CS 284: Homework Assignment 3
Due: Wednesday, March 6th, 11:59pm

1 Assignment Policies

Collaboration Policy. Homework will be done individually: each student must hand in their own answers. It is acceptable for students to collaborate in understanding the material but not in solving the problems or programming. Use of the Internet is allowed, but should not include searching for existing solutions.

Under absolutely no circumstances code can be exchanged between students. Excerpts of code presented in class can be used.

Assignments from previous offerings of the course must not be re-used. Violations will be penalized appropriately.

2 Assignment

This assignment consists in implementing a *Rolodex*. A *Rolodex* consists of a circular list of entries. Each entry can either be a *separator* (depicted in blue in the figure) or a *card* (depicted in white in the figure). There is one separator for each letter in the alphabet. Between separators one finds cards. Each card has two data items: a name and a cellphone number. Separators are ordered alphabetically. Except, of course, for the separator for "Z" which is followed by the separator for "A". Also, all the cards that come after the separator for "A" and before the separator for "B" must have names that start with "A". Moreover, the cards between each separator are also ordered alphabetically. For example, "Adam" will appear before "Anne". If a person has multiple cellphones, then there will be multiple cards. For example, if "Anne" has two cellphones 123 and 456, then there will be two cards for Anne. Note that there is no specific ordering between cellphones that belong to Anne. It is possible for (Anne,456) to come before (Anne,123) or viceversa. But, as mentioned above, all the cards for Anne have to be placed after those for Adam.

The implementation for Rolodex is based on a double linked-list. Each node in the list is called an *entry*. Each entry will have a reference to the next entry and to the previous

entry. An entry may either be a separator or a card. The application is organized into four Java classes. Further details on these classes are listed at the end of this document:

- `Rolodex`: This is the main class. Your code will go here.
- `Entry`: Implemented for you. Abstract class.
- `Card`: Implemented for you. Subclass of `Entry`.
- `Separator`: Implemented for you. Subclass of `Entry`.

3 Implementation

3.1 Part 1: Basic Operations

You are asked to implement the operations for `Rolodex` described below. Make sure you first take a look at the detailed description of this class located at the end of this document. In particular, note that `Rolodex.toString()` is implemented for you in the stub.

The `Rolodex` class has two private fields, namely `Entry cursor` and `Entry[] index`. The former is used for the exercises described in Sec. 3.2. The latter should have 26 entries, one for each letter. Each entry should refer to the corresponding separator. For example, `index[0]` should be a reference to the separator for the letter "A", `index[1]` to the one for the letter "B", and so on. This should be setup in the constructor, as described below.

- `Rolodex()`, that creates a new Rolodex. It initializes the `index` data field by assigning each entry, between 0 and 25, with a new separator. The entry at index 0 corresponds to the letter "A", the one in entry 1 to "B" and so on. Note that the `next` field in the separator for "Z" should reference the separator for "A"
- `public Boolean contains(String name)`. Determines whether there is a card for `name`.
- `public int size()` returns the size of the Rolodex. Only cards are counted, separators do not count.
- `public ArrayList<String> lookup(String name)` returns an `ArrayList` with all the cellphones of `name` (in the order in which they occur in the Rolodex). If `name` is not in the Rolodex, then an `IllegalArgumentException` with the message `"lookup: name not found"` should be thrown.
- `public void addCard(String name, String cell)` adds a new card with the specified information to the Rolodex. If the card already exists (with the same name and cell), then a `IllegalArgumentException` with the message `"addCard: duplicate entry"` should be thrown.
- `public void removeCard(String name, String cell)` removes the specified card. You must throw an `IllegalArgumentException` with message `"removeCard: name does not exist"` if there is not card for that name. If there is a card with that name but with a different cellphone number, then you must throw an `IllegalArgumentException` with the message `"removeCard: cell for that name does not exist"`.

- `public void removeAllCards(String name)` removes all cards for `name`. You must throw an `IllegalArgumentException` with message `"removeAllCards: name does not exist"` if the name is not in the Rolodex.

Important: For all methods above that have a `name` parameter, you must only search through the cards that start with the same letter as that of the first letter of `name`. In particular, you cannot exhaustively search through the entire Rolodex.

Some examples follow.

```
public static void main(String[] args) {
        Rolodex r = new Rolodex();
        System.out.println(r);
}
```

Should print:

```
* Separator A
* Separator B
* Separator C
* Separator D
* Separator E
* Separator F
* Separator G
* Separator H
* Separator I
* Separator J
* Separator K
* Separator L
* Separator M
* Separator N
* Separator O
* Separator P
* Separator Q
* Separator R
* Separator S
* Separator T
* Separator U
* Separator V
* Separator W
* Separator X
* Separator Y
* Separator Z
```

Also, the code should print the output that follows:

```
public static void main(String[] args) {
        Rolodex r = new Rolodex();
        r.addCard("Chloe", "123");
        r.addCard("Chad", "23");
        r.addCard("Cris", "3");
```

```
        r.addCard("Cris", "4");
        r.addCard("Cris", "5");
        r.addCard("Maddie", "23");
        System.out.println(r);
}
```

```
* Separator A
* Separator B
* Separator C
Name: Chad, Cell: 23
Name: Chloe, Cell: 123
Name: Cris, Cell: 5
Name: Cris, Cell: 4
Name: Cris, Cell: 3
* Separator D
* Separator E
* Separator F
* Separator G
* Separator H
* Separator I
* Separator J
* Separator K
* Separator L
* Separator M
Name: Maddie, Cell: 23
* Separator N
* Separator O
* Separator P
* Separator Q
* Separator R
* Separator S
* Separator T
* Separator U
* Separator V
* Separator W
* Separator X
* Separator Y
* Separator Z
```

