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.

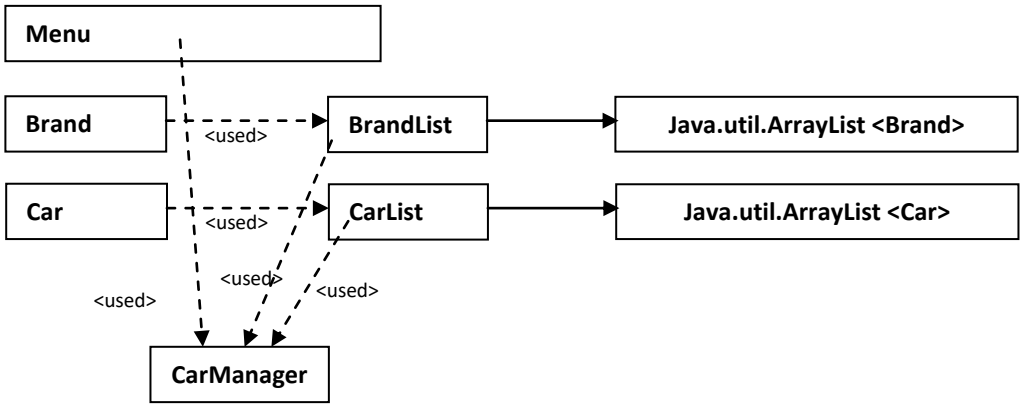
Analysis

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

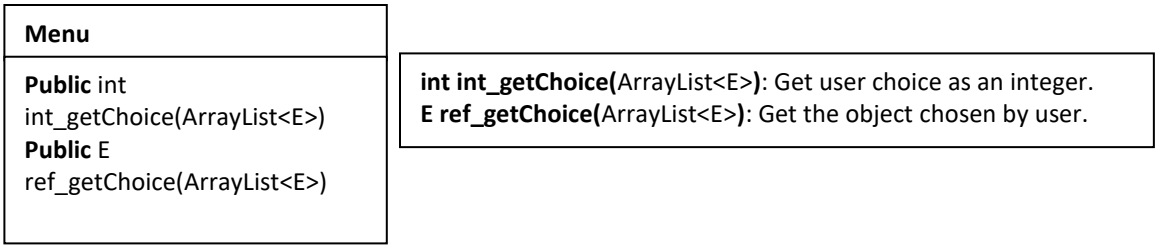
Concept	Detail
Brand	Brand ID, brand name, sound brand, price
List of brands	
Car	Car ID, brand ID, color, frame ID, engine ID
List of cars	
Menu	A list of objects
Program	A menu, a list of brands, a list of cars

