

# PRO192: OOP in Java

## Assignment

### Learning outcome:

Upon successful completion of this assignment, you will have demonstrated the abilities to:

- Uses streams to read and write data from/to different types of sources/targets
- Identify classes, objects, members of a class, and relationships among them needed for a specific problem
- Explain the concept and demonstrates the use of Polymorphism, Encapsulation, Abstraction, and Inheritance in java
- Understand and implement a complete program using a collection framework
- Describe to your instructor what you have learned in completing this workshop.

### Scenario

The car showroom, named Minh Trang BMW, has a list of BMW cars. BMW brands are stored in a text file, named **brands.txt**, and cars are stored in a text file, named **cars.txt** as following:

File brands.txt	Description
B7-2018, BMW 730Li (2018), Harman Kardon: 3.749 B7-MS, BMW 730Li M Sport, Harman Kardon: 4.319 B7-MS20, BMW 730Li M Sport (2020), Harman Kardon: 4.369 B7-PE, BMW 730Li Pure Excellence, Harman Kardon: 4.929 B5-18, BMW 530i (2018), Alpine: 2.599 B7019, BMW 530i (2019) , Alpine: 2.729 BX4-18, BMW X4 xDrive20i (2018), Sony: 2.799 BX4-17, BMW X4 xDrive20i (2019) , Sony: 2.899 B3-GT18, BMW 320i GT (2018), Bose: 1,799 B3-S19, BMW 320i Sportline (2019), Bose: 1.899 B5-X19, BMW X5 xDrive40i XLine (2019), Bose: 4.199 B5-X20, BMW X5 xDrive40i XLine (2020), Bose: 4.239	Information in a line: <ID, brand name, sound brand: price>

File cars.txt	Description
C01, B7-2018, red, F12345, E12345 C02, B7-2018, black, F12346, E12346 C03, B7-MS, orange, F12347, E12347 C04, B7-MS20, white, F12348, E12348 C05, B7-PE, pink, F12349, E12349 C06, B5-18, pink, F12350, E12350 C07, B5-X20, grey, F12351, E12351	Information of a line: <ID, brand ID, color, frame ID, engine ID>

### Problem requirements

The manager of the showroom needs a Java console application in which operations must be supported:

- 1- List all brands
- 2- Add a new brand
- 3- Search a brand based on its ID
- 4- Update a brand
- 5- Save brands to the file, named brands.txt
- 6- List all cars in ascending order of brand names
- 7- List cars based on a part of an input brand name
- 8- Add a car
- 9- Remove a car based on its ID
- 10- Update a car based on its ID
- 11- Save cars to file, named cars.txt

## Constraints

### 1- Constraints on brands:

- a. Brand ID can not be duplicated.
- b. The brand name can not be blank.
- c. The sound manufacturer can not be blank.
- d. The price must be a positive real number.

### 2- Constraints on cars:

- a. Car ID can not be duplicated.
- b. Brand ID must have existed and it must be inputted using a menu.
- c. Color can not be blank.
- d. Frame ID can not be blank and must be in the "F00000" format and can not be duplicated.
- e. Engine ID can not be blank and must be in the "E00000" format and can not be duplicated.

