

# CSE143—Computer Programming II

## Programming Assignment #3

### due: Thursday, 4/18/24, 11 pm

This assignment will give you practice with linked lists. You are to write a class `AssassinManager` that allows a client to manage a game of assassin. Each person playing assassin has a particular target that he/she is trying to assassinate. One of the things that makes the game more interesting to play is that initially each person knows only who they are assassinating (they don't know who is trying to assassinate them nor do they know who other people are trying to assassinate). You are working on a program for the “game administrator” who needs to keep track of who is stalking whom and the history of who killed whom.

The game of assassin is played as follows. You start out with a group of people who want to play the game. For example, let's say that we have five people playing whose names are Joe, Sally, Jim, Carol and Chris. A circular chain of assassination targets is established (what is called the “kill ring” in the sample log of execution). For example, we might decide Joe should stalk Sally, Sally should stalk Jim, Jim should stalk Carol, Carol should stalk Chris and Chris should stalk Joe.

```

Joe --> Sally --> Jim --> Carol --> Chris
  ^                               |
  |                               v
+-----<-----<-----<-----<-----+

```

When someone is assassinated, the chain needs to be relinked by “skipping” that person. For example, suppose that Jim is assassinated first (obviously this would have been by Sally). Sally needs a new target, so we give her Jim's target: Carol. Thus, the chain becomes:

```

+----->-----+
  ^               |
  |               v
Joe --> Sally    Jim    Carol --> Chris
  ^                               |
  |                               v
+-----<-----<-----<-----<-----+

```

The main program has been written for you and is called `AssassinMain`. It reads a file of names, shuffles the names, and constructs an object of type `AssassinManager`. You are writing the `AssassinManager` class. The main program then asks the user for the names of the victims in order until the game is over (until there is just one player left alive), calling methods of the `AssassinManager` class to carry out the tasks involved in administering the game.

Your class will keep track of two different lists: the list of those currently alive and the list of those who are dead. Each is to be stored in a linked list. We are requiring you to use our node class which is called `AssassinNode`. The `AssassinNode` class has three data fields: one for the name of the person, one for the name of the killer and a “next” field to keep track of the next value in the list. The `AssassinNode` class appears at the end of this write-up.

The constructor for the `AssassinManager` class will be passed an object of type `List<String>`. You can manipulate this object the same way you would manipulate an `ArrayList<String>`. So you can call methods like `size` and `get` and you can write a for-each loop using this object, but you are not allowed to modify it. You will need to include the following line at the beginning of your class to have access to `List`:

```
import java.util.*;
```

Your class should have the following public methods.

Method	Description
AssassinManager(List<String> names)	This is your method for constructing an assassin manager object. It should add the names from the list into the kill ring in the same order in which they appear in the list. For example, if the list contains {"John", "Sally", "Fred"}, then in the initial kill ring we should see that John is stalking Sally who is stalking Fred who is stalking John (reported in that order). You may assume that the names are nonempty strings and that there are no duplicate names (ignoring case). Your method should throw an IllegalArgumentException if the list is empty.
void printKillRing()	This method should print the names of the people in the kill ring, one per line, indented four spaces, with output of the form "<name> is stalking <name>". If there is only one person in the ring, it should report that the person is stalking themselves (e.g., "John is stalking John").
void printGraveyard()	This method should print the names of the people in the graveyard, one per line, indented four spaces, with output of the form "<name> was killed by <name>". It should print the names in reverse kill order (most recently killed first, then next more recently killed, and so on). It should produce no output if the graveyard is empty.
boolean killRingContains(String name)	This should return true if the given name is in the current kill ring and should return false otherwise. It should ignore case in comparing names.
boolean graveyardContains(String name)	This should return true if the given name is in the current graveyard and should return false otherwise. It should ignore case in comparing names.
boolean gameOver()	This should return true if the game is over (i.e., if the kill ring has just one person in it) and should return false otherwise.
String winner()	This should return the name of the winner of the game. It should return null if the game is not over.
void kill(String name)	This method records the killing of the person with the given name, transferring the person from the kill ring to the graveyard. This operation should not change the kill ring order of printKillRing (i.e., whoever used to be printed first should still be printed first unless that's the person who was killed, in which case the person who used to be printed second should now be printed first). It should throw an IllegalArgumentException if the given name is not part of the current kill ring and it should throw an IllegalStateException if the game is over (it doesn't matter which it throws if both are true). It should ignore case in comparing names.

