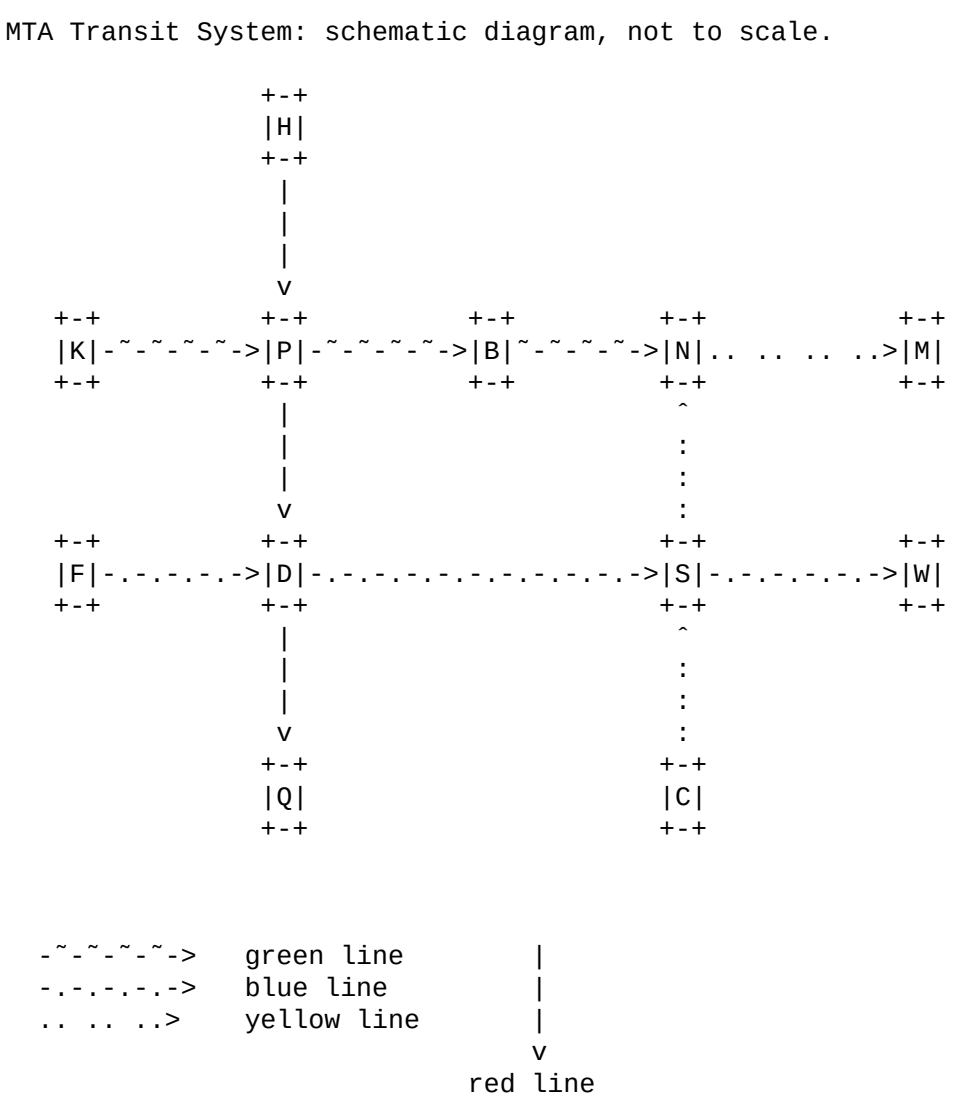
Design the class hierarchy which represents this data. Show your design in the form of a class diagram. Make examples of data that represent the transit system shown in figure 5.∎



Locations (in real life):

B 220, 100
D 200, 180
F 100, 200
H 100, 40
K 60, 120
P 140, 120
S 300, 140

Figure 5: A simple transit system diagram



Locations (in real life):

B 220, 100
C 300, 220
D 200, 180
F 100, 200
H 100, 40
K 60, 120
M 340, 40
N 300, 40
P 140, 120
Q 260, 220
S 300, 140
W 360, 180

Figure 6: A transit system diagram