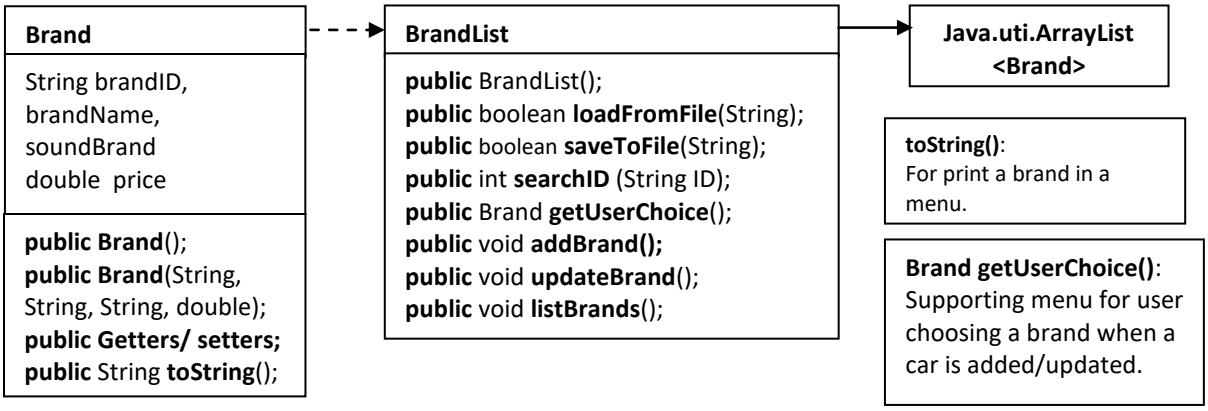
Design

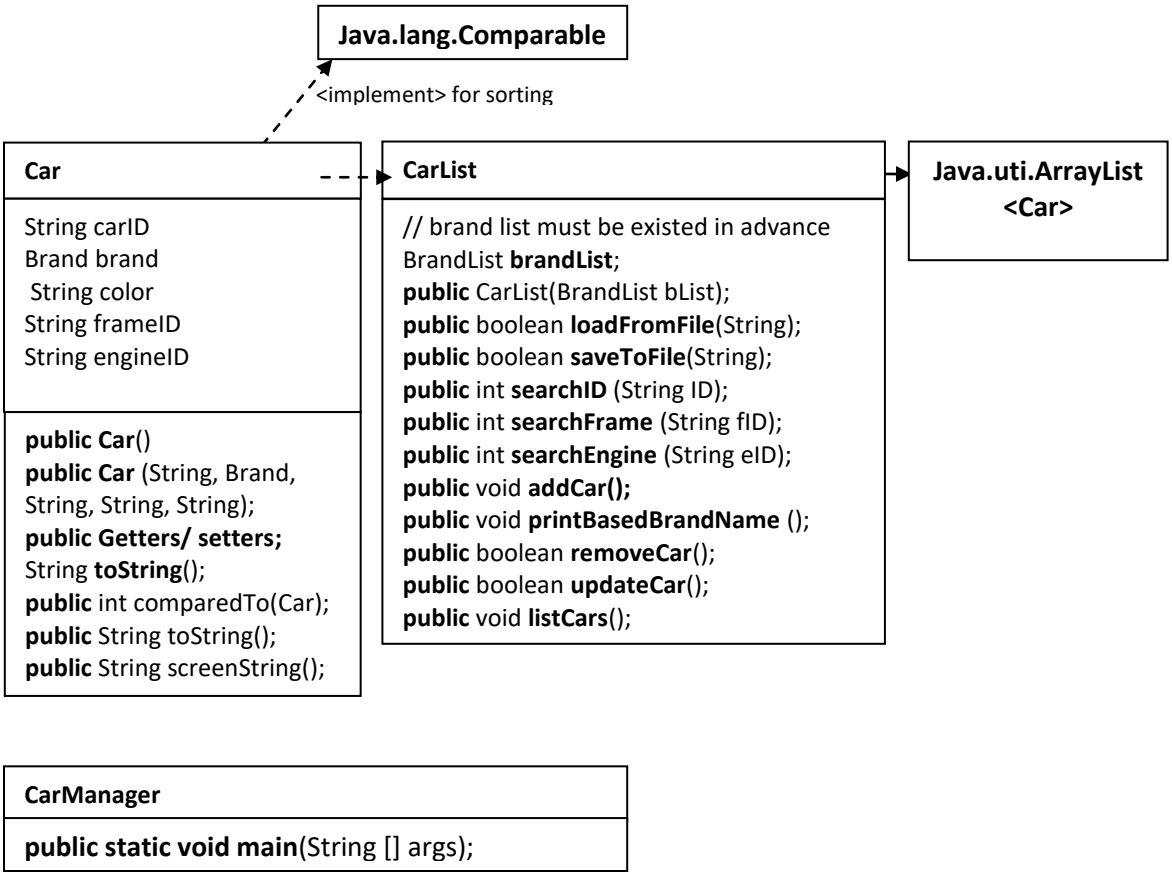
1- Class Design outline



2- Class Design in Details



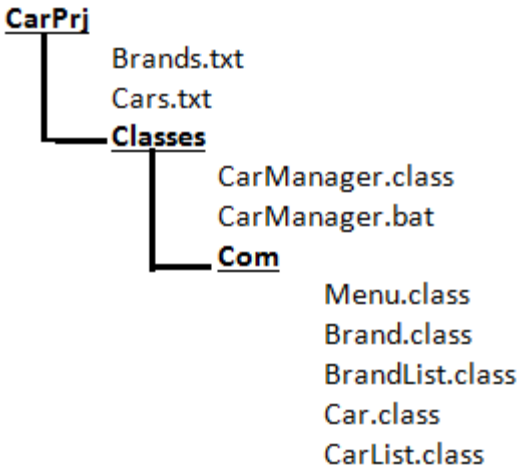




3- Software Structure design

Project name: CarPrj

Package structure:



4- Main Algorithm

Class: Menu	Description and main idea of an algorithm
int int_getChoice(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
public String **toString**()	Return a string in the template: < brandID, brandName, soundBrand: price>

Class: BrandList	Description and main idea of an algorithm

public boolean **loadFromFile**(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;
	}
	Return true;

public boolean **saveToFile**(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;
	Return true;

public int **searchID** (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;
public Brand **getUserChoice**();	Transform the list to a menu, the user will choose a brand from this menu. Menu mnu = new Menu(); Return (Brand)mnu. ref_getChoice(this);
public void **addBrand()**	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.

public void **updateBrand**();	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.
	}

public void **listBrands**();	N = size of the list; For I = 0.. N-1 Print out this.get(i);

Class: Car	**Description and main idea of an algorithm**

public int comparedTo(Car c);	Used in the operation opf 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);

