# Source Code

```java
// Car.java

package com;

public class Car {
        public String make;
        public String model;
        public int mpg;

        public Car(String make, String model, int mpg) {
                this.make = make;
                this.model = model;
                this.mpg = mpg;
        }

}
```

```java
// CompareCarsByMakeThenModel.java

package com;

import java.util.Comparator;

public class CompareCarsByMakeThenModel implements Comparator<Car>{
        public int compare(Car c1, Car c2) {
                int result;
                // compare by make first
                result = c1.make.compareTo(c2.make);
                if (result != 0) {
                        return result;
                }
                // then compare by model
                return c1.model.compareTo(c2.model);
        }
}
```

```java
// CompareByDescendingMPG.java

package com;

import java.util.Comparator;
```

```java
public class CompareCarsByDescendingMPG implements Comparator<Car>{
        public int compare(Car c1, Car c2)
        {
                if (c1.mpg < c2.mpg) {
                        return 1;
                }
                if (c1.mpg > c2.mpg)
                {
                        return -1;
                }
                return 0;
        }
}



// CompareCarsByMakeThenDescendingMPG.java

package com;

import java.util.Comparator;

public class CompareCarsByMakeThenDescendingMPG implements Comparator<Car>{
        public int compare(Car c1, Car c2) {
                // compare by make first
                int result;
                result = c1.make.compareTo(c2.make);
                // then compare by descending MPG
                if (result != 0) {
                        return result;
                }
                if (c1.mpg < c2.mpg) {
                        return 1;
                }
                if (c1.mpg > c2.mpg)
                {
                        return -1;
                }
                return 0;
        }

}



// Main.java
```

```java
package com;

import containers.QuickSort;

public class Main {

    // Create test case
    private static Car[] cars = {
    new Car("Toyota", "Camry", 33),
    new Car("Ford", "Focus", 40),
    new Car("Honda", "Accord", 34),
    new Car("Ford", "Mustang", 31),
    new Car("Honda", "Civic", 39),
    new Car("Toyota", "Prius", 48),
    new Car("Honda", "Fit", 35),
    new Car("Toyota", "Corolla", 35),
    new Car("Ford", "Taurus", 28)
    };

    // Implement a display method to display the array of cars
    static void display(Car[] cars) {
            for(int i=0 ; i<cars.length; i++ ) {
                    System.out.printf("%s %s %d \n",
                            cars[i].make,cars[i].model, cars[i].mpg);;
            }
    }

    // main method for testing
    public static void main(String[] args) {

            // display in original unsorted order
            System.out.println("\nCars in original unsorted order:");
            display(cars);

            // display cars sorted by make then model
            QuickSort.quickSort(cars, new CompareCarsByMakeThenModel());
            System.out.println("\nCars sorted by make then model:");
            display(cars);

            // display cars sorted by descending MPG
            QuickSort.quickSort(cars, new CompareCarsByDescendingMPG());
            System.out.println("\nCars sorted by descending MPG:");
            display(cars);
```

```java
        // display cars sorted by make then descending MPG
        QuickSort.quickSort(cars, new CompareCarsByMakeThenDescendingMPG());
        System.out.println("\nCars sorted by make then descending MPG:");
        display(cars);


    }
}
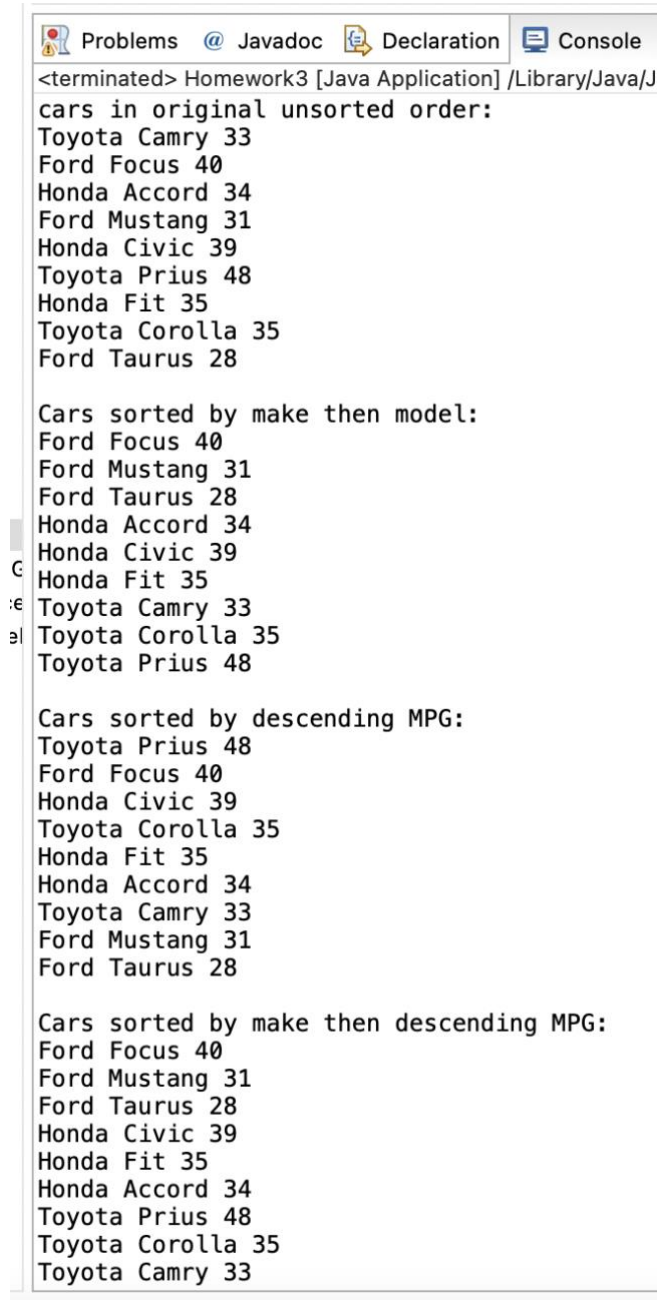```

# Outputs

Cars in original unsorted order:

Toyota Camry 33

Ford Focus 40

Honda Accord 34

Ford Mustang 31

Honda Civic 39

Toyota Prius 48

Honda Fit 35

Toyota Corolla 35

Ford Taurus 28


Cars sorted by make then model:

Ford Focus 40

Ford Mustang 31

Ford Taurus 28

Honda Accord 34

Honda Civic 39

Honda Fit 35

Toyota Camry 33

Toyota Corolla 35

Toyota Prius 48


Cars sorted by descending MPG:

Toyota Prius 48

Ford Focus 40

Honda Civic 39

Toyota Corolla 35

Honda Fit 35

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Honda Accord 34

Toyota Camry 33

Ford Mustang 31

Ford Taurus 28

Cars sorted by make then descending MPG:

Ford Focus 40

Ford Mustang 31

Ford Taurus 28

Honda Civic 39

Honda Fit 35

Honda Accord 34

Toyota Prius 48

Toyota Corolla 35

Toyota Camry 33