Project 01: ER Diagram

Group #47

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Application Constraints

Data

Customers		
✔	email address (**email**)	Key attributes Customers should be uniquely identified by their email address
✔	phone number (**phone**) date of birth (**dob**)	Attributes
✔	home address (**address**) full name (**name**)	Composite Attributes *home address*: Composed of street (**street**), block (**block**), zip (**zip**) *full name*: Composed of first name (**fname**) and last name (**lname**)
✔	age (**age**)	Derived Attributes Derived from *date of birth*

Bookings		
✔	booking id (**bid**)	Key attributes Booking must have a unique booking id
✔	booking date (**bdate**) start date (**sdate**) number of days (**days**) pickup location (**location**) credit card number(**ccnum**) driver (**driver**) brand (**brand**) car model (**cmodel**)	Attributes Employees must choose a car model, pickup location, start date, and number of days to rent Booking date is recorded after Customer makes a booking Customers credit card number must be recorded after a booking is made
✔	end date (**edate**)	Derived Attributes Derived from (*start date + number of days*)

Employees		
✔	employee_id(**empid**)	Key attribute Employees must be uniquely identified by their employee id
✔	phone number(**pnum**)	Attributes
✔	full name(**fname**) location (**location**)	Composite attributes full name: Composed of first name and last name location:Composed of location name and location code

Drivers		
✔	Driver's License (**pdvl**)	Attribute A driver must have a private hire driver vocational license

Car Model		
✔	brand (**brand**) car model (**cmodel**)	Key Attribute Different brands of cars can have the same car model.
✔	capacity (**capacity**)	Attribute The car model must have a capacity.
✔	rental pricing information (**price**)	Composite attributes rental pricing information: Composed of daily rent price (**dailyrent**) and deposit (**deposit**)

Car		
✔	license plate number (**pnumber**)	Key Attribute Every car is uniquely identified by its license plate number
✔	color (**color**) year produced (**year**) brand (**brand**) car model (**cmodel**) location (**lzip**) is damaged (**isdamaged**)	Attribute

Offices		
✔	location zip code (**lzip**)	Key Attribute
✔	location name (**lname**)	Attribute
╳	location name (**lname**)	Unique

RentalTransaction (weak entity set)		
✔	booking id (**bid**) pickup employee id (**pempid**)	Key Attribute Assumption: There is only 1 driver for each booking Partial Key Attribute: pickup employee id (**pempid**)
✔	rental start date (**rsdate**) key return date (**krdate**) return employee id (**retempid**) deposit amount (**deposit**) daily rental (**drental)** credit card number (**ccnum**)	Attribute
✔	additional cost (**addcost**) total cost (**totalcost**)	Derived Attributes totalcost = (krdate - rsdate) * drental addcost = totalcost - deposit

DriverHiring		
✔	booking id (**bid**)	Key Attribute Assumption: There is only 1 driver for each booking

✔	Employee ID (**empid**) Start Date (**sdate**) Number of Days (**ndays**) Credit Card Number (**ccnum**)	Attribute

Relations

Initiates (**Binary relationship involving customers and bookings**)	
✔	*No additional attributes*
✔	A customer may initiate 0 bookings (lower bound - pp constraint)
✔	A customer may initiate more than 1 bookings
✔	A booking must be initiated by at least 1 customer (upper bound - tp constraint)
✔	A booking may be initiated by at most 1 customer (*i.e., for the same booking id*) (upper bound - key constraint)
╳	A booking initiated by a customer may be cancelled if no car is available after 2 days *[Not enforced because this is an automatic action]*

Is-A (**Relationship involving employees and drivers**)	
✔	*No additional attributes*
✔	An employee need not be a driver (covering constraint is false)
✔	An employee cannot belong to multiple specialised entity sets (overlap constraint is false)

Works At (**Binary relationship involving employees and offices**)	
✔	*No additional attributes*
✔	An employee must work at one location minimum .
✔	An employee must work at one location max.
✔	A location must have at least one employee

