LOGICAL MODELLING

Student Name: Aishwarya Manumari   Student Id: 2219873   Student FAN: manu0083

VehicleType (make, model, doors, body, trim)
Primary Key (make, model)
Foreign Key make **references** VehicleType (make) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key model **references** VehicleType (model) ON UPDATE CASCADE ON DELETE NO ACTION

Justification
VehicleType is a strong entity. Primary keys make, model are set to NOT NULL to maintain entity integrity constraint and VehicleType has mandatory participation in Has a relationship with Vehicle and booked relationship with booking. UPDATE CASCADE was chosen to update make, model whenever the attribute changes in the VehicleType table. DELETE NO ACTION has been selected to stop make, model being deleted without first updating VehicleType.

DailyTariff (tariffID, conditions)
Primary Key tariffID
Foreign Key tariffID **references** DailyTariff (tariffID) ON UPDATE CASCADE ON DELETE NO ACTION

Justification
DailyTariff is a strong entity. Primary key tariffID is NOT NULL to maintain entity integrity and has mandatory participation with tariffs relationship. UPDATE CASCADE was chosen to update tariffID whenever the attribute changes in the DailyTariff table. DELETE NO ACTION has been selected to stop tariffID being deleted without first updating DailyTariff.

Records (make, model, tariffID, rentalPrice)
Primary Key (make, model, tariffID)
Foreign Key make **references** VehicleType (make) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key model **references** VehicleType (model) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key tariffID **references** DailyTariff (tariffID) ON UPDATE CASCADE ON DELETE NO ACTION

Justification
Records is a strong entity. VehicleType and DailyTariff entities have been merged to create a new relation due to their *:* binary relationship/cardinality. The primary keys make, model from VehicleType entity and tariffID from DailyTariff entity have been posted into the Records relation to act as foreign keys. Due to *:* relationship Records has no parent or child. These foreign keys also form the primary key of the new relation, with rentalPrice being the attribute of relationship. Primary keys make, model, tariffID are NOT NULL as Records has mandatory participation in Has a, Tariffs and Booked relationships and to maintain entity integrity. UPDATE CASCADE was chosen to update make, model, tariffID whenever the attribute changes in the VehicleType and DailyTariff table. DELETE NO ACTION has been selected to stop make, model, tariffID being deleted without first updating Records.

Vehicle (regNum, fleetNum, colour, scheduleDate, kilometrage, make, model, scheduledepotID, availabledepotID)
Primary Key regNum
Foreign Key make **references** VehicleType (make) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key model **references** VehicleType (model) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key scheduledepotID **references** Depot (depotID) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key availabledepotID **references** Depot (depotID) ON UPDATE CASCADE ON DELETE NO ACTION

Justification
Vehicle is a Strong entity. scheduleDate has been merged into the Vehicle entity from the ScheduledService entity from a 1:1 States with mandatory participation on both sides, where its PK regNum is NOT NULL. Make and model, have been posted into the Vehicle relation from 1:* has a relationship where Vehicle was the child and VehicleType was the parent. scheduledepotID and availabledepotID have been posted into the Vehicle relation from 1:* Has Available and Scheduled For relationships where Vehicle is the child and Depot is the parent. All foreign keys are set to NOT NULL as Vehicle has mandatory participation with parent tables. UPDATE CASCADE was chosen to update all foreign keys whenever the attribute changes in the Vehicle table. DELETE NO ACTION has been selected to stop foreign keys being deleted without first updating Vehicle.

Client (clientID, street, postcode)
Primary Key clientID

Justification
Client is a Strong entity. The composite attribute address has only its constituent simple attributes street and postcode listed. Primary key clientID is NOT NULL to maintain entity integrity and has mandatory participation with Hires and Makes relationships.

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PhoneNumber (clientID, PhoneNumber)
Primary Key (clientID, PhoneNumber)
Foreign Key clientID **references** Client (clientID) ON UPDATE CASCADE ON DELETE CASCADE

Justification
PhoneNumber is a multi-valued attribute with clientID being the primary key posted into the new relation PhoneNumber to act as a foreign key. UPDATE CASCADE was chosen to update clientID whenever the attribute changes in the Client table. DELETE CASCADE has been selected to automatically delete all the child/subclass tuples being deleted when clientID from the superclass is deleted. **Ex:** clientID 'B003' no longer wants a hire a vehicle therefore delete his/her clientID also deletes their phone number. If wants to hire again a new clientID shall be given.

