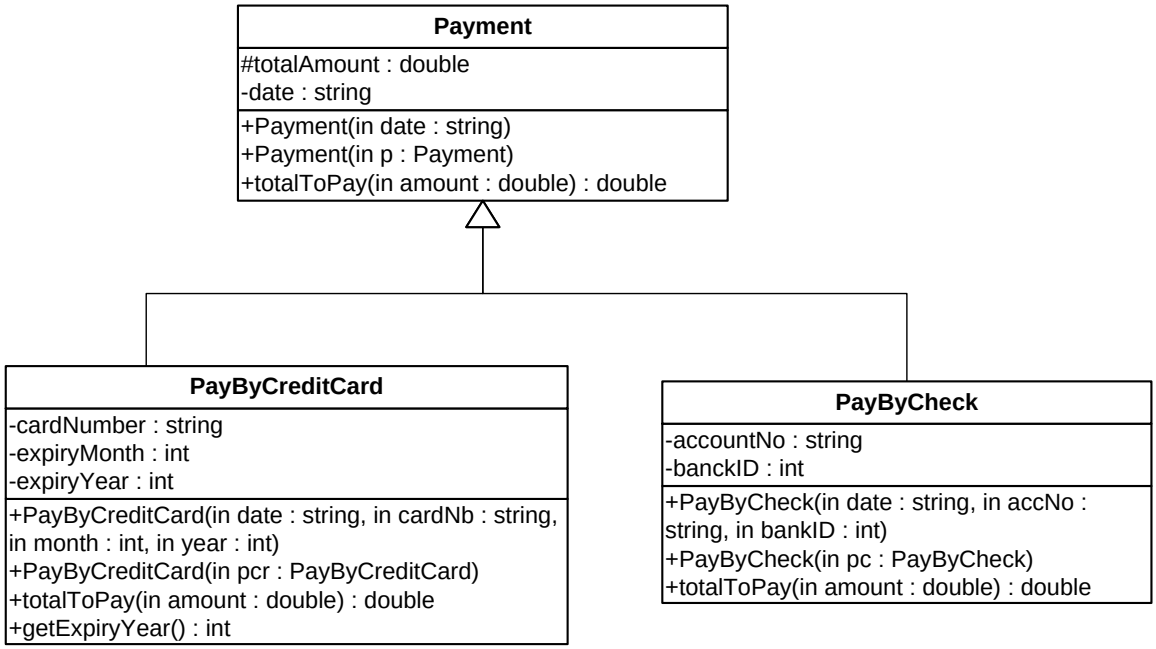
Exercise 1



Payment class:

- Attributes:
  - ***totalAmount***: the *total amount of the payment*. It is initially equal to 0.
  - ***date***: the date of the payment.
- METHODS:
  - ***Payment(date: String):*** constructor**.**
  - ***Payment(p: Payment): copy*** constructor**.**
  - ***totalToPay(amount: double): double***: this method receives an amount, calculates and returns the *total amount of the payment*. The *total amount of the payment* is computed as follows:
    - *for the payment by credit card*:
      - *total amount of the payment = amount – (amount *0.*05)
    - *for the payment by check*:
      - *total amount of the payment = amount + (amount *0.*10)

