

Polymorphism Exercises

In order to practice applying polymorphism, your task is to create interface definitions and class implementations for the exercises defined below. In any of the cases, you may add attributes (i.e. properties) and other supporting methods to the classes in order to fully implement the interface.

Each implementation class requires unit tests to verify its correctness.

Postage

DeliveryDriver Interface

calculateRate(distance, weight)

Implementing Classes

Postal Service

The Postal Service "is-a" DeliveryDriver and bases the rate upon weight in ounces up to 1 pound, in pounds beginning with 16 ounces or greater

	1st Class	2nd Class	3rd Class
Ounces	Per Mile	Per Mile	Per Mile
0 – 2	0.035	0.0035	0.0020
3 – 8	0.040	0.0040	0.0022
9 – 15	0.047	0.0047	0.0024
Pounds			
1 – 3	0.195	0.0195	0.0150
4 – 8	0.450	0.0450	0.0160
9+	0.500	0.0500	0.0170

|-----|-----|-----|-----|

```
rate = per mile rate * distance
```

FexEd

FexEd "is-a" DeliveryDriver and charges a flat rate for all packages, but may apply extra charges based upon weight and distance

```
rate = 20.00
if distance > 500 miles then rate = rate + 5.00
if weight > 48 ounces then rate = rate + 3.00
```

SPU

SPU "is-a" DeliveryDriver and follows a simple formula based upon class, weight (in lbs) and distance.

```
If four-day ground then rate = (weight * 0.0050) *
distance
If two-day business then rate = (weight * 0.050) *
distance
if next day then rate = (weight * 0.075) * distance
```

Main

Following the approach that the morning's examples has led, create a List that represents a distribution hub and can calculate the shipping values for the various delivery methods so that the customer can make a safe and informed decision.

Sample Output

```
Please enter the weight of the package? 15
(P)ounds or (O)unces? 0
What distance will it be traveling to? 340
```

Delivery Method	\$ cost
Postal Service (1st Class)	\$15.98
Postal Service (2nd Class)	\$1.65
Postal Service (3rd Class)	\$0.84
FexEd	\$20.00
SPU (4-day ground)	\$1.75
SPU (2-day business)	\$17.50
SPU (next-day)	\$26.25

Vehicle

Vehicle Interface Methods

calculateToll(distance)

Implementing Classes

Car

Tolls for cars are based upon distance.

```
toll = distance * 0.020
if pulling a trailer then toll = toll + 1.00
```

Truck

A truck "is-a" vehicle and the tolls for trucks are based upon the number of axles.

Axles	Per Mile
4	0.040
6	0.045
8+	0.048

$\text{toll} = \text{rate per mile} * \text{distance}$

Tank

A tank "is-a" vehicle and all military vehicles travel free on the toll roads.

$\text{toll} = 0;$

Main

Following the approach that the morning's examples has led, create a List that represents all of the cars that travel through a particular tollbooth. Using a random number for distance (10 to 240) calculate the tolls for each vehicle so that you can:

- indicate each vehicle, its distance traveled, and toll
- indicate the sum of all miles traveled and total tollbooth revenue

Sample Output

Vehicle	Distance Traveled	Toll \$
Car	100	\$2.00
Car	75	\$2.50
Tank	240	\$0.00
Truck	150	\$6.75