## SmartCard

Passengers on a certain subway system insert a SmartCard when entering a station and when exiting at their destination station. The SmartCard, after checking some things, subtracts the cost for traveling between stations. The stations are assigned to zones and the cost depends on the travel from zone to zone. Thus, each station knows its own name and zone.

Write the Station class. Include

* Two private fields
* A default constructor
* A two-arg constructor
* getZone()
* getName()

Know that the driver will instantiate four stations in four zones in this way:

Station downtown = new Station("Downtown", 1);

Station center = new Station("Center City", 1);

Station uptown = new Station("Uptown", 2);

Station suburbia = new Station("Suburb", 4);

Write the Station class below.

Write the SmartCard class. Each SmartCard needs to store the money (the balance) and the Station where the passenger entered. A SmartCard also has a Boolean to record whether the passenger is on board the train or not. It’s principle of object oriented programming that the state of the object should always match the state of reality. For example, if the passenger leaves the station, then he/she cannot be on board the train. Nor can he/she be in the station. And so on.

* How many fields does SmartCard need?
* Make a one-arg constructor to satisfy

SmartCard buddy = new SmartCard(20.00); .

Set the other fields to the standard default values: 0 for numbers, null for the Station object, and false for the boolean.

* Include these accessor (getter) methods:

getBalance()– returns the balance on the SmartCard as a double.

getFormattedBalance()– returns the balance on the SmartCard as a String   
 formatted as dollars and cents (Ex: $10.00). Be sure to import java.text.DecimalFormat.

getIsBoarded()– this method returns a boolean value as to whether the passenger is   
 on board or not

getBoardedAt() – returns the Station where the passenger entered. Note: the   
 method returns the entire Station object, not simply the name of the Station.

Now run the driver and test what we have so far. The output might be:

getBalance() 🡪 20.0  
getIsBoarded() 🡪 false  
getBoardedAt() 🡪 null

getFormattedBalance() 🡪 $20.00

When people enter a Station and put their SmartCard into the turnstyle, the SmartCard records the Station and the fact that they have entered. When people exit a Station by putting their card into the turnstyle, their SmartCard calculates and subtracts the cost of the trip.

Implement these actions with these methods:

board(Station s)– If the passenger tries to board without having previously exited, it prints (exactly, with single spaces) "Error: already boarded?!" and returns without changing anything. If the passenger has less than $0.50 (minimum fare), it prints "Insufficient funds to board. Please add more money." and returns without changing anything. If it passes those checks, the method saves the station where the passenger boarded and updates the boarding status.

To test, have buddy board at Downtown and examine two fields on the SmartCard.

getIsBoarded() 🡪 true  
 getBoardedAt() 🡪 Station@5b480cf9

If buddy boards twice in a row, what should be printed?

If buddy’s SmartCard starts off with $0.25, what should be printed?

cost(Station s) – calculates and returns the cost to exit at this station, as follows:

* Travel within the same zone is charged 0.50
* In addition, for each zone outside the starting zone passengers go through, they pay 0.75
* To get from any zone to another zone, passengers must pass through all zones in between. For example,
  + to travel from zone 1 to zone 1 costs 0.50
  + to travel from zone 1 to zone 2 costs 1.25
  + to travel from zone 1 to zone 4 costs 2.75
  + to travel from zone 4 to zone 1 costs 2.75

Test each situation, including (of course) the ones not listed.

exit(Station s) – if the passenger tries to exit without having previously boarded, it prints (exactly, with single spaces) "Error: Did not board?!" and returns. If the cost of the travel exceeds the balance on the SmartCard, it prints "Insufficient funds to exit. Please add more money." and returns. If it passes those two checks, the method updates the balance and the boarding information, prints the names of the two cities, the cost, and the balance on the SmartCard . For example:

From Center City to Downtown costs $0.50. SmartCard has $9.50

If a passenger boards and exits at the same station, it costs $0.50.

Test each situation.

addMoney(double d)- Finally, let’s allow the passenger to add some money to the SmartCard. The method prints, e.g., “$5.00 added. Your new balance is $25.00”.

Test it.

Assume that the system will always work and that no one will lose a SmartCard between boarding and exiting. The shell is SmartCard\_Driver.java. You will turn in SmartCard which also has the Station class.