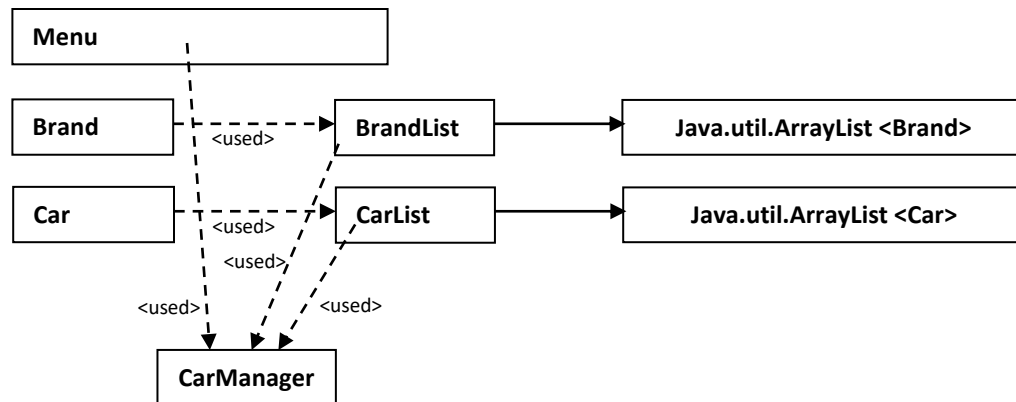
## Analysis

From the problem description, main concepts and their details are identified:

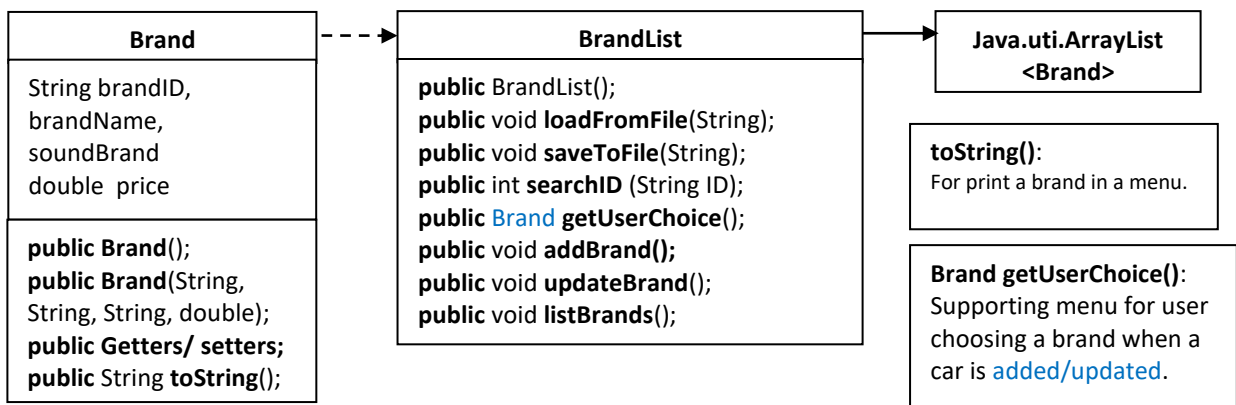
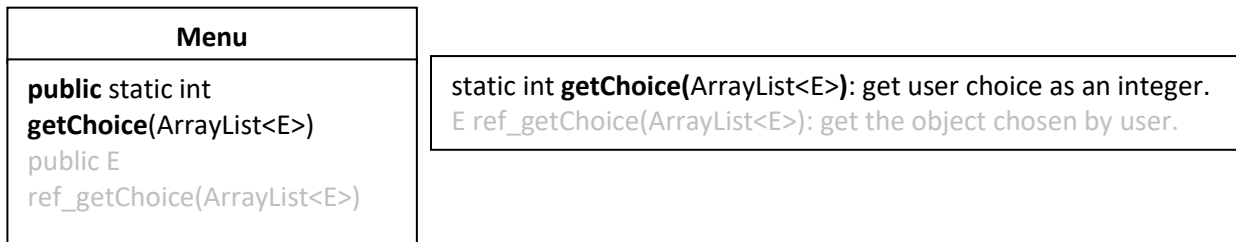
Concept	Detail
Brand	Brand ID, brand name, sound brand, price
List of brands	
Car	Car ID, brand ID, color, frame ID, engine ID
List of cars	
Menu	A list of objects
Program	A menu, a list of brands, a list of cars

