



Warning: Redistribution or publication of this document or its text, by any means, is strictly prohibited. Additionally, publishing the solution publicly, at any point of time, will result in an immediate filing of an academic misconduct.

Purpose: The purpose of this assignment is to allow you practice Linked Lists, along with other previous topics.

Note: You are **NOT** allowed to use any built-in types (such as Lists, Hash Tables, Hash Maps, Collections, etc.).

Use of any of these built-in types will result in a grade of zero.

The Cell Phones Records

In this assignment, you are required to write a program, using your own-created linked lists, that manipulates a set of records of cell phones and performs some operations on these records.

I) The **CellPhone** class has the following attributes: a `serialNum` (long type), a `brand` (String type), a `year` (int type, which indicates manufacturing year) and a `price` (double type). It is assumed that brand name is always recorded as a single word (i.e. Motorola, SonyEricsson, Panasonic, etc.). It is also assumed that all cellular phones follow one system of assigning serial numbers, regardless of their different brands, so no two cell phones may have the same serial number.

You are required to write the implementation of the **CellPhone** class. Beside the usual mutator and accessor methods (i.e. `getPrice()`, `setYear()`) the class must have the following:

- (a) Parameterized constructor that accepts four values and initializes *serialNum*, *brand*, *year* and *price* to these passed values;
- (b) Copy constructor, which takes two parameters, a **CellPhone** object and a long value. The newly created object will be assigned all the attributes of the passed object, with the exception of the serial number. *serialNum* is assigned the value passed as the second parameter to the constructor. It is always assumed that this value will correspond to the unique serial number rule;
- (c) `clone()` method. This method will prompt the user to enter a new serial number, then creates and returns a clone of the calling object with the exception of the serial number, which is assigned the value entered by the user;
- (d) Additionally, the class should have a `toString()` and an `equals()` methods. Two cell phones are equal if they have the same attributes, with the exception of the serial number, which could be different.

II) The file **Cell_Info.txt**, which one of its versions is provided with this assignment, has the information of various cell phone objects. The file may have zero or more records. The information stored in this file is always assumed to be correct and following the unique serial number rule. A snapshot of the contents of the `Cell_info.txt` file is shown in Figure 1 below.

```
Cell_Info - Notepad
File Edit View

3890909 Samsung      987.28 2022
2787985 Acer         572.20 2013
4900088 LG           232.99 2008
1989000 Nokia        237.24 2006
0089076 Sharp         564.22 2009
2887685 Motorola      569.28 2012
7559090 Panasonic     290.90 2005
2887460 Siemens       457.28 2009
2887685 Apple         569.28 2015
6699001 Lenovo        237.29 2012
9675654 Nokia        388.00 2009
1119002 Motorola      457.28 2008
5000882 Apple         977.27 2020
8888902 Samsung       810.35 2017
5890779 Motorola      457.28 2007
7333403 BenQ          659.00 2009
2999900 Siemens       457.28 2006
6987612 HTC           577.25 2009
8888902 BenQ          410.35 2009
8006832 Motorola      423.22 2019
5555902 SonyEricsson  177.11 2007
9873330 Nokia        677.90 2010
8888902 BenQ          410.35 2009
5909887 Apple         726.99 2017
2389076 BlackBerry    564.22 2010
1119000 SonyEricsson  347.94 2009

Ln 20, Col 31
```

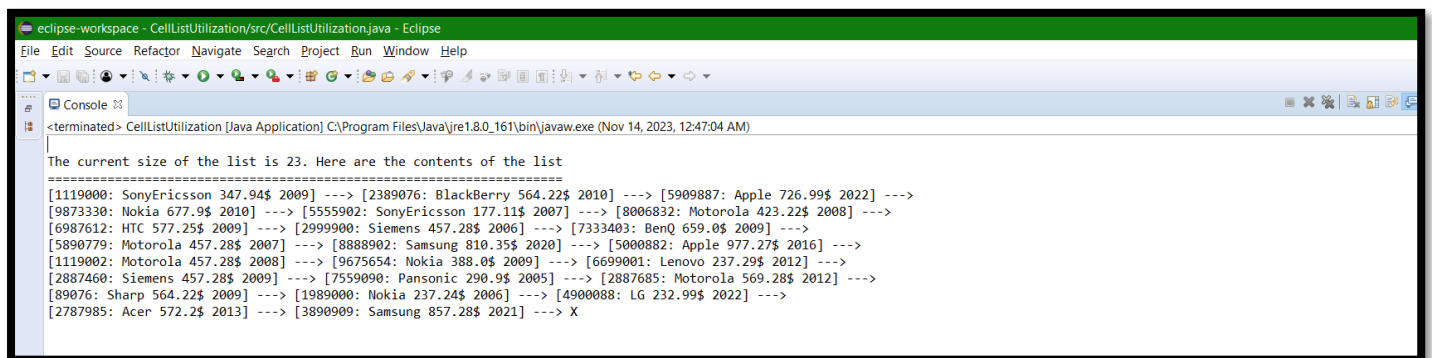
Figure 1: Cell_info.txt

III) The `CellList` class has the following:

