Test Cases:

Customer:

Test Case	Purpose	Expected Result
Valid Customer Creation	Test if the constructor successfully creates a Customer object with the provided attributes.	Customer object is created with the specified customer_id, name, contact, and loyalty points.
Invalid Customer ID	Test if the constructor handles invalid input for customer_id (e.g., empty string, negative number).	Error message indicating invalid customer ID.
Empty Name	Test if the constructor handles an empty name.	Error message indicating missing name.
Invalid Contact Information	Test if the constructor handles invalid contact information (e.g., empty string, invalid format).	Error message indicating invalid contact information.
Negative Loyalty Points	Test if the constructor handles negative loyalty points.	Error message indicating invalid loyalty points.
Getters for Attributes	Test if the getter methods (e.g., getCustomerId(), getName(), etc.) return the correct values set during construction.	The getter methods return the corresponding values set for each attribute.
Purchase with Valid Input	Test if the purchase(carPart, quantity) method successfully updates the customer's loyalty points based on the purchase amount.	Loyalty points are updated based on a pre-defined logic (e.g., points per dollar spent).
Purchase with Insufficient Loyalty Points	Test if the purchase(carPart, quantity) method handles attempts to use more loyalty points than available.	Error message indicating insufficient loyalty points or no deduction if points are not used.
Purchase with Negative Quantity	Test if the purchase(carPart, quantity) method handles negative quantity input.	Error message indicating invalid quantity.

Vehicle:

Test Case	Purpose	Expected Result
Valid Vehicle Creation	Test if the constructor successfully creates a Vehicle object with the provided attributes.	Vehicle object is created with the specified model, id, and year_of_manufacture.
Empty Model	Test if the constructor handles an empty model string.	Error message indicating missing model.
Invalid ID Format	Test if the constructor handles an invalid ID format (e.g., special characters, exceeding length limit).	Error message indicating invalid ID.
Getters for Attributes	Test if the getter methods (e.g., getModel(), getId(), getYearOfManufacture()) return the correct values set during construction.	The getter methods return the corresponding values set for each attribute.
Get Compatible Parts with Valid Vehicle	Test if the getCompatibleParts() method returns a list of parts compatible with the specific vehicle model and year.	The returned list should contain relevant parts like engine parts, brakes, tires, etc., potentially filtered based on the vehicle's model and year.

Get Compatible Parts with New Vehicle Model	Test if the getCompatibleParts() method handles a newly introduced vehicle model that might not have a pre-defined list of compatible parts.	The method might return a more generic list of parts applicable to a wider range of vehicles or indicate that specific compatible parts information is unavailable.
Get Compatible Parts with Outdated Vehicle	Test if the getCompatibleParts() method considers the year of manufacture when determining compatible parts (e.g., parts specific to older models might not be relevant for newer versions).	The returned list should be adjusted based on the vehicle's year, potentially excluding parts no longer compatible with older models.

Order:

Test Case	Purpose	Expected Result
Valid Order Creation	Test if the constructor successfully creates an Order object with the provided attributes.	Order object is created with the specified id, customer_id, order_items, price, and status.
Empty ID	Test if the constructor handles an empty ID string.	Error message indicating missing order ID.
Invalid Customer ID	Test if the constructor handles an invalid customer ID format (e.g., special characters, exceeding length limit).	Error message indicating invalid customer ID.
Empty Order Items List	Test if the constructor handles an empty list for order items.	Error message indicating missing order items.
Negative Price	Test if the constructor handles a negative price.	Error message indicating invalid price.
Invalid Status	Test if the constructor handles an invalid status value (not one of the expected options like "Processing", "Shipped", etc.).	Error message indicating invalid status.
Getters for Attributes	Test if the getter methods (e.g., get_id(), get_customer_id(), etc.) return the correct values set during construction.	The getter methods return the corresponding values set for each attribute.
Place Order	Test if the place_order() method successfully simulates placing the order.	The method should print a message indicating successful order placement (e.g., "Order {order_id} placed successfully!").
Update Status with Valid Status	Test if the update_status() method successfully updates the order status.	The method should update the status attribute and print a message confirming the update (e.g., "Order {order_id} status updated to {new_status}").
Update Status with Invalid Status	Test if the update_status() method handles attempts to set an invalid status value.	The method should not update the status and potentially provide an error message indicating the invalid status.
Get Estimated Delivery Date	Test if the get_estimate_delivery_date() method simulates estimating the delivery date.	The method should print a message containing the estimated delivery date for the order (e.g., "Estimated delivery date for order {order_id}: {estimated_date}").