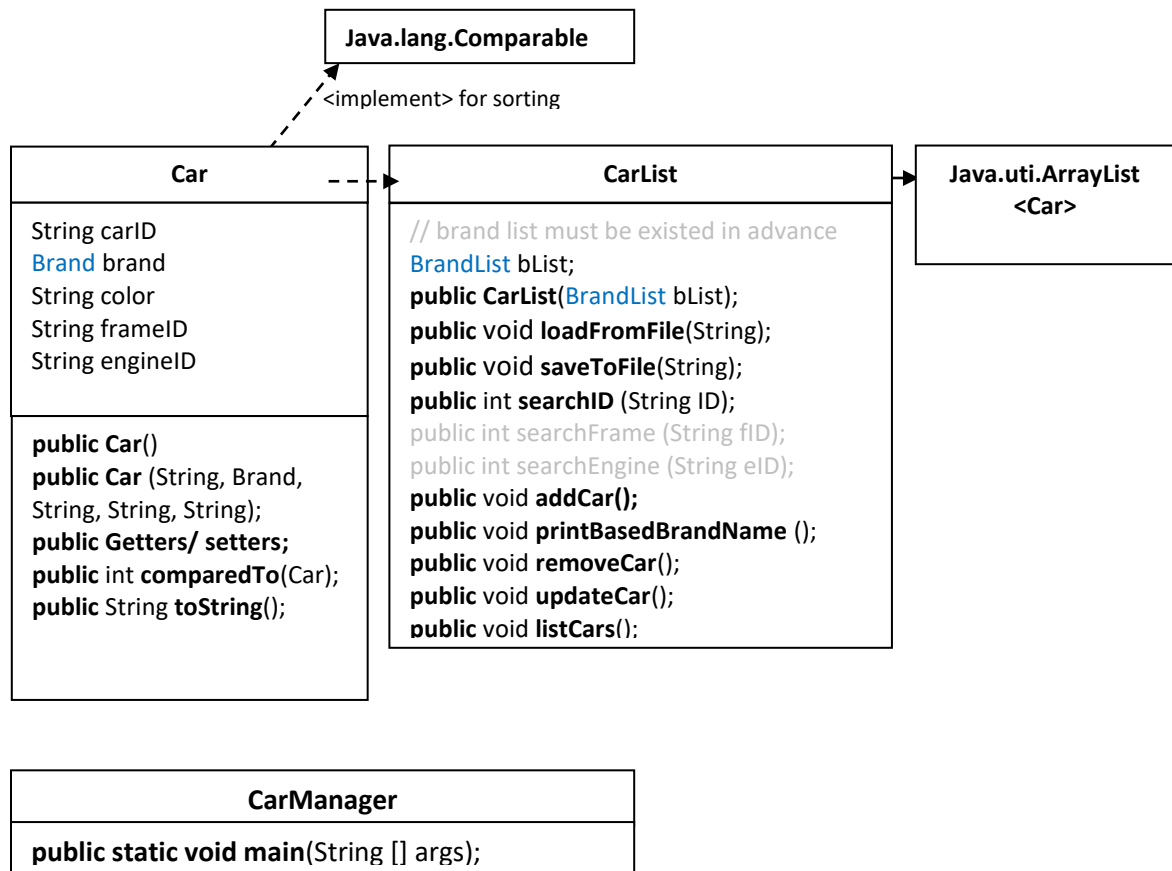
# Design

## 1- Class Design outline



## 2- Class Design in Details

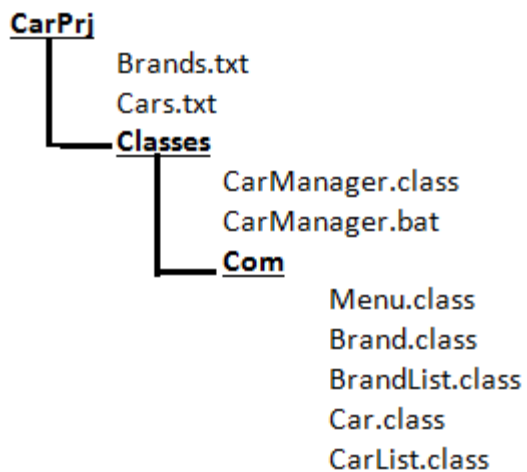




### 3- Software Structure design

Project name: CarPrj

Package structure:



#### 4- Main Algorithm

Class: Menu	Description and main idea of an algorithm
<b>public static int getChoice</b> (ArrayList<E> options)	Get user choice as an integer: int response; n = size of the list options; for i = 0 ... n print out (i+1) + options.get(i); print out " Please choose an option 1...n:" receive response; return response;
E ref_getChoice(ArrayList<E> options)	Get user choice as an object in the list: int response; int n = size of the list options; do { response = int_getChoice(options) } while ( response<0    response>n); return options.get(response-1);

Class: Brand	Description and main idea of an algorithm
<b>public String toString()</b>	return a string in the template: < brandID, brandName, soundBrand: price>

Class: BrandList	Description and main idea of an algorithm
<b>public void loadFromFile</b> (String filename)	File f = new File (filename); if (f does not exist) exit the program; else { open file in text format for reading line-by-line; while ( a line is read from file) { split the read line into parts; create a brand from input data(parts); add the brand to this list; } close the file; }
<b>public void saveToFile</b> (String filename);	open the file based on the filename to write data in line-by-line text format; for each brand in the list { write the brand to file + "\n"; } close the file;
<b>public int searchID</b> (String bID);	Search a brand based on brand ID, return the existence position(int) n = size of the list; for i = 0 ... n-1 if (this.get(i).brandID == bID) return i; return -1;

<b>public Brand getUserChoice();</b>	Transform the list to a menu, the user will choose a brand from this menu. choice = Menu.getChoice(this); return this.get(choice-1);
<b>public void addBrand()</b>	Add a new Brand to the list. receive String ID, constraint: input ID can not exist in the list receive String brandName, the brand name is not blank receive String soundBrand, the sound brand is not blank receive double price, price >0 create a new brand from inputted data; add a new brand to the list.
<b>public void updateBrand();</b>	Update brand_name, sound_brand, price of an existed brand. receive brandID; pos = searchID (brandID); if pos<0 print out "Not found!"; else{ receive String brandName, the brand name is not blank receive String soundBrand, the sound brand is not blank receive double price, price >0 update new brandName, new sound brand, new price to the pos(th) brand. }
<b>public void listBrands();</b>	n = size of the list; for i = 0 ... n-1 print out this.get(i);

<b>Class: Car</b>	<b>Description and main idea of an algorithm</b>
<b>public int comparedTo(Car c);</b>	Used in the operation ops listing cars in ascending order of brand names. int d = this.brand.brandName.compareTo(c.brand.brandName); if (d!=0) return d; // they are in the same brand, comparing based on their ID return this.carID.compareTo(c.carID);
<b>public String toString()</b>	return a string in the template: < carID, brand, color, frameID, engineID>

<b>Class: CarList</b>	<b>Description and main idea of an algorithm</b>
<b>public CarList(BrandList bList);</b>	Initialize a list based on the existed brand list; brandList=bList;
<b>public void loadFromFile(String filename);</b>	File f = new File (filename); if (f doesn't exist) return false; else { open file in text format for reading line-by-line; while ( a line is read from file) { split the read line into parts; extract parts to carID, brandID, color, frameID, engineID