This is meant to be an exercise in implementing linked lists that are like the built-in `LinkedList<E>` (you are not allowed to use the built-in structure because you are implementing your own). In implementing this structure, you will be required to adhere to the following rules:

- You must use our `AssassinNode` class for your lists. You are not allowed to modify it.
- You may not construct any arrays or `ArrayLists` or other data structures to solve this problem. You must solve it using linked sequences of `AssassinNode` objects. You can examine the list of `Strings` passed to the constructor, but you are not allowed to modify it.
- If there are  $n$  names in the list of `Strings` passed to your constructor, you should ask for a new `AssassinNode` exactly  $n$  times. This means that as people are killed, you have to move their node from the kill ring to the graveyard without creating any new nodes.

The main effect of the rules above is that your constructor will create an initial set of nodes (the initial kill ring) and then your class will not create any more nodes for the rest of the program execution. That means that you need to solve the problem of moving people from the kill ring to the graveyard by rearranging references, not by creating new nodes. You are allowed to declare local variables of type `AssassinNode` (like “current” and “prev” in handout 5) because otherwise you can’t solve the problem at all. Local variables of type `AssassinNode` are not the same as node objects and, therefore, don’t count against the limit of  $n$  nodes.

For this assignment we are specifying what data fields you should have in your class. You should have exactly two data fields: a reference to the front of the kill ring and a reference to the front of the graveyard. You are not allowed to have any other data fields.

In lecture and section we have been looking at nodes of type `ListNode` that have just two fields: a field called `data` of type `int` and a field called `next` that points to the next value in the list. The `AssassinNode` class has three fields. The first two are fields for storing data called `name` and `killer` (they are used to store the name of a player and the name of the person who killed that player). The third field is called `next` and it serves the same purpose as the `next` field in the `ListNode` class.

For this particular program, it is intuitive to store the kill ring in what is known as a “circular” linked list. Normally lists have the value “null” stored in the `next` field of the last node of the list. Such lists are known as “null terminated” lists. In a circular list, the final element stores a reference to the first element in the list. But most novices find it difficult to work with a circular list, especially since all of our examples involve null-terminated lists. **There is no need to use a circular list to solve the problem, so you are encouraged to solve it with a null-terminated list.** If you feel strongly that you want to attempt the circular list, you are allowed to do so, but it is likely to make the program harder to write.

You will want to write your own testing program (`AssassinMain`, for example, never generates any of the exceptions you have to handle). When your class is in good shape, you can use the `AssassinMain` program to make sure it works properly. A log of execution for `AssassinMain` appears at the end of this write-up. Your program should exactly reproduce the format and general behavior demonstrated in the log.

In terms of correctness, your class must provide all of the functionality described above and satisfy all of the constraints mentioned in this writeup. In terms of style, we will be grading on your use of comments, good variable names, consistent indentation and good coding style to implement these operations.

You should name your file `AssassinManager.java` and should turn it in electronically from the “homework” link on the class web page. A collection of files needed for the assignment is included on the web page, including several name files and several logs of execution. You will need to have `AssassinNode.java`, `AssassinMain.java`, and whatever names file you are using all in the same directory as your `AssassinManager.java` in order to run `AssassinMain`. You can use the output comparison tool to check your output.

## Using jGRASP

In jGRASP you can use a structure viewer to see what your list looks like (you do so by dragging one of your fields from the debug window outside the window and jGRASP will launch a viewer). This viewer will show you the structure of the list, but won't show you the contents of the nodes. You can fix this by selecting the wrench icon ("Configure the structure to view mapping"). Under "Value Expressions" say:

```
_node_.name
```

Then click on apply and you should see the names in the nodes. You can also adjust settings like the Width (to see more of the name) or Scale (to stretch or shrink the diagram).

## AssassinNode Class

```
// The AssassinNode class is used to store the information for one
// player in the game of assassin. Initially the "killer" field
// is set to null, but when the person is killed, this should be
// set to the name of the killer.
```

```
public class AssassinNode {
    public String name;          // this person's name
    public String killer;       // name of who killed this person
    public AssassinNode next;   // next node in the list

    // constructs a node with the given name and a null link
    public AssassinNode(String name) {
        this(name, null);
    }

    // constructs a node with the given name and link
    public AssassinNode(String name, AssassinNode next) {
        this.name = name;
        this.killer = null;
        this.next = next;
    }
}
```

## Log of execution (user input underlined)

Welcome to the CSE143 Assassin Manager

What name file do you want to use this time? names3.txt  
Do you want the names shuffled? (y/n)? n

Current kill ring:  
Athos is stalking Porthos  
Porthos is stalking Aramis  
Aramis is stalking Athos

Current graveyard:

next victim? Aramis

Current kill ring:  
Athos is stalking Porthos  
Porthos is stalking Athos  
Current graveyard:  
Aramis was killed by Porthos

next victim? Athos

Game was won by Porthos  
Final graveyard is as follows:  
Athos was killed by Porthos  
Aramis was killed by Porthos