PersonClient (personClientID, fName, IName, title, driversNum)
Primary Key personClientID
Foreign Key personClientID **references** Client (clientID) ON UPDATE CASCADE ON DELETE NO ACTION

Justification
PersonClient is a Weak entity. The composite attribute name has only its constituent simple attributes fName, lname and title listed. clientID from Client entity has been merged into PersonClient entity as personClientID with *Mandatory* participation and *Or* disjoint however this is not possible with this participation/disjoint constraint as one of child's (person or company) must be NULL but Client can be a person or a company. This superclass/subclass relationship becomes even complex where parent Client participates in hires relationship with HiredVehicle entity. As a result *Optional, Or* was used to maintain each superclass/subclass as their own relations. Primary key clientID of the parent is posted into PersonClient subclass to act as foreign key. UPDATE CASCADE was chosen to update clientID whenever the attribute changes in the Client table. DELETE NO ACTION has been selected to stop foreign keys being deleted without first updating Client. ClientID is set to NOT NULL due to mandatory participation with parent Client.

CompanyClient (companyClientID, cName, personclientID)
Primary Key companyClientID
Foreign Key companyClientID **references** Client (clientID) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key personClientID **references** Client (clientID) ON UPDATE CASCADE ON DELETE NO ACTION

Justification
CompanyClient is a Weak entity. clientID from Client entity has been merged into CompanyClient entity as companyClientID using *Optional, Or* participation, disjoint . This enabled to maintain each superclass Client and subclasses (PersonClient and CompanyClient) with their own relations. Primary key personClientID is posted into the CompanyClient entity from the PersonClient entity on the optional side from a 1:1 states relationship with mandatory participation on one side. Primary key clientID of the parent is posted into the CompanyClient subclass to act as foreign key. UPDATE CASCADE was chosen to update clientID whenever the attribute changes in the Client table. DELETE NO ACTION has been selected to stop foreign keys being deleted without first updating Client. ClientID is set to NOT NULL due to mandatory participation with parent Client.

Depot (depotID, street, postcode, fax)
Primary Key depotID

Justification
Depot is a Strong entity. The composite attribute address has only its constituent simple attributes street and postcode listed. Primary key depotID is NOT NULL to maintain entity integrity. Fax from Depot is SET to NULL due to 0:* states optional participation with relationships serviced at, has available, HiredVehicle pick up at, returns to, booking pick up at from child entities and depot being the parent.

TelephoneNum (depotID, telephoneNum)
Primary Key (depotID, telephoneNum)
Foreign Key depotID **references** Depot (depotID) ON UPDATE CASCADE ON DELETE CASCADE

Justification
TelephoneNum is a multi-valued attribute with depotID being the primary key posted into the new relation telephoneNum to act as a foreign key. UPDATE CASCADE was chosen to update depotID whenever the attribute changes in the Depot table. DELETE CASCADE has been selected to automatically delete all the child tuples being deleted when depotID from the superclass is deleted.

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Insurance (insuranceID, policyType, cost)
Primary Key insuranceID

Justification
Insurance is a strong entity. 'policyNumber' as the attribute of relationship which is posted into the HiredVehicle which is the child. Primary key insuranceID is NOT NULL to maintain entity integrity.

HiredVehicle (regdate, cardType, cardNo, kilometrage, days, regNum, tariffID, returndepotID, pickupdepotID, clientID, insuranceID, policyNumber)
Primary Key (regDate, regNum)
Foreign Key regNum **references** Vehicle (regNum) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key tariffID **references** DailyTariff (tariffID) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key returndepotID **references** Depot (depotID) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key pickupdepotID **references** Depot (depotID) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key clientID **references** Client (clientID) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key insuranceID **references** Insurance (insuranceID) ON UPDATE CASCADE ON DELETE SET NULL

Justification
HiredVehicle is a weak entity. regnNum has been posted into the HiredVehicle relation from a 1:* Hired relationship where HiredVehicle was the child and Vehicle was the parent. HiredVehicle has two primary keys regDate and regNum (which is also a foreign key) from Vehicle entity for unique identification. tariffID has been posted into the HiredVehicle relation from a 1:* Tariffs relationship where HiredVehicle was the child and DailyTariff was the parent. returndepotID has been posted into the HiredVehicle relation from a 1:* Returns to relationship where HiredVehicle was the child and Depot was the parent. pickupdepotID has been posted into the HiredVehicle relation from a 1:* pickup at relationship where HiredVehicle was the child and Depot was the parent. clientID has been posted into the HiredVehicle relation from a 1:*Hires relationship where HiredVehicle was the child and Client was the parent. insuranceID has been posted into the HiredVehicle relation from a 1:* Insures relationship where HiredVehicle was the child and Insurance was the parent. 'policyNumber' as the attribute of relationship is posted into the HiredVehicle as it is the child. All foreign keys are NOT NULL as parent entities have mandatory participation in relationship with HiredVehicle. UPDATE CASCADE was chosen to update foreign keys whenever the attribute changes in the parent tables. DELETE NO ACTION has been selected to stop foreign keys being deleted without first updating HiredVehicle. However insuranceID is given DELETE SET NULL because of its optional participation with Insures relationship with HiredVehicle. Therefore if insuranceID is deleted from the Insurance table, insuranceID participating in the HiredVehicle as a foreign key is set to NULL due to its optional participation.