PayByCreditCard class

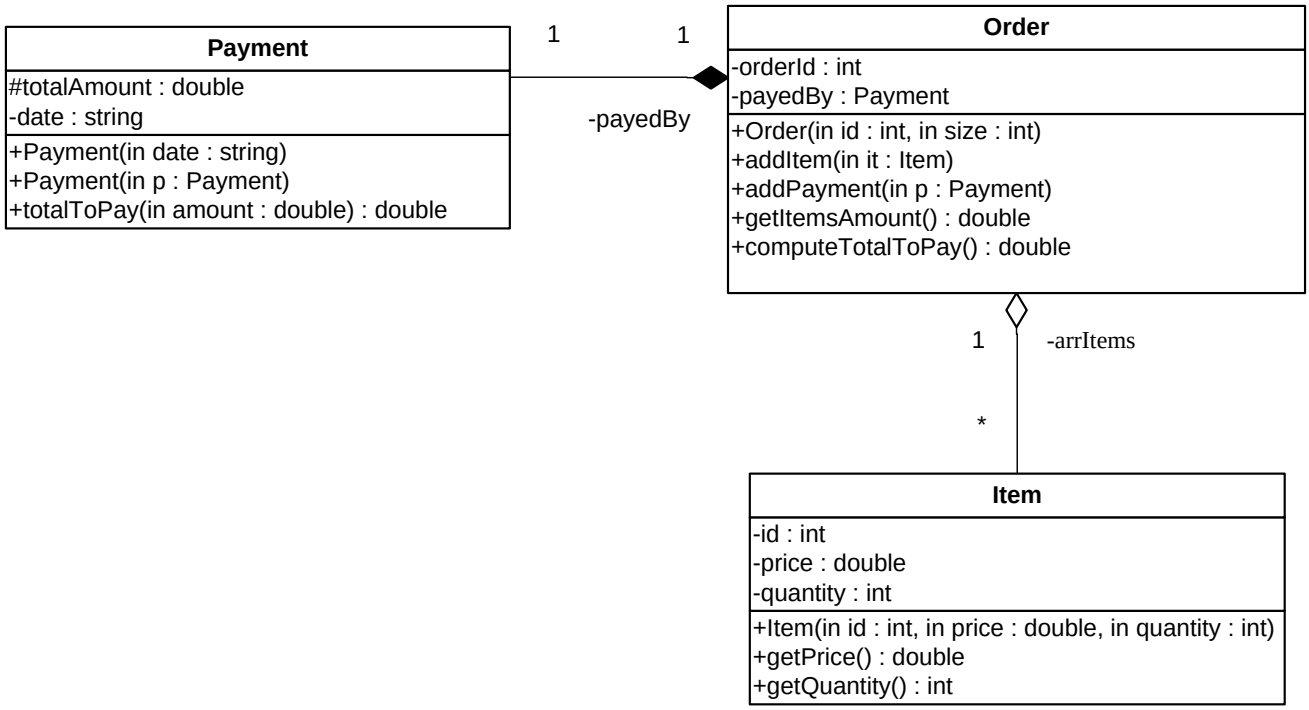
- Attributes:
  - ***cardNumber***: the credit card number.
  - ***expiryMonth***: the month of the expiry date of the credit card.
  - ***expiryYear***: the year of the expiry date of the credit card.

- METHODS:

- ***PayByCreditCard (date: String, cardNb: String, month: int, year: int)***: constructor.
- ***PayByCreditCard (pcr: PayByCreditCard)***: copy constructor.
- ***totalToPay(amount: double): double***: this method receives an amount, calculates and returns the *total amount of the payment* as mentioned above.

QUESTION: Translate into Java code the class ***Payment*** and the class ***PayByCreditCard***.

Exercise 2



Payment class: *described in exercise 1.*

Order class

- Attributes:
  - ***orderId***: the order number.
  - ***payedBy***: the payment mode of the order.
- METHODS:
  - ***Order (id: int, size: int)***: constructor. It receives the order number and the number of items.
  - ***addItem (it: Item)***: adds a new item in the array ***arrItems***.
  - ***addPayment (p: Payment)***: this method assigns the *payment mode* ***p*** to the attribute ***payedBy***.
    Notice: The attribute **payedBy** is not an array.
    The relationship with Payment is a **composition**.
  - ***getItemsAmount(): double***: this method returns an exception "No Items" if there are no items in the order. Otherwise, it calculates and returns the **total amount of the items** of the order as follows:

    total amount of the items = $\sum_{i=1}^{nb\ of\ items}$(price of the item $*$ quatity)
  - ***computeTotalToPay(): double***: this method returns the **total amount to pay** of the order.

The **total amount to pay** of the order is calculated by the object ***payedBy*** based on the **total amount of the items** of the order using the method ***totalToPay()***.

QUESTION: Translate into Java code the class ***Order***.