	<pre> int pos= brandList.searchID(brandID); Brand b = brandList.get(pos); create new car with data above; add new car to the list; } close the file; } </pre>
<b>public void saveToFile(String);</b>	<pre> open the file based on the filename to write data in line-by-line in text format; for each car in the list {     write the car to file + "\n"; } close the file; </pre>
<b>public int searchID (String carID);</b>	<pre> Search a car based on car ID, return the existence position(int) n = size of the list; for i = 0 ... n-1     if (this.get(i). carID == carID) return i; return -1; </pre>
<b>public int searchFrame (String fID);</b>	<pre> Search a car by its frame ID. Use in checking frames are not duplicated. n = size of the list; for i = 0 ... n-1     if (this.get(i).frameID == fID) return i; return -1; </pre>
<b>public int searchEngine (String eID);</b>	<pre> Search a car by its engine ID. Use in checking engines are not duplicated. n = size of the list; for i = 0 ... n-1     if (this.get(i).engineID == eID) return i; return -1; </pre>
<b>public void addCar();</b>	<pre> Add a new Car to the list. receive carID, carID must be not duplicated // for choosing a brand Brand b = brandList.getUserChoice(); receive color, color can not be blank receive frameID. It must be in the "F00000" format and not be duplicated receive engineID. It must be in the "E00000" format and not be duplicated create a new car with inputted data; add a new car to the list </pre>
<b>public void printBasedBrandName();</b>	<pre> receive aPartOfBrandName; n = size of the list; int count = 0; for i = 0 ... n-1 {     Car c = this.get(i);     if (aPartOfBrandName is a sub-string of c.brand.brandName) { </pre>

	<pre>         print out c;         count++;     }     if (count==0) print out "No car is detected!"; </pre>
<b>public void removeCar();</b>	<pre> Remove a car based on it's ID receive removedID; int pos = <b>searchID</b>(removedID); if (pos&lt;0) {     print out "Not found!" } else {     remove (pos);     print out "Car ... has been removed." } </pre>
<b>public void updateCar();</b>	<pre> Update a car based on it's ID receive updatedID; int pos = <b>searchID</b>(updatedID); if (pos&lt;0) {     print out "Not found!" } else {     // for choosing a brand     Brand b = brandList.getUserChoice();     receive color, color can not be blank     receive frameID. It must be in the "F00000" format and not be     duplicated     receive engineID. It must be in the "E00000" format and not be     duplicated     update brand, color, Frame ID, Machine ID for the pos(th) car     print out "Car ... has been updated." } </pre>
<b>public void listCars();</b>	<pre> Listing cars in ascending order of brand names. sorting cars // Collection.sort(this); n = size of the list; for i = 0 ... n-1     print out this.get(i); </pre>

<b>Class: CarManager</b>	<b>Description and main idea of an algorithm</b>
<pre> public static void main(String[] args) </pre>	<pre> Main program Create ArrayList ops of strings containing options of the program; Create an empty brandList; Load brands from the file brands.txt to brandList; Create an empty carList using brandList; Load cars from the file cars.txt to carList; Int choice; Create a menu; Do{ </pre>



	<pre> Choice = menu.int_getChoice(ops); Switch (choice) {     Case 1: brandList.listBrands(); break;     ..... } } } While (choice&gt;0 &amp;&amp; choice &lt;=ops.size()); </pre>
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## 5- Test cases