Class: CarList	**Description and main idea of an algorithm**
public CarList(BrandList bList);	Initialize a list based on the existed brand list; brandList=bList;
public String **toString**();	Associating fields to a string for writing a car to file Return format < carID, brand.brandID, color, frameID, engineID>
public String **screenString**();	Associating fields to a string for outputting a car to screen Return format < brand, “\n”, car_ID, color, frameID, engineID>
public boolean **loadFromFile**(String filename);	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
	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;
	Return true;
	}

public boolean **saveToFile**(String);	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;
	Return true;

public int **searchID** (String carID);	Search a car based on car ID. Return the existed position(int) N= size of the list; For I = 0 … N-1 If (this.get(i).carID == carID) return I; Return -1;
public int **searchFrame** (String fID);	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;
public int **searchEngine** (String eID);	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;
public void **addCar();**	Receive carID, carID must be not duplicated Create a menu for choosing a brand; Band b = (Brand)menu. ref_getChoice(brandList); Receive color, color can not be blank Receive frameID. It must be in the "F0000" and not be duplicated Receive engineID. It must be in the "E0000" format and not be duplicated Create a new car with inputted data; Add a new car to the list
public void **printBasedBrandName** ();	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) {
	  Print out c.screenString();
	  count++;
	}
	If (count==0) print out “No car is detected!”;

public boolean **removeCar**();	Remove a car based on it’s ID
	Receive removedID;
	Int pos = searchID(removedID);
	If (pos<0) {
	  print out “Not found!”
	  return false;
	}
	Else{
	  Remove (pos);
	}
	Return true;

public boolean **updateCar**();	Update a car based on it’s ID
	Receive updatedID;
	Int pos = searchID(updatedID);
	If (pos<0) {
	  print out “Not found!”
	  return false;
	}
	Else{
	  Create a menu for choosing a brand;
	  Band b = (Brand)menu. ref_getChoice(brandList);
	  Receive color, color can not be blank
	  Receive frameID. It must be in the “F0000” and not be duplicated
	  Receive engineID. It must be in the “E0000” format and not be duplicated
	
	  Update brand, color, Frame ID, machine ID for the pos(th) car.
	}
	Return true;

public void **listCars**();	Listing cars in ascending order of brand names.
	Sorting cars // Collection.sort(this);
	N = size of the list;
	For i=0 … N-1 {
	  Car c = this.get(i);
	  Print out c.screenString();
	}

Class: CarManager	**Description and main idea of an algorithm**
Public static void main(String[] args)	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{
	  Choice = menu.int_getChoice(ops);
	  Switch (choice) {
	  Case 1: brandList.listBrands(); break;
	  ……
	  }
	}
	While (choice>0 && choice <=ops.size());

5- Test cases

Test	Option	Objective	Requirements
1	1	List all brands [0.5 point]	All brands in the file must be shown correctly
2	2	Add a new brand [1 point]	• Brand ID can not be duplicated. • Brand name can not be blank. • Sound manufacturer can not be blank. • Price must be a positive real number. Add: B7-MS2, BMW 730Li M, Alpine: 4.050
3	3	Search a brand based on it's ID [1 point]	Test 2 cases: - BrandID = B5-30 → Not found - BrandID = B5-18 → Brand result is shown.
4	4	Update a brand [1 point]	• Brand name can not be blank. • Sound manufacturer can not be blank. • Price must be a positive real number. Update: B7-MS, BMW 730Li M Sport, Harman Kardon: 4.319 To: B7-MS, BMW 730Li MS, Sony: 4.150
5	5	Save brands to the file, named brands.txt [1 point]	This operation must be successful. Open the file to check its content.
6	6	List all cars in ascending order of brand names [1 point]	All cars in the file must be shown in ascending order of brand names and their ID.
7	7	List cars based on a part of an input brand name [1 point]	Input: "960": No result Input: "730": All cars of the brand 730 must be shown.
8	8	Add a car	- Car ID can not be duplicated (C05, C08)

		[1 point]	- Brand ID must have existed and it must be inputted using a menu. Choose B5-18 - Color can not be blank.(black/ yellow) - Frame ID can not be blank and must be in the "F00000" format and can not be duplicated (K0123/ F12345/ F12352). - Engine ID can not be blank and must be in the "E00000" format and can not be duplicated (M0123/ M12345/ E12352) Add: C08, B5-18, yellow, F12352, E12352 → successful
9	9	Remove a car based on its ID [1 point]	C10 → Not found. C06 → Remove successfully.
10	10	Update a car based on its ID [1 point]	ID = C10 → Not found. ID= C03 Update: C03, B7-MS, orange, F12347, E12347 To: C03, B5-18, brown, F99999, E99999 - Brand ID must have existed and it must be inputted using a menu. Choose B5-18 - Color can not be blank. (black/ brown) - Frame ID can not be blank and must be in the "F00000" format and can not be duplicated (K0123/ F12345/ F99999). - Engine ID can not be blank and must be in the "E00000" format and can not be duplicated (M0123/ M12345/ E99999)
11	11	Save cars to file [0.5 point]	This operation must be successful. Open the file to check its content.