1.1. Solution Final Exam

Exercise 1

```
public abstract class Payment {

	protected double totalAmount;
	private String date;

	public Payment(String d) {
		date = d;
		totalAmount = 0.0;
	}
	public Payment(Payment p) {
		date = p.date;
		totalAmount = p.totalAmount;
	}

	public abstract double totalToPay(double d);
}

public class PayByCreditCard extends Payment {
	private String cardNumber;
	private int expiryMonth;
	private int expiryYear;

	public PayByCreditCard (String d, String cardNumber, int month, int
year) {
		super(d);
		this.cardNumber = cardNumber;
		expiryMonth = month;
		expiryYear= year;
	}

	public PayByCreditCard (PayByCreditCard pcr) {
		super(pcr);
		this.cardNumber = pcr.cardNumber;
		expiryMonth = pcr.expiryMonth;
		expiryYear= pcr.expiryYear;
	}

	public double totalToPay(double amount) {
		totalAmount = amount - amount * 0.05;
		return totalAmount;
	}

	public int getExpiryYear() {
		return expiryYear;
	}

}
```

Exercise 2

```java
public class Order {
	private int orderId;
	private Payment payedBy;
	private Item[] arrItems;
	private int nbItems;

	public Order(int id, int size) {
		orderId = id;
		arrItems = new Item[size];
		nbItems = 0;
		payedBy = null;
	}
	public void addItem(Item it) {
		if (nbItems < arrItems.length) {
			arrItems[nbItems] = it;
			nbItems ++;
		}
	}
	public void addPayment(Payment p) {
		if (p instanceof PayByCreditCard) {
			payedBy = new PayByCreditCard((PayByCreditCard)p);
		}
		else {
			payedBy = new PayByCheck((PayByCheck) p);
		}
	}

	public double getItemsAmount() throws Exception {
		double res = 0.0;
		int i;

		if (nbItems == 0) throw new Exception("No Items");

		for (i =0; i<nbItems; i++) {
			res += arrItems[i].getPrice() * arrItems[i].getQuantity();
		}
		return res;
	}

	public double computeTotalToPay() {
		double total = 0.0;

		try {
			total = payedBy.totalToPay(getItemsAmount());
		} catch (Exception e) {
			System.out.println(e.getMessage());
		}
		return total;
	}

}
```

1.2. Midterm 2

Exercise 1.

1. What is the output of the following? 4 Points

```
public class ExcepTest{

   public static void main(String args[]){
      int a[] = new int[2];
      try{
         System.out.println("Access element three :" + a[3]);
      }catch(ArrayIndexOutOfBoundsException e){
         System.out.println("Exception thrown");
      }
      finally{
         a[0] = 6;
         System.out.println("First element value: " +a[0]);
         System.out.println("The finally statement is executed");
      }
   }
}
```

Answer:

Exception thrown 2

First element value: 6 1

The finally statement is executed 1

2. What will happen when you attempt to compile and run the following class? 4 Points

```
public class Base{
      public Base(int i){
          System.out.println("Base");
      }
}

public class Second extends Base {
      public static void main(String args[]){
              Second s = new Second ();
      }
      public Second (){
               System.out.println("Second");
      }
}
```

Choose the right answer

1) Compilation and output of the string "Second" at runtime
2) Compilation and no output at runtime
3) Compilation and output of the string "Base"
4) Compile time error: An error occurs at the constructor of the class Second because this constructor calls implicitly the default constructor (without parameter constructor) of the class Base which does not exist.

Answer:
Option 4.

