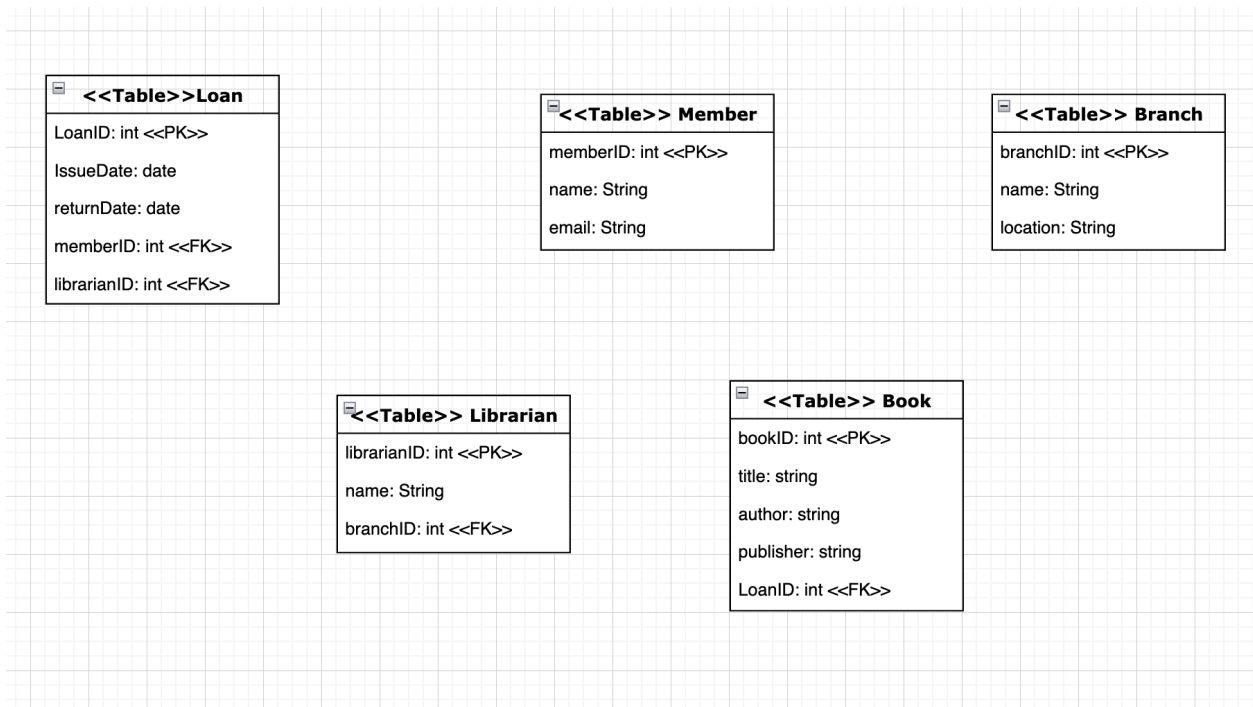
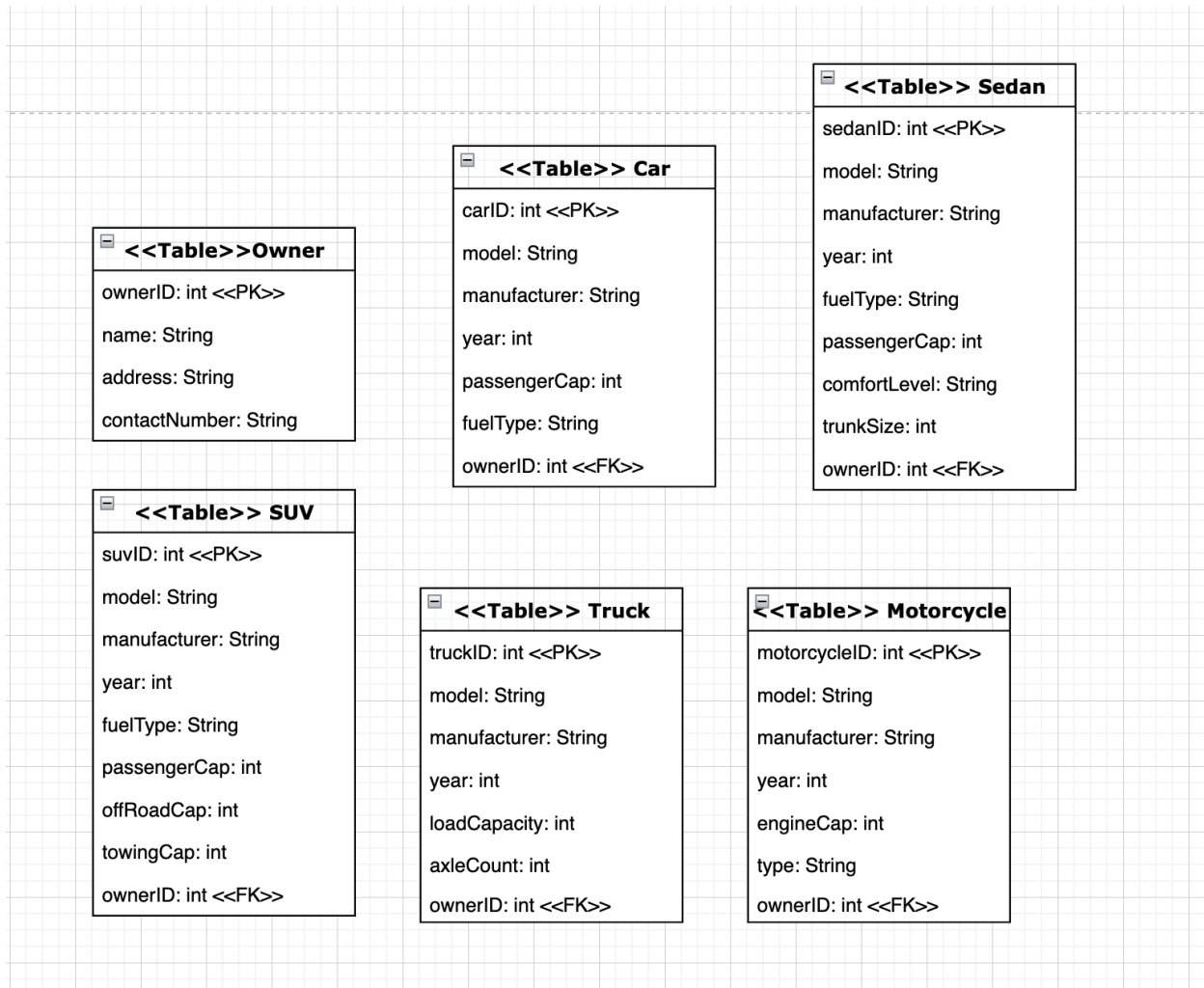