StockItem:

Test Case	Purpose	Expected Result
Valid StockItem Creation	Test if the constructor successfully creates a StockItem object with the provided attributes.	StockItem object is created with the specified id, name, description, price, and stock level.
Empty ID	Test if the constructor handles an empty ID string.	Error message indicating missing car part ID.
Empty Name	Test if the constructor handles an empty name string.	Error message indicating missing car part name.
Empty Description	Test if the constructor handles an empty description string.	Error message indicating missing car part description.
Negative Price	Test if the constructor handles a negative price.	Error message indicating invalid price.
Negative Stock Level	Test if the constructor handles a negative stock level.	Error message indicating invalid stock level.
Getters for Attributes	Test if the getter methods (e.g., get_id(), get_name(), etc.) return the correct values set during construction.	The getter methods return the corresponding values set for each attribute.
Restock with Valid Quantity	Test if the restock(quantity) method successfully increases the stock level by the given positive amount.	The stock level is incremented by the specified quantity, and a confirmation message is printed.
Restock with Negative or Zero Quantity	Test if the restock(quantity) method handles non-positive restock quantities.	Error message indicating invalid restock quantity.
Sell with Valid Quantity	Test if the sell(quantity) method successfully reduces the stock level by the given positive amount within the available stock.	The stock level is decremented by the specified quantity, and a confirmation message is printed.
Sell with Insufficient Quantity	Test if the sell(quantity) method handles attempts to sell more units than available.	Error message indicating insufficient stock.
Sell with Negative or Zero Quantity	Test if the sell(quantity) method handles non-positive selling quantities.	Error message indicating invalid sell quantity.
Update Price with Valid Price	Test if the update_price(new_price) method successfully updates the price to the given positive value.	The price is updated to the new value, and a confirmation message is printed.
Update Price with Negative Price	Test if the update_price(new_price) method handles attempts to set a negative price.	Error message indicating invalid price.

CarAccessories:

Test Case	Purpose	Expected Result
Valid Car Accessory Creation	Test if the constructor successfully creates a CarAccessories object with the provided attributes.	CarAccessories object is created with the specified accessory_id and colour.
Empty Accessory ID	Test if the constructor handles an empty accessory ID string.	Error message indicating missing accessory ID.
Empty Colour	Test if the constructor handles an empty colour string.	Error message indicating missing colour information.
Getters for Attributes	Test if the getter methods (e.g., get_accessory_id(), get_colour()) return the correct values set during construction.	The getter methods return the corresponding values set for each attribute.
Get Colour	Test if the get_colour() method returns the colour attribute.	The method returns the colour string set for the CarAccessories object.

NavSys:

Test Case	Purpose	Expected Result
Valid Navigation System Creation	Test if the constructor successfully creates a NavigationSystem object with the provided attributes.	NavigationSystem object is created with the specified name, type, date_of_manufacture, and stock.
Empty Name	Test if the constructor handles an empty name string.	Error message indicating missing name.
Empty Type	Test if the constructor handles an empty type string.	Error message indicating missing type.
Invalid Date Format	Test if the constructor handles an invalid date format for date_of_manufacture.	Error message indicating invalid date format.
Negative Stock Level	Test if the constructor handles a negative stock level.	Error message indicating invalid stock level.
Getters for Attributes	Test if the getter methods (e.g., getName(), getType(), etc.) return the correct values set during construction.	The getter methods return the corresponding values set for each attribute.