EXERCISE 2

Give the output of the following program. **10 Points**

```
public class Flight {
	private String flightNum;
	protected int dist;

	public Flight() {
		flightNum = "Unknown";
		dist = 500;
		System.out.println ("The Flight is Created");
	}

	public Flight (String flightNum, int dist) {
		this.flightNum = flightNum;
		this.dist=dist;
	}

	public void display() {
	System.out.println ("Flight number: " +  flightNum + " distance: " +  dist );
	}

	public int cost () throws Exception {
			return 200;
	}
}
```

```
public class LongDistanceFlight extends Flight {
	protected int rate;

	public LongDistanceFlight () {
		rate = 2;
	}

	public LongDistanceFlight (String flightNum, int dist, int r) {
		super(flightNum, dist);
		rate = r;
	}

	public void display () {
		System.out.println ("Long Distance Flight ");
		super.display();
	}

	public int cost() throws Exception {
		if (dist < 1000 ) throw new Exception (
					"Exception: Distance Less Than 1000 Km");
		return (super.cost()+ dist*rate);
	}
}
```

```
public class InternationalFlight extends LongDistanceFlight{
```

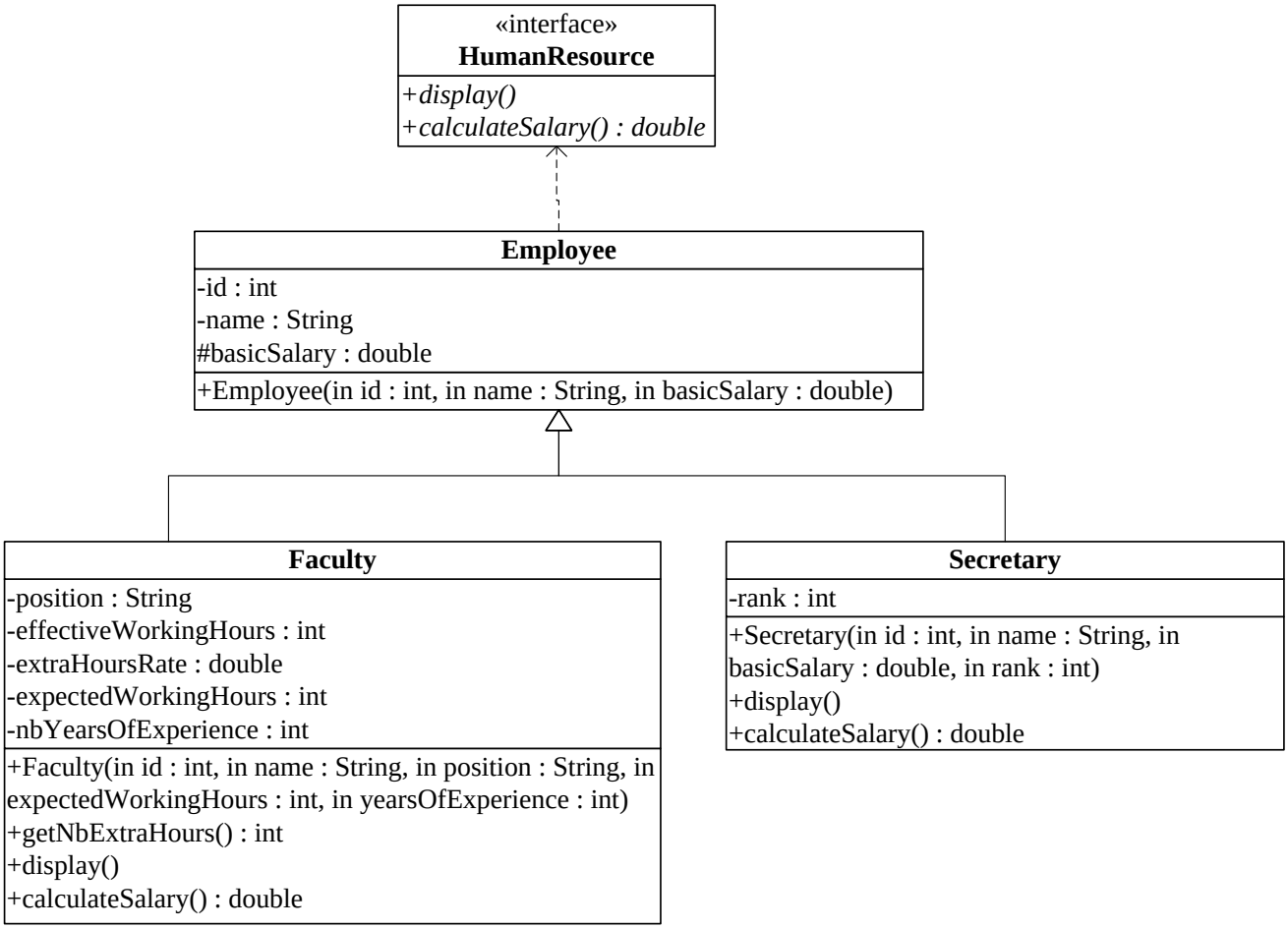
```
	protected int airportFee;

	public InternationalFlight(String s, int d, int r, int f) {
		super(s,d,r);
		airportFee = f;
	}

	public InternationalFlight(int f) {
		airportFee = f;
	}

	public void display()  {
		System.out.println ("International Flight ");
		super.display();
		try {
			System.out.println(this.cost());
		}
		catch (Exception e) {System.out.println(e.getMessage());
		}
	}

	public int cost() throws Exception {
		return (super.cost()+airportFee);
	}
}
```

```
public class TestFlights {
	public static void main(String[] args) {
		int i;
		Flight [] flightList = new Flight[2];

		flightList[0]  = new InternationalFlight("SV3875", 1000, 3, 100);
		flightList[1]  = new InternationalFlight(500);

		for (i=0; i< 3; i++) {
			System.out.println("Iteration " + (i+1));
			try {
				flightList[i].display();
			} catch (Exception e) { System.out.println(
							"Exception in Iteration " + (i+1));
			}
		}// end for
	}// end main
}
```

