

Comment

Tutorial exercises should be done without a computer

Classes

In the following, all classes, interfaces, and members are public. Many details have been omitted. All relevant details have been included.

```
class Location {...}

class Vehicle {
    int travelTime(Location start, Location end);
    int topSpeed();
}

class GravityPowered extends Vehicle {
    int getWeight();
    int topSpeed();
}

class Motorised extends Vehicle {
    int travelTime(Location start, Location end);
    int topSpeed();
    boolean licenceRequired();
}

class Skateboard extends GravityPowered {}

class Bicycle extends GravityPowered {}

class Motorbike extends Motorised {
    int topSpeed();
    int travelTime(Location location);
}

class Car extends Motorised {
    int topSpeed();
}

class Taxi extends Car {}

class Bus extends Motorised {
    int topSpeed();
}
```

1. Draw a diagram which makes it easier for you to understand the above.
2. For the creation and usage of objects below, indicate whether the statements would compile or not. If it would not compile, explain why.
 - (a) `Vehicle bus = new Bus();`
 - (b) `Motorised skateboard = new Skateboard();`
 - (c) `Motorbike vehicle = new Vehicle();`
 - (d) `Motorised motorbike = new Motorbike();`
`Location loc = new Location();`
`motorbike.travelTime(loc);`
 - (e) `Motorbike motorbike = new Motorbike();`
`Location loc1 = new Location();`
`Location loc2 = new Location();`
`motorbike.travelTime(loc1, loc2);`
 - (f) `Car car = new Taxi();`
`Taxi taxi = car;`
 - (g) `Vehicle bike = new Bicycle();`
`bike.getWeight();`
3. This question looks at how you cast the type of an object to be another type. You can find a good overview of casting at: <https://www.baeldung.com/java-type-casting> (skip section 5). For the purposes of this part, assume that `xyz` is an instance of class `XYZ`. eg: `bus` is an instance of `Bus`. For each cast, indicate whether it:
 - would compile
 - could be implicit
 - could generate a runtime error.
 - (a) `(Vehicle) bus`
 - (b) `(Taxi) car`
 - (c) `(Bicycle) motorised`
 - (d) `(Vehicle) taxi`
4. If we wanted a class to represent a Bicycle with a backup motor, where would that fit in the hierarchy?
5. For each of the following, write where the method definition that actually runs is (Assume `location1` and `location2` are `Location` objects):
 - (a) `Vehicle vehicle = new Taxi(); vehicle.topSpeed();`
 - (b) `Vehicle vehicle = new Bicycle(); vehicle.topSpeed();`
 - (c) `Vehicle vehicle = new Motorbike(); vehicle.travelTime(location1, location2);`