Parked At (**Binary relationship involving cars and offices**)	
✔	*No additional attributes*
✔	A car must be parked at one office location minimum.
✔	A car must be parked at one office location max.
✔	A location may have 0 cars.
✔	A location may have 1 or more cars.
╳	A car returned not at it's parking office will be returned to its parking office the next day *[Not enforced because this is an automatic action]*

Includes (**Binary relationship involving bookings and offices**)	
✔	*No additional attributes*
✔	A booking must include at least one office location
✔	A booking must include at most one office location.
✔	An office location can be in 0 bookings
✔	An office location can be in any number of bookings

Books (**Binary relationship involving bookings and car models**)	
✔	*No additional attributes*
✔	A booking must include at most one car model. (there can be a pending booking without any driver)
✔	A car model can be in 0 bookings
✔	A car model can be more than 1 booking

Has (**Binary relationship involving car and car models**)	
✔	*No additional attributes*
✔	A car must have at least one car model
✔	A car must have at most one car model
✔	A car model can be the car model of 0 cars
✔	A car model can be the car model of more than 1 car

Hires (**Binary relationship involving booking and drivers**)	
✔	*credit card (**ccard**) [as may be different than the credit card used for booking]* *hire start date (**hsdate)** [driver hire start date may not be on the rental start date]* *hire end date (**hedate)** [driver hiring might end before the rental return date]*
✔	A booking has at most 1 driver
✔	A booking can have 0 drivers.
✔	A driver can have 0 bookings.
✔	A driver can have more than 1 booking.
╳	A driver will not be assigned if the booking does not have a car assigned to it yet. *[Unable to capture in ER diagram, implementation specific]*
╳	A driver can only be assigned to one booking in a given time period *[Unable to capture in ER diagram, implementation specific]*

Key Transact (**Ternary relationship involving booking and rental transaction and employees)**	
✔	*No additional attributes*
✔	A rental transaction is assigned to 1 booking.
✔	A booking is assigned to 1 rental transaction
✔	A rental transaction has 0 or more employees
✔	A booking can be assigned at most 1 car
✔	An employee can be the employee handing over the keys for 0 rental transactions
✔	An employee can be the employee handing over the keys for more than 1 rental transaction
✔	An employee can be the employee receiving the keys for 0 rental transactions
✔	An employee can be the employee receiving the keys for more than 1 rental transaction

Non-trivial designs

Ternary Relationship involving bookings, employees and rental transaction

Key transact is implemented as a ternary relationship between *bookings* and *employees* because an employee is involved in each rental transaction (handover and takeover) and each rental transaction corresponds to one booking.

RentalTransaction as a Weak Entity Set

The *RentalTransaction* and *Bookings* entities are related as each (successful) booking will experience two key transactions, a handover on the rental start date and a takeover on a date on or before the rental end date. Each rental transaction can be uniquely identified by the corresponding booking id, which makes *Bookings* the owning entity set of *RentalTransactions*, and *RentalTransactions* a weak entity set. Hence, *key transact* is the identifying relationship set.