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Problem 1:



Problem 2:



Here we are using Concrete Table Inheritance because relational databases do not support inheritance. We use this strategy so that each concrete subclass has its own table that contains the inherited attributes from Vehicle Class, the subclasses own attributes and the foreign key that Class Vehicle has on Owner Class for all subclasses. By doing so, we are not creating the Class Vehicle, and this allows us to avoid using operation JOIN for each subclass. We know for a fact that the JOIN statement is very costly to use. It also allows us to avoid any NULL columns in the Vehicle Class too. This will allow us to not waste space in memory.

Problem 3:

| <table><tr><th>Branch</th></tr><tr><td>BranchId: String &lt;&lt;PK&gt;&gt;</td></tr><tr><td>Location: String</td></tr></table>   | Branch   | BranchId: String <<PK>>   | Location: String | <table><tr><th>RentalHistory</th></tr><tr><td>RentalID: String &lt;&lt;PK&gt;&gt;</td></tr><tr><td>CarId: String &lt;&lt;FK&gt;&gt;</td></tr><tr><td>CustomerId: String &lt;&lt;FK&gt;&gt;</td></tr><tr><td>RentalDate: Date</td></tr><tr><td>ReturnedDate: Date</td></tr><tr><td>ReturnedToBranchId: String &lt;&lt;FK&gt;&gt;</td></tr><tr><td>RentedToBranchId: String &lt;&lt;FK&gt;&gt;</td></tr></table> | RentalHistory | RentalID: String <<PK>> | CarId: String <<FK>> | CustomerId: String <<FK>> | RentalDate: Date | ReturnedDate: Date | ReturnedToBranchId: String <<FK>> | RentedToBranchId: String <<FK>> |
|--|----------|---------------------------|------------------|--|---------------|-------------------------|----------------------|---------------------------|------------------|--------------------|-----------------------------------|---------------------------------|
| Branch   |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| BranchId: String <<PK>>  |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| Location: String   |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| RentalHistory  |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| RentalID: String <<PK>>  |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| CarId: String <<FK>>   |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| CustomerId: String <<FK>>  |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| RentalDate: Date   |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| ReturnedDate: Date   |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| ReturnedToBranchId: String <<FK>>  |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| RentedToBranchId: String <<FK>>  |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| <table><tr><th>Customer</th></tr><tr><td>CustomerID: String &lt;&lt;PK&gt;&gt;</td></tr><tr><td>Name: String</td></tr></table>   | Customer | CustomerID: String <<PK>> | Name: String     |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| Customer   |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| CustomerID: String <<PK>>  |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| Name: String   |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| <table><tr><th>Car</th></tr><tr><td>CarId: String &lt;&lt;PK&gt;&gt;</td></tr><tr><td>Status: String</td></tr><tr><td>CurrentBranchId: String &lt;&lt;FK&gt;&gt;</td></tr></table> | Car      | CarId: String <<PK>>      | Status: String   | CurrentBranchId: String <<FK>>   |               |                         |                      |                           |                  |                    |                                   |                                 |
| Car  |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| CarId: String <<PK>>   |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| Status: String   |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |
| CurrentBranchId: String <<FK>>   |          |                           |                  |  |               |                         |                      |                           |                  |                    |                                   |                                 |