- (a) An inner class called `CellNode`. This class has the following:
 - i. Two private attributes: an object of `CellPhone` and a pointer to a `CellNode` object;
 - ii. A default constructor, which assigns both attributes to `null`;
 - iii. A parameterized constructor that accepts two parameters, a `CellPhone` object and a `CellNode` object, then initializes the attributes accordingly;
 - iv. A copy constructor;
 - v. A `clone()` method;
 - vi. Other mutator and accessor methods.
- (b) A private attribute called `head`, which should point to the first node in this list object;
- (c) A private attribute called `size`, which always indicates the current size of the list (how many nodes are in the list);
- (d) A default constructor, which creates an empty list;
- (e) A copy constructor, which accepts a `CellList` object and creates a copy of it;
- (f) A method called `addToStart()`, which accepts one parameter, an object from `CellPhone` class. The method then creates a node with that passed object and inserts this node at the head of the list;
- (g) A method called `insertAtIndex()`, which accepts two parameters, an object from `CellPhone` class, and an integer representing an index. If the index is not valid (a valid index must have a value between 0 and `size-1`), the method must throw a `NoSuchElementException` and terminate the program. If the index is valid, then the

method creates a node with the passed `CellPhone` object and inserts this node at the given index. The method must properly handle all special cases;

- (h) A method called `deleteFromIndex()`, which accepts one integer parameter representing an index. Again, if the index is not valid, the method must throw a `NoSuchElementException` and terminate the program. Otherwise; the node pointed by that index is deleted from the list. The method must properly handle all special cases;
- (i) A method called `deleteFromStart()`, which deletes the first node in the list (the one pointed by `head`). All special cases must be properly handled.
- (j) A method called `replaceAtIndex()`, which accepts two parameters, an object from `CellPhone` class, and an integer representing an index. If the index is not valid, the method simply returns; otherwise the object in the node at the passed index is to be replaced by the passed object;
- (k) A method called `find()`, which accepts one parameter of type `long` representing a serial number. The method then searches the list for a node with a cell phone with that serial number. If such an object is found, then the method returns a pointer to that node where the object is found; otherwise, the method returns `null`. The method must keep track of how many iterations were made before the search finally finds the phone or concludes that it is not in the list;
- (l) A method called `contains()`, which accepts one parameter of type `long` representing a serial number. The method returns `true` if an object with that serial number is in the list; otherwise, the method returns `false`;
- (m) A method called `showContents()`, which displays the contents of the list, in a similar fashion to what is shown in Figure 2 below.
- (n) A method called `equals()`, which accepts one parameter of type `CellList`. The method returns `true` if the two lists contain similar objects; otherwise the method returns `false`. Recall that two `CellPhone` objects are equal if they have the same values with the exception of the serial number, which can, and actually is expected to be, different.



```
<terminated> CellListUtilization [Java Application] C:\Program Files\Java\jre1.8.0_161\bin\javaw.exe (Nov 14, 2023, 12:47:04 AM)

The current size of the list is 23. Here are the contents of the list
=====
[1119000: SonyEricsson 347.94$ 2009] ---> [2389076: BlackBerry 564.22$ 2010] ---> [5909887: Apple 726.99$ 2022] --->
[9873330: Nokia 677.9$ 2010] ---> [5555902: SonyEricsson 177.11$ 2007] ---> [8006832: Motorola 423.22$ 2008] --->
[6987612: HTC 577.25$ 2009] ---> [2999900: Siemens 457.28$ 2006] ---> [7333403: BenQ 659.0$ 2009] --->
[5890779: Motorola 457.28$ 2007] ---> [8888902: Samsung 810.35$ 2020] ---> [5000882: Apple 977.27$ 2016] --->
[1119002: Motorola 457.28$ 2008] ---> [9675654: Nokia 388.0$ 2009] ---> [6699001: Lenovo 237.29$ 2012] --->
[2887460: Siemens 457.28$ 2009] ---> [7559090: Panasonic 290.9$ 2005] ---> [2887685: Motorola 569.28$ 2012] --->
[89076: Sharp 564.22$ 2009] ---> [1989000: Nokia 237.24$ 2006] ---> [4900088: LG 232.99$ 2022] --->
[2787985: Acer 572.2$ 2013] ---> [3890909: Samsung 857.28$ 2021] ---> X
```