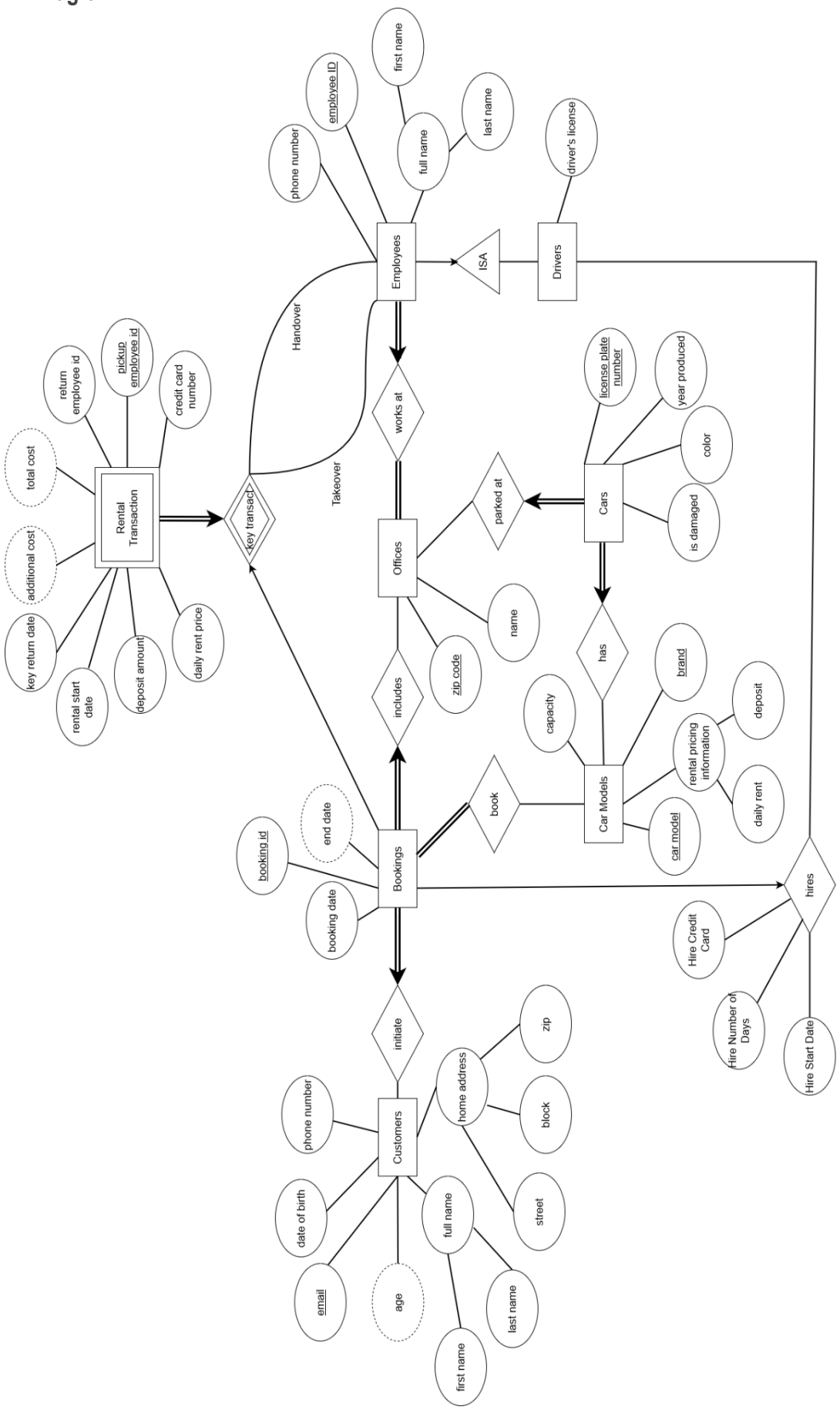
Employee Relationship with RentalTransaction

An employee can be involved with a rental transaction as the employee handing over the keys, or as the employee receiving the keys. An employee can be involved in the same transaction as both the employee handing over and receiving the keys. As the employee handing over the keys, an employee can be involved in 0 or more than 1 rental transactions. Likewise for the employee receiving keys.

ISA Relationship between Drivers and Employees

A driver is a specialized employee with the additional attribute of a driver's license. Hence an ISA relationship is best suited to model this relationship and this also allows a clearer and easier association between entities with drivers and employees.

ER Diagram


Employees
phone number
employee ID
first name
full name
last name
ISA
Drivers
driver's license
Handover
Takeover
works at
Offices
name
zip code
includes
parked at
Cars
license plate number
year produced
color
is damaged
has
Car Models
capacity
brand
rental pricing information
deposit
daily rent
car model
book
Bookings
booking id
end date
booking date
hires
Hire Credit Card
Hire Number of Days
Hire Start Date
initiate
Customers
phone number
date of birth
email
age
full name
first name
last name
home address
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block
street
Rental Transaction
total cost
additional cost
key return date
rental start date
deposit amount
daily rent price
return employee id
pickup employee id
credit card number
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