Answer:

```
The Flight is Created .....1
Iteration 1
International Flight .....1
Long Distance Flight .....1
Flight number: SV3875 distance: 1000 .....1
3300    .....1
Iteration 2
International Flight .....1
Long Distance Flight  .....1
Flight number: Unknown distance: 500 .....1
Exception: Distance Less Than 1000 Km    .....1
Iteration 3
Exception in Iteration 3    .....1
```

EXERCISE 3



HumanResource interface:

- METHODS:
  - ***display()***: this method displays all the attributes.
  - ***calculateSalary***: calculates and returns the salary.

Employee class

- METHODS:
  - ***Employee(id: int, name: string, basicSalary: double)***: constructor.
  - ***display()***: this method displays all the attributes of the employee.
  - ***calculateSalary***: returns the salary of the employee which is calculated as following:
    - *For* ***Faculty***:
      salary = basic salary + (**number of extra hours** * extra hours rate * 4) + (number of years of experience * 500).
    - *For* ***Secretary***:

salary = basic salary + (rank * 2000).

Faculty class

- Attributes:
  - ***position***: the position of the Faculty.
  - ***effectiveWorkingHours***: the number of working hours.
  - ***extraHoursRate***: the rate of an extra hour.
  - ***expectedWorkingHours:*** The minimum load of the faculty.
  - ***nbYearsOfExperience:*** The number of years of experience.
- METHODS:
  - ***Faculty(id: int, name: string, basicSalary: double, expectedWorkingHours: int)***: constructor.
  - ***display()***: this method displays the salary and all the attributes of the Faculty.
  - ***getNbExtraHours***: this method returns the number of extra hours which is calculated as following:

    number of extra hours = effective working hours - expected working hours.

    N.B:
    - *If the number of extra hours is less than 0 this method throws an exception.*
    - the number of extra hours is obtained **only** using the method *getNbExtraHours.*

Secretary class

- Attributes:
  - ***rank***: the rank of the Secretary.
- METHODS:
  - ***Secretary(id: int, name: string, basicSalary: double, rank: int)***: constructor.
  - ***display()***: this method displays the salary and all the attributes of the secretary.

QUESTION: Translate into Java code the interface HumanResource, the class ***Employee*** and the class ***Faculty*** .