The code:

```
public static void main(String[] args) {
        Rolodex r = new Rolodex();
        r.addCard("Chloe", "123");
        r.addCard("Chad", "23");
        r.addCard("Cris", "3");
        r.addCard("Cris", "4");
        r.addCard("Cris", "5");
        r.addCard("Maddie", "23");
```

```
        r.removeAllCards("Cris");
        System.out.println(r);
}
```

will produce:

```
* Separator A
* Separator B
* Separator C
Name: Chad, Cell: 23
Name: Chloe, Cell: 123
* Separator D
* Separator E
* Separator F
* Separator G
* Separator H
* Separator I
* Separator J
* Separator K
* Separator L
* Separator M
Name: Maddie, Cell: 23
* Separator N
* Separator O
* Separator P
* Separator Q
* Separator R
* Separator S
* Separator T
* Separator U
* Separator V
* Separator W
* Separator X
* Separator Y
* Separator Z
```

3.2 Part 2: A Simple Cursor

In order to browse through a Rolodex the following operations are to be implemented.

- `public void initializeCursor()`
- `public void nextSeparator()`
- `public void nextEntry()`
- `public String currentEntryToString();`

Here is sample code that shows how these operations may be used to browse through the first 12 entries of the Rolodex:

```
r.initializeCursor();
for (int i=0; i<12; i++) {
        System.out.println(r.currentEntryToString());
        r.nextEntry();
}
```

You are asked to implement them:

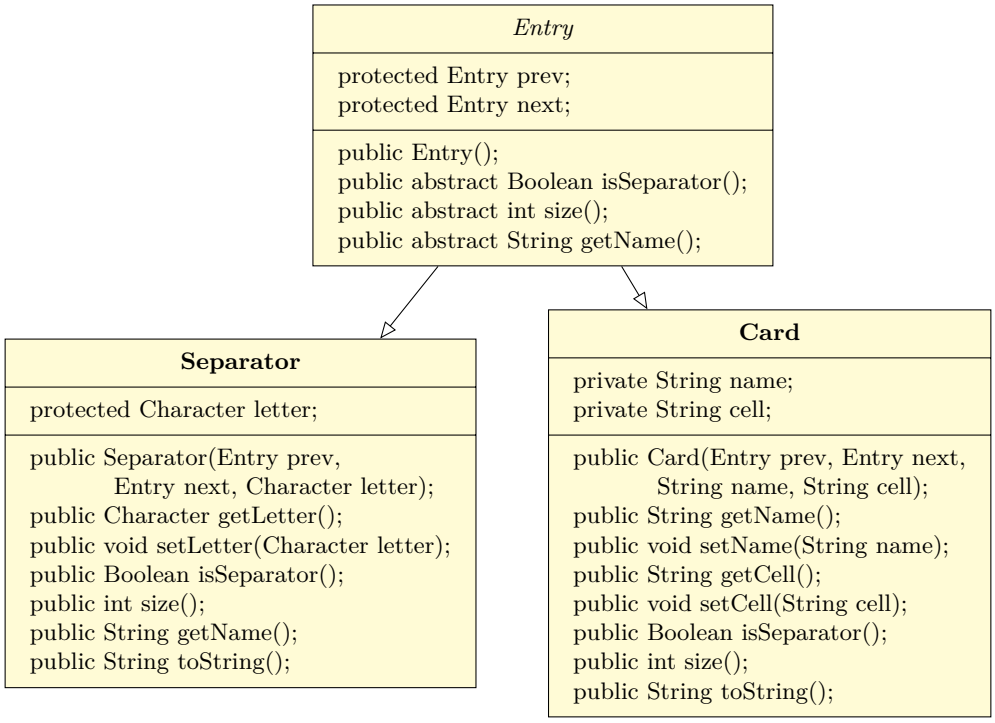
- `public void initializeCursor()` sets the `cursor` field to the separator for "A".
- `public void nextSeparator()` moves cursor to the next separator.
- `public void nextEntry()` moves cursor to the next entry, which could be card or a separator.
- `public String currentEntryToString()` returns the string representation of the current entry pointed to by the cursor.

4 Submission instructions

Submit a single file named `Rolodex.zip` through Canvas that includes all files in stub (which must have been completed according to the instructions above) and a file `RolodexTest.java` with your test cases. No report is required. Your grade will be determined as follows:

- You will get 0 if your code does not compile.
- We will try to feed erroneous and inconsistent inputs to all methods. All arguments should be checked.
- Your code must include documentation (Javadoc is recommended) and a header with your name, section, and the Stevens honor pledge.
- The code must implement the following UML diagram precisely.

The UML diagram of the abstract class `Entry` (italic typeface below indicates it is abstract) together with its subclasses (indicated with the arrow) `Card` and `Separator` are given below:



The class `Rolodex` should include the following operations: