INFO20003 Database Systems

Week 4

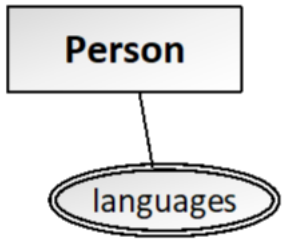
Assignment

- Assignment 1 is out

Q1) Multivalued & Composite Attributes

Multivalued attributes: can have **more than one value** at the same time

- E.g. phone numbers, skills, languages spoken, etc.
- drawn using a double outline



Multivalued attribute

Q1) Multivalued & Composite Attributes

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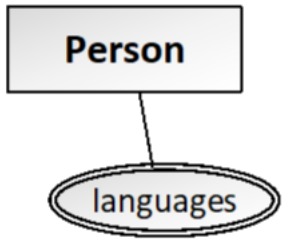
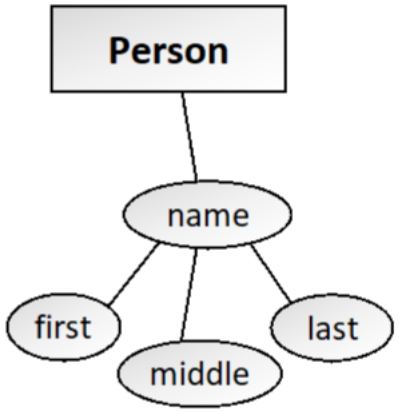


Multivalued attribute



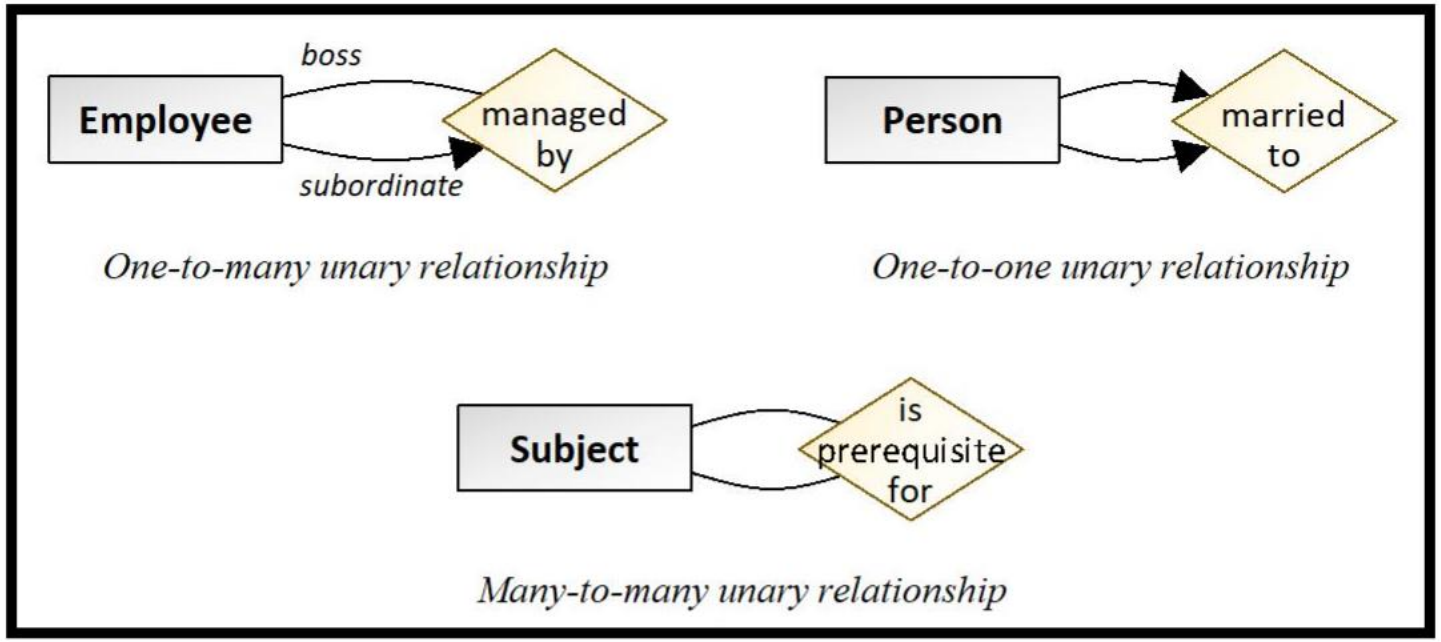
Composite attribute

Composite attributes: have **multiple components** and can be broken down into multiple attributes

- E.g. name (first name + last name)
- drawn by branching the sub-attributes off the composite attribute

Q1) Unary relationship

- unary relationship: relationship between an entity and itself



When the two sides of the relationship have different constraints, it is important to label the two ends of the unary relationship to make it clear what the constraints apply to.