Answer:

```
public interface HumanResource {    .....1
      public void display();    .....1
      public double calculateSalary();    .....1

}

public abstract class Employee implements HumanResource {  .....1 + .....1
      private int id;  .....0.5
      private String name;  .....0.5
      protected double basicSalary;  .....0.5

      public Employee(int i, String s, double d) {
            id  = i; .....1
            name = s;  .....1
            basicSalary = d;  .....1
      }

      public void display() {
            System.out.println(id + name + basicSalary); .....3
      }
}

public class Faculty extends Employee { .....1
      private String position; .....0.5
      private int effectiveWorkingHours; .....0.5
      private double extraHoursRate;  .....0.5
      private int expectedWorkingHours;  .....0.5
      private int nbYearsOfExperience;  .....0.5

      public Faculty(int i, String s, double bs, String pos, int exwh, int
years) {
            super(i, s, bs);  .....2
            position = pos; .....1
            expectedWorkingHours = exwh;  .....1
            nbYearsOfExperience = years;    .....1
      }

      public void display() {
            super.display();  .....2

            System.out.println(position + effectiveWorkingHours+
                        extraHoursRate + expectedWorkingHours +
                        nbYearsOfExperience); .....2.5
            System.out.println(calculateSalary());.....2.5
      }



      public int getNbExtraHours() throws Exception{ .....1
            int nbExtra = effectiveWorkingHours - expectedWorkingHours;
.....2
```

```
            if (nbExtra < 0) .....1
                  throw new Exception("Number of Extra Hours Less than 0");
                  .....2
            return nbExtra; .....1
      }

      public double calculateSalary () {
            double salary = 0.0 ;
            try { .....1
                  salary = basicSalary +
                              (getNbExtraHours() * extraHoursRate *4) +
                              (nbYearsOfExperience * 500.0); .....3
            } catch (Exception e) { System.out.println(e.getMessage()); }
.....1 + .....1
            return salary; .....1
      }
}
```

1.3. Midterm 1

EXERCISE 1

Give the output of the following program.

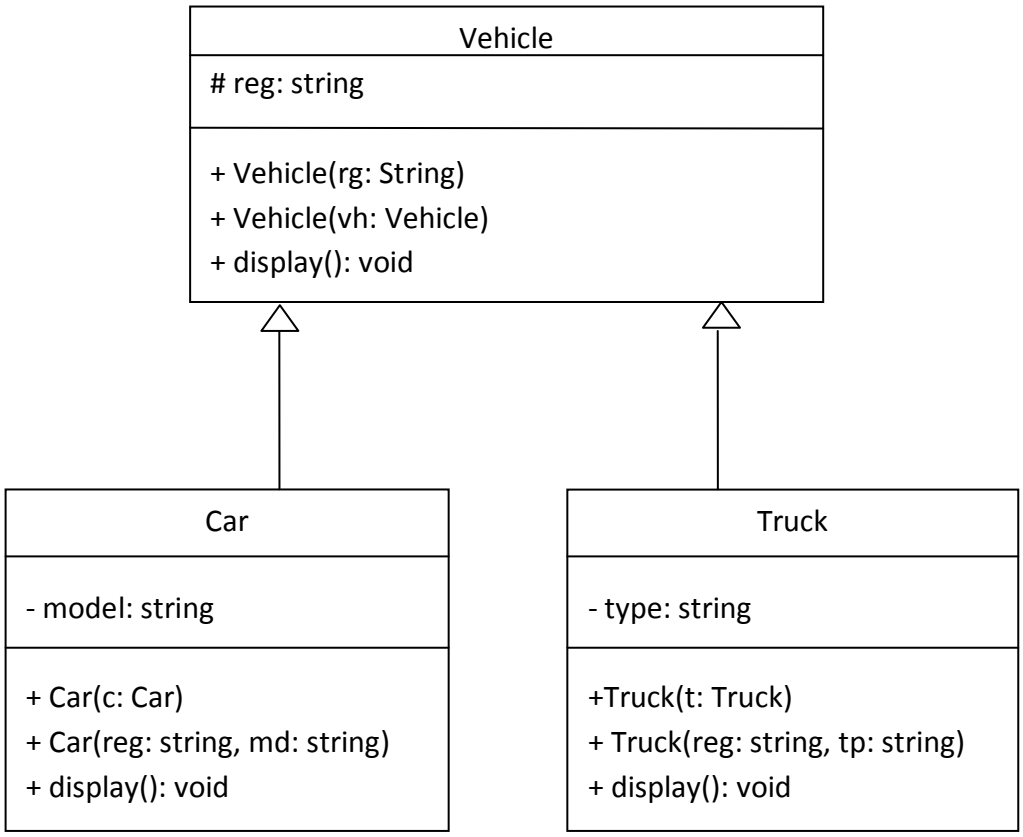
```
public class Flight {
        protected  String flightNum;
        protected int dist;
        public Flight ( ) {
                System.out.println ("Created Flights:"); }

        public Flight (String flightNum, int dist) {
                this.flightNum = flightNum;
                this.dist=dist;  }

        public void display() {
                System.out.println ("Flight number:" + flightNum );
                System.out.println ("distance:" +  dist); }

        public int cost () {  return 200; }
}
```

```
public class InternationalFlight extends Flight{


        public InternationalFlight (String flightNum, int dist) {
                super(flightNum, dist); }
        public void display () {
                System.out.println ("International Flight ");
                super.display()); }
        public int cost () { return (super.cost()+dist*2); }

}
```

```
public class test {
        public static void main(String[] args) {
        int i;

        Flight x = new Flight ();
        Flight [] flightList = new Flight [2];
        flightList [0]= new InternationalFlight ("FRA334", 4000);
        flightList [1]= new InternationalFlight ("TUN654",3000);

        for (i=0; i< flightList.length; i++) {
           flightList[i].display() ;
           System.out.println("Cost: "+ flightList[i].cost() +"SR");
                }
        }
 }
```