Audio System:

Test Case	Purpose	Expected Result
Valid Audio System Creation	Test if the constructor successfully creates an AudioSystem object with the provided attributes.	AudioSystem object is created with the specified power_input, number_of_speakers, compatibility, and date_of_manufacture.
Empty Power Input	Test if the constructor handles an empty power input string.	Error message indicating missing power input information.
Invalid Power Input Format	Test if the constructor handles an invalid power input format (e.g., not a voltage value).	Error message indicating invalid power input format.
Negative Number of Speakers	Test if the constructor handles a negative number of speakers.	Error message indicating invalid number of speakers.
Empty Compatibility	Test if the constructor handles an empty compatibility string.	Error message indicating missing compatibility information.
Invalid Compatibility Format	Test if the constructor handles an invalid compatibility format (e.g., not a supported vehicle type).	Error message indicating invalid compatibility format.
Invalid Date Format	Test if the constructor handles an invalid date format for date_of_manufacture.	Error message indicating invalid date format.
Getters for Attributes	Test if the getter methods (e.g., getPowerInput(), getNumberOfSpeakers(), etc.) return the correct values set during construction.	The getter methods return the corresponding values set for each attribute.

Visual System:

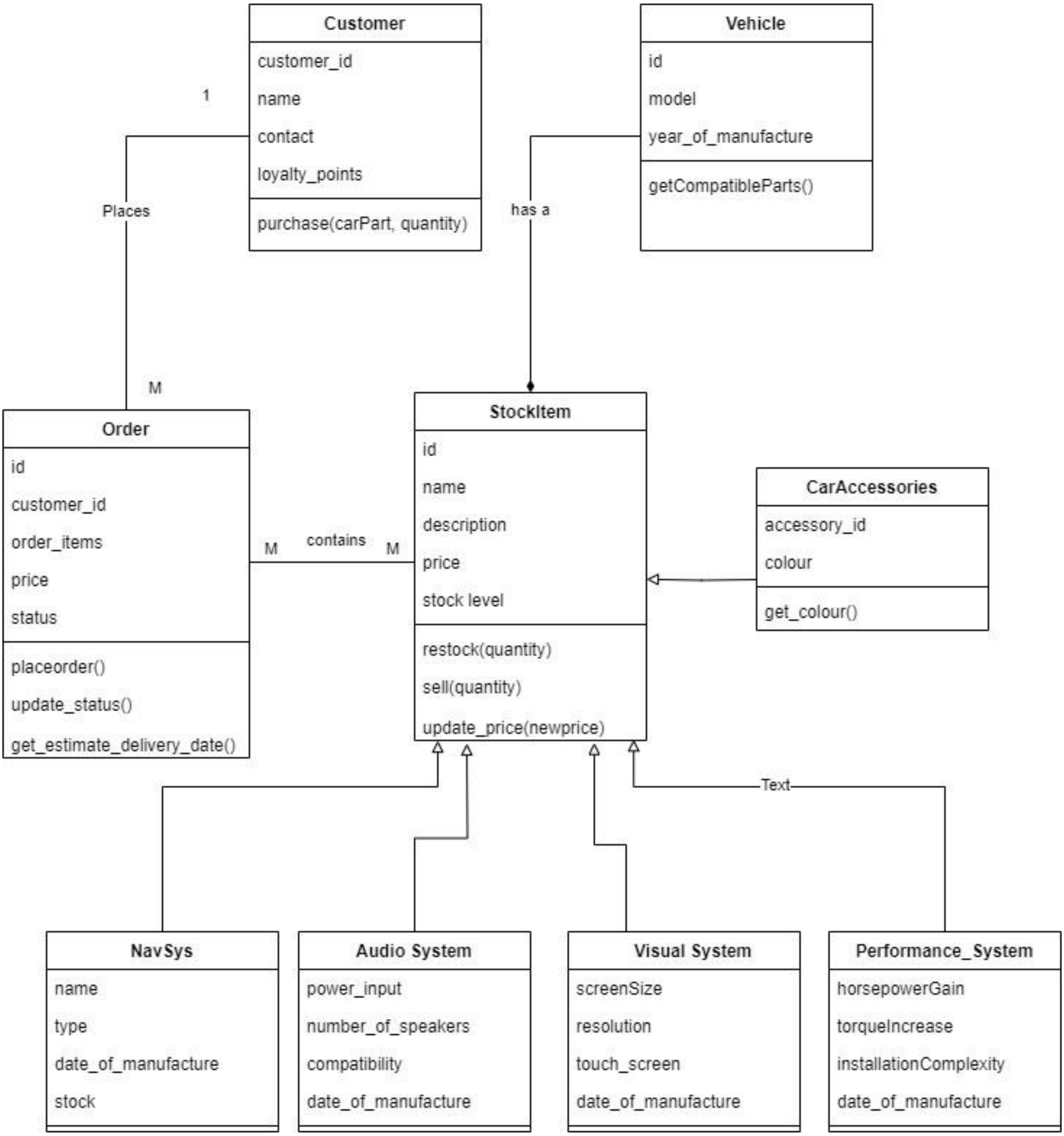
Test Case	Purpose	Expected Result
Valid Visual System Creation	Test if the constructor successfully creates a VisualSystem object with the provided attributes.	VisualSystem object is created with the specified screenSize, resolution, touch_screen capability, and date_of_manufacture.
Empty Screen Size	Test if the constructor handles an empty screen size string.	Error message indicating missing screen size information.
Invalid Screen Size Format	Test if the constructor handles an invalid screen size format (e.g., not a valid measurement like inches or centimeters).	Error message indicating invalid screen size format.
Empty Resolution	Test if the constructor handles an empty resolution string.	Error message indicating missing resolution information.
Invalid Resolution Format	Test if the constructor handles an invalid resolution format (e.g., not a common resolution format like "1920x1080").	Error message indicating invalid resolution format.
Invalid Touch Screen Value	Test if the constructor handles invalid values for touch_screen (e.g., anything other than "Yes" or "No").	Error message indicating invalid touch screen value.