ServiceHistory (regNumDate, cost, description, regNum, depotID)
Primary Key regNumDate
Foreign Key regNum **references** Vehicle (regNum) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key depotID **references** Depot (depotID) ON UPDATE CASCADE ON DELETE NO ACTION

Justification
Service History is a Weak Entity. regNum has been posted into the ServiceHistory relation from a 1:* Keeps relationship where ServiceHistory was the child and Vehicle was the parent. depotID has been posted into the ServiceHistory relation from a 1:* Serviced at relationship where ServiceHistory was the child and Depot was the parent. Foreign keys regNum and depotID is NOT NULL as ServiceHistory has mandatory participation in the Keeps and Serviced at relationships. Primary key regNumDate is NOT NULL to maintain entity integrity. UPDATE CASCADE was chosen to update regNum whenever the attribute changes in the Vehicle table and depotID whenever the attribute changes in the Depot table . DELETE NO ACTION has been selected to stop regNum and depotID being deleted without first updating ServiceHistory.

Booking (startDate, hireDays, colour, make, model, depotID, clientID)
Primary Key (startDate, clientID)
Foreign Key make **references** VehicleType (make) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key model **references** VehicleType (model) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key depotID **references** Depot (depotID) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key clientID **references** Client (clientID) ON UPDATE CASCADE ON DELETE NO ACTION

Justification
Booking is a Strong Entity. Primary Keys make and model from the VehicleType have been posted into Booking from a 1:* Booked relationship where Booking was the child and VehicleType was the parent. depotID from Depot has been posted into Booking from 1:* Pickup at relationship where Booking was the child and Depot was the parent. clientID from the Client has been posted into Booking from 1:* Makes relationship where Booking was the child and Client was the parent. Primary key

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startDate, clientID is NOT NULL to maintain entity integrity. UPDATE CASCADE was chosen to update foreign keys (make, model, depotID, clientID) whenever the attribute changes in the Booking table. DELETE NO ACTION has been selected to stop foreign keys being deleted without first updating Booking.

Invoice (invoiceID, qualityCheck, datePaid, regDate, regNum)
Primary Key invoiceID
Foreign Key regDate **references** HiredVehicle (regDate) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key regNum **references** HiredVehicle (regNum) ON UPDATE CASCADE ON DELETE NO ACTION
Derived finalCost

Justification
Invoice is a Weak Entity. Primary key regDate and regNum is posted into the Invoice entity from the HiredVehicle entity on the optional side from a 1:1 states relationship with mandatory participation on one side. Primary key invoiceID is NOT NULL to maintain entity integrity, however datePaid is set to NULL as it is dependent on the calculated value or derived attribute. The value for the finalCost attribute of the Invoice entity is calculated from HiredVehicle date and datePaid in Invoice, where finalCost is the derived attribute. HiredVehicle is the parent in the Generated For relationship while Invoice is the child. UPDATE CASCADE was chosen to update regDate and regNum whenever the attribute changes in the HiredVehicle table. DELETE NO ACTION has been selected to stop foreign keys being deleted without first updating Invoice.

Nominate (regDate, regNum, personclientID)
Primary Key (regDate, regNum, clientID)
Foreign Key regDate **references** HiredVehicle (regDate) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key regNum **references** HiredVehicle (regNum) ON UPDATE CASCADE ON DELETE NO ACTION
Foreign Key personclientID **references** Client (clientID) ON UPDATE CASCADE ON DELETE NO ACTION

Justification
Nominate is a Weak entity. HiredVehicle and PersonClient entities have been merged to create a new relation due to their *:* binary relationship/cardinality. The primary keys regDate and regNum from HiredVehicle entity and personClientID from PersonClient entity have been posted into the Nominate relation to act as foreign keys. Due to *:* relationship Nominate has no parent or child. These foreign keys also form the primary key of the new relation. Primary keys regDate and regNum, and personClientID are NOT NULL as Nominate has mandatory participation in Nominate and Represent relationships and to maintain entity integrity. UPDATE CASCADE was chosen to update regDate and regNum, personClientID whenever the attribute changes in the HiredVehicle and PersonClient table. DELETE NO ACTION has been selected to stop regDate and regNum and personClientID being deleted without first updating Nominate.