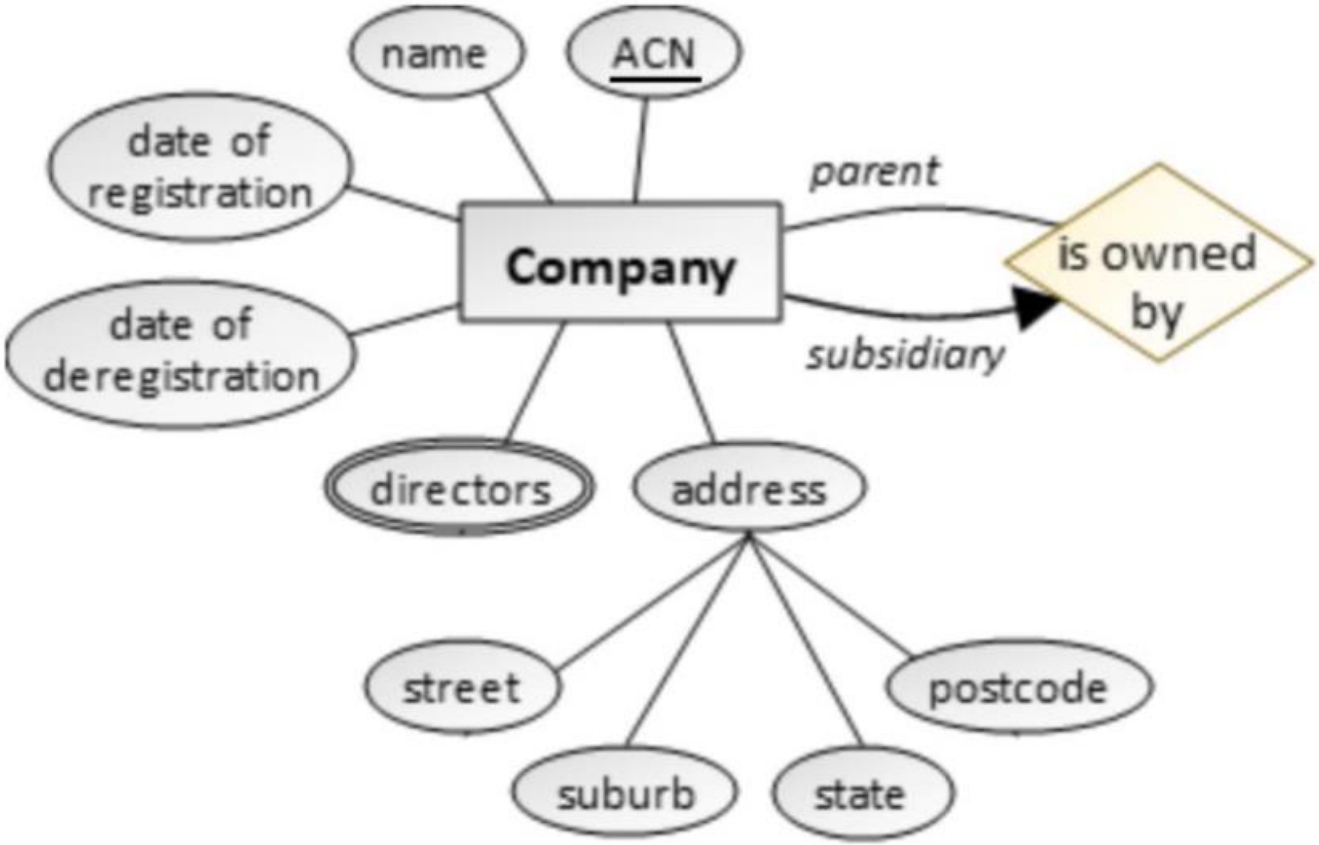
Q2)

2. Practising these concepts:

Australia's corporate regulator, ASIC, stores a range of information about every Australian company, including the name, the nine-digit ACN (Australian Company Number), the date of registration and deregistration, and the names of the company's directors. Every company has a registered address, made up of the street address, suburb, state and postcode. A company may be owned by another company; in this situation ASIC keeps track of the company's parent company.

Use this information to model a "company" entity using Chen's notation.

Q2)


name
ACN
date of registration
Company
parent
is owned by
subsidiary
date of deregistration
directors
address
street
suburb
state
postcode

Q3)

A bus company owns a number of buses. Each bus is allocated to a particular route, although some routes may have several buses. Each route passes through a number of towns. One or more drivers are allocated to each stage of a route, which corresponds to a journey through some or all of the towns on a route. Some of the towns have a depot where buses are kept – each bus always returns to its allocated depot at the end of the day.

Each of the buses is identified by its registration number and can carry different numbers of passengers, since the vehicles vary in size and can be single or double-decked. Each route is identified by a route number and information is available on the average number of passengers carried per day for each route. Drivers have an employee number, name, address, and sometimes a telephone number, and the names of the training courses they have completed need to be stored. Each depot also has an address.

a) Identify the entities.
b) Identify the relationships (use business rules to identify relationships). State all the key constraints and participation constraints.
c) Draw a conceptual model and populate entities with appropriate attributes (use Chen's notation).
d) Discuss the logical modelling of the Driver entity.

Q3a) Entities

- Bus ← Each bus is allocated to a particular route
- Route ← Each route passes through a number of towns
- Stage ← One or more drivers are allocated to each stage of a route
- Town ← Some of the towns have a depot where buses are kept
- Depot ← Some of the towns have a depot where buses are kept
- Driver ← One or more drivers are allocated to each stage of a route

Q3b) Relationships

A bus company owns a number of buses. Each bus is allocated to a particular route, although some routes may have several buses. Each route passes through a number of towns. One or more drivers are allocated to each stage of a route, which corresponds to a journey through some or all of the towns on a route. Some of the towns have a depot where buses are kept – each bus always returns to its allocated depot at the end of the day.