EXERCISE 2

Consider the following UML class diagrams:



And the following specification:

- ***Vehicle*** class
  - ATTRIBUTES:
    - ***reg***: vehicle's registration ID, like: ABC434.
  - METHODS:
    - ***Vehicle(rg: string)***:constructor.
    - ***display()***:this method writes on the screen the attributes of ***Vehicle***.

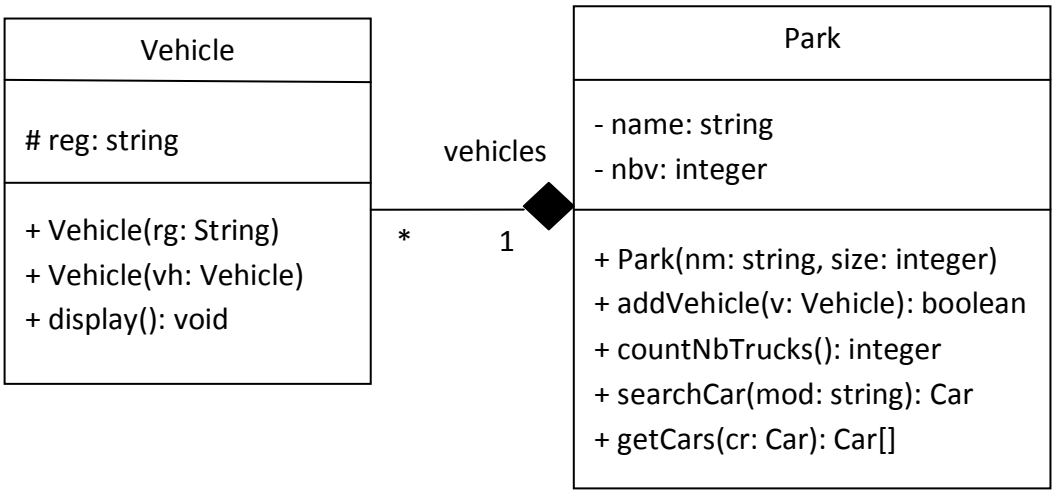
- ***Car*** class
  - ATTRIBUTES:
    - ***model***: car's model, like: Toyota Tercel.
  - METHODS:
    - ***Car(c: Car)***: constructor.
    - ***Car(reg: string, md: string)***: constructor.
    - ***display()***:this method writes on the screen the attributes of ***Car***.