Test	Option	Objective	Requirements
1	1	List all brands [0.5 point]	<p>All brands in the file must be shown correctly</p> <p>B7-2018, BMW 730LI (2018), HARMAN KARDON: 3.749  B7-MS, BMW 730LI M SPORT, HARMAN KARDON: 4.319  B7-MS20, BMW 730LI M SPORT (2020), HARMAN KARDON: 4.369  B7-PE, BMW 730LI PURE EXCELLENCE, HARMAN KARDON: 4.929  B5-18, BMW 530I (2018), ALPINE: 2.599  B7019, BMW 530I (2019), ALPINE: 2.729  BX4-18, BMW X4 XDRIVE20I (2018), SONY: 2.799  BX4-17, BMW X4 XDRIVE20I (2019), SONY: 2.899  B3-GT18, BMW 320I GT (2018), BOSE: 1.0  B3-S19, BMW 320I SPORTLINE (2019), BOSE: 1.899  B5-X19, BMW X5 XDRIVE40I XLINE (2019), BOSE: 4.199  B5-X20, BMW X5 XDRIVE40I XLINE (2020), BOSE: 4.239  Total: 12 brand(s).</p>
2	2	Add a new brand [1 point]	<ul style="list-style-type: none"> <li>Brand ID can not be duplicated.</li> <li>Brand name can not be blank.</li> <li>Sound manufacturer can not be blank.</li> <li>Price must be a positive real number.</li> </ul> <p>Add:  B7-MS2, BMW 730Li M, Alpine: 4.050</p>
3	3	Search a brand based on it's ID [1 point]	<p>Test 2 cases:</p> <ul style="list-style-type: none"> <li>BrandID = B5-30 → Not found</li> <li>BrandID = B5-18 → Brand result is shown.</li> </ul>
4	4	Update a brand [1 point]	<ul style="list-style-type: none"> <li>Brand name can not be blank.</li> <li>Sound manufacturer can not be blank.</li> <li>Price must be a positive real number.</li> </ul> <p>Update: B7-MS, BMW 730Li M Sport, Harman Kardon: 4.319  To: B7-MS, BMW 730Li MS, Sony: 4.150</p>
5	5	Save brands to the file, named brands.txt [1 point]	<p>This operation must be successful.</p> <p>Open the file to check its content.</p>
6	6	List all cars in ascending order of brand names [1 point]	<p>All cars in the file must be shown in ascending order of brand names and their ID.</p> <p>C06, B5-18, BMW 530I (2018), ALPINE: 2.599, PINK, F12350, E12350  C01, B7-2018, BMW 730LI (2018), HARMAN KARDON: 3.749, RED, F12345, E12345  C02, B7-2018, BMW 730LI (2018), HARMAN KARDON: 3.749,</p>

			<p>BLACK, F12346, E12346</p> <p>C03, B7-MS, BMW 730LI M SPORT, HARMAN KARDON: 4.319, ORANGE, F12347, E12347</p> <p>C04, B7-MS20, BMW 730LI M SPORT (2020), HARMAN KARDON: 4.369, WHITE, F12348, E12348</p> <p>C05, B7-PE, BMW 730LI PURE EXCELLENCE, HARMAN KARDON: 4.929, PINK, F12349, E12349</p> <p>C07, B5-X20, BMW X5 XDRIVE40I XLINE (2020), BOSE: 4.239, GREY, F12351, E12351</p> <p>Total: 7 car(s).</p>
7	7	List cars based on a part of an input brand name [1 point]	<p>Input: "960": No result</p> <p>Input: "730": All cars of the brand 730 must be shown.</p>
8	8	Add a car [1 point]	<ul style="list-style-type: none"> <li>- Car ID can not be duplicated (C05, C08)</li> <li>- Brand ID must have existed and it must be inputted using a menu. Choose B5-18</li> <li>- Color can not be blank. ( black/ yellow)</li> <li>- Frame ID can not be blank and must be in the "F00000" format and can not be duplicated (K0123/ F12345/ F12352).</li> <li>- Engine ID can not be blank and must be in the "E00000" format and can not be duplicated (M0123/ M12345/ E12352)</li> </ul> <p>Add: C08, B5-18, yellow, F12352, E12352 → successful</p>
9	9	Remove a car based on its ID [1 point]	<p>C10 → Not found.</p> <p>C06 → Remove successfully.</p>
10	10	Update a car based on its ID [1 point]	<p>ID = C10 → Not found.</p> <p>ID= C03</p> <p>Update: C03, B7-MS, orange, F12347, E12347</p> <p>To: C03, B5-18, brown, F99999, E99999</p> <ul style="list-style-type: none"> <li>- Brand ID must have existed and it must be inputted using a menu. Choose B5-18</li> <li>- Color can not be blank. ( black/ brown)</li> <li>- Frame ID can not be blank and must be in the "F00000" format and can not be duplicated (K0123/ F12345/ F99999).</li> <li>- Engine ID can not be blank and must be in the "E00000" format and can not be duplicated (M0123/ M12345/ E99999)</li> </ul>
11	11	Save cars to file [0.5 point]	<p>This operation must be successful.</p> <p>Open the file to check its content.</p>