Invalid Date Format	Test if the constructor handles an invalid date format for date_of_manufacture.	Error message indicating invalid date format.
Getters for Attributes	Test if the getter methods (e.g., getScreenSize(), getResolution(), etc.) return the correct values set during construction.	The getter methods return the corresponding values set for each attribute.

Performance System:

Test Case	Purpose	Expected Result
Valid Performance System Creation	Test if the constructor successfully creates a PerformanceSystem object with the provided attributes.	PerformanceSystem object is created with the specified horsepowerGain, torqueIncrease, installationComplexity, and date_of_manufacture.
Negative Horsepower Gain	Test if the constructor handles negative values for horsepowerGain.	Error message indicating invalid horsepower gain value.
Negative Torque Increase	Test if the constructor handles negative values for torqueIncrease.	Error message indicating invalid torque increase value.
Invalid Installation Complexity Format	Test if the constructor handles an invalid format for installationComplexity (e.g., not a numerical value or outside a defined range).	Error message indicating invalid installation complexity value.
Invalid Date Format	Test if the constructor handles an invalid date format for date_of_manufacture.	Error message indicating invalid date format.
Getters for Attributes	Test if the getter methods (e.g., getHorsepowerGain(), getTorqueIncrease(), etc.) return the correct values set during construction.	The getter methods return the corresponding values set for each attribute.

Detailed UML Diagram: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contact
loyalty_points
purchase(carPart, quantity)
Vehicle
id
model
year_of_manufacture
getCompatibleParts()
1
Places
M
has a
Order
id
customer_id
order_items
price
status
placeorder()
update_status()
get_estimate_delivery_date()
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contains
M
StockItem
id
name
description
price
stock level
restock(quantity)
sell(quantity)
update_price(newprice)
CarAccessories
accessory_id
colour
get_colour()
Text
NavSys
name
type
date_of_manufacture
stock
Audio System
power_input
number_of_speakers
compatibility
date_of_manufacture
Visual System
screenSize
resolution
touch_screen
date_of_manufacture
Performance_System
horsepowerGain
torqueIncrease
installationComplexity
date_of_manufacture