Figure 2: Sample of Displaying the Contents of a CellList

→ Finally, here are some general rules that you must consider when implementing the above methods:

- Whenever a node is added or deleted, the list size must be adjusted accordingly;
- All special cases must be handled, whether or not the method description explicitly states that;
- All `clone()` and copy constructors must perform a deep copy; no shallow copies are allowed;
- If any of your methods allows a privacy leak, you must clearly place a comment at the beginning of the method 1) indicating that this method may result in a privacy leak 2) explaining the reason behind the privacy leak. Please keep in mind that you are not required to implement these proposals;

IV) Now, you are required to write a public class called **CellListUtilization**. In the `main()` method, you must do the following:

- (a) Create at least two empty lists from the `CellList` class;
- (b) Open the `Cell_Info.txt` file, and read its contents line by line. Use these records to initialize one of the `CellList` objects you created above. You can simply use the `addToStart()` method to insert the read objects into the list. However, the list should not have any duplicate records, so if the input file has duplicate entries, which is the case in the file provided with the assignment for instance, your code must handle this case so that each record is inserted in the list only once;
- (c) Show the contents of the list you just initialized;
- (d) Prompt the user to enter a few serial numbers and search the list that you created from the input file for these values. Make sure to display the number of iterations performed;
- (e) Following that, you must create enough objects to test each of the constructors/methods of your classes. The details of this part are left as open to you. You can do whatever you wish as long as your methods are being tested including some of the special cases.

General Guidelines When Writing Programs:

- Include the following comments at the top of your source codes
// -----
// Assignment (include number)
// Question: (include question/part number, if applicable)
// Written by: (include your name and student id)
// -----
- In a comment, give a general explanation of what your program does. As the programming questions get more complex, the explanations will get lengthier.
- Include comments in your program describing the main steps in your program.
- Display a welcome message which includes your name(s).
- Display clear prompts for users when you are expecting the user to enter data from the keyboard.
- All output should be displayed with clear messages and in an easy to read format.
- End your program with a closing message so that the user knows that the program has terminated.

JavaDoc Documentation:

Documentation for your program must be written in **JavaDoc**.

In addition, the following information must appear at the top of each file:

```
Name(s) and ID(s)      (include full names and IDs)
COMP249
Assignment #           (include the assignment number)
Due Date               (include the due date for this assignment)
```

Submitting Assignment 3

- For this assignment, you are allowed to work individually, or in a group of a maximum of 2 students (i.e. you and one other student). Groups of more than 2 students = zero mark for all members! Submit only ONE version of an assignment. If more than one version is submitted the first one will be graded and all others will be disregarded.
- Students will have to submit their assignments (one copy per group) using Moodle. Assignments must be submitted in the right submission folder of the assignments. **Assignments uploaded to an incorrect folder will not be marked and result in a zero mark. No resubmissions will be allowed.**
- **Naming convention for zip file:** Create one zip file, containing all source files and produced documentations for your assignment using the following naming convention:
The zip file should be called *a#_StudentName_StudentID*, where # is the number of the assignment and *StudentName/StudentID* is your name and ID number respectively. Use your “official” name only - no abbreviations or nicknames; capitalize the usual “last” name. Inappropriate submissions will be heavily penalized. For example, for the first assignment, student 12345678 would submit a zip file named like: *a1_Mike-Simon_123456.zip*. If working in a group, the name should look like: *a1_Mike-Simon_12345678-AND-Linda-Jackson_98765432.zip*.

- If working in a team, only one of the members can upload the assignment. Do NOT upload the file for each of the members!

IMPORTANT (Please read very carefully): Additionally, which is very important, a demo will take place with the markers afterwards. Markers will inform you about the details of demo time and how to book a time slot for your demo. If working in a group, both members must be present during demo time. Different marks may be assigned to teammates based on this demo.

- **If you fail to demo, a zero mark is assigned regardless of your submission.**
- **If you book a demo time, and do not show up, for whatever reason, you will be allowed to reschedule a second demo but a penalty of 50% will be applied.**
- **Failing to demo at the second appointment will result in zero marks and no more chances will be given under any conditions.**

<p style="text-align: center;"><u>Evaluation Criteria</u> Evaluation Criteria for Assignment 3</p>
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Total (10 points)	
Design and Corretness of Classes	6.5pts
clone methods	1pt
Proper and Sufficient Testing of Your Methods	2 pts
Privay Leak Comments and Proposals to Avoid Them	0.5 pts