- ***Truck*** class
  - ATTRIBUTES:
    - ***type***: truck's type, like: dump truck.
  - METHODS:
    - ***Truck(t: Truck)***: constructor.
    - ***Truck(reg: string, tp: string)***: constructor.
    - ***display()***:this method writes on the screen the attributes of ***Truck***.

QUESTION: Translate into Java code ***Vehicle*** and ***Car*** classes only, taking into consideration the above specification.

EXERCISE 3

In order to represent parks of vehicles that may contain cars and trucks, we add a new class, ***Park***:



Park class

- METHODS:
  - ***Park(nm: string, size: integer)***: constructor.
  - ***addVehicle(v: Vehicle)***: this method adds a vehicle to the park.
  - ***countNbTrucks()***: returns the number of trucks in the park.
  - ***searchCar(mod: string)***: returns a car that has the model mod.
  - ***getCars (c: Car)***: returns all the cars that have the same model as the model of ***cr***.

QUESTION: Translate into Java code the class ***Park*** class only. Assume that all getters and setters are available.

1.4. Solution Midterm 1

Answer Exercise 2:

```
public class Vehicle
{
	protected String reg;

	public Vehicle(String rg)
	{
		reg = rg;
	}

	public Vehicle(Vehicle v)
	{
		this.reg = v.reg;
	}

	public void display()
	{
		System.out.println("Vehicle's reg: " + reg);
	}

}

public class Car extends Vehicle
{
	private String model;

	public Car(Car c)
	{
		super(c);
		model = c.model;
	}

	public Car(String reg, String md)
	{
		super(reg);
		model = md;
	}


	public void display()
	{
		super.display();
		System.out.println("Car's model: " + model);
	}
}
```

Answer Exercise 3:

```
public class Park
{
	private Vehicle[] vehicles;
	private String name;
	private int nbV;


	public Park(String nm, int size)
	{
		name = nm;
		vehicles = new Vehicle[size];
	}

	public boolean addVehicle(Vehicle v)
	{
		if (nbV < vehicles.length)
		{
			if(v instanceof Truck)
			{
				vehicles[nbV] = new Truck((Truck)v);
			}
			else
			{
				vehicles[nbV] = new Car((Car)v);
			}
			nbV++;
			return true;
		}
		return false;
	}

	public int countNbTrucks()
	{
		int nbT = 0;
		for(int i=0; i<nbV; i++)
		{
			if(vehicles[i] instanceof Truck)
			{
				nbT++;
			}
		}
		return nbT;
	}

	public Car searchCar(String mod)
	{
		for(int i=0; i<nbV; i++)
		{
			if((vehicles[i] instanceof Car))
			{
				if( ((Car)vehicles[i]).getModel().equals(mod))
				{
					return (Car)vehicles[i];
				}
			}
```

```
            }
            return null;
      }


      public Car[] getCars(Car cr)
      {
            Car[] toRet = new Car[vehicles.length];
            int j = -1;

            for(int i=0; i<nbV; i++)
            {
                  if((vehicles[i] instanceof Car))
                  {
                        if( ((Car)vehicles[i]).getModel().
                        equals(cr.getModel()))
                        {
                              j++;
                              toRet[j] = new Car((Car)vehicles[i]);
                        }
                  }
            }
            if(j >= 0 )
            {
                  return toRet;
            }
            else
            {
                  return null;
            }
      }
}


public class Application
{
      public static void main(String[] args)
      {
            Park pk = new Park("Park1", 50);
            Car c1 = new Car("CRA122" , "Corolla");
            Car c2 = new Car("CRA656", "Civic");
            Truck t = new Truck("TTR999", "Dump");

            pk.addVehicle(c1);
            pk.addVehicle(c2);
            pk.addVehicle(t);

            System.out.println("Number of trucks: " + pk.countNbTrucks());
            Car c = pk.searhCar("Civic");
            if (c != null)
            {
                  c.display();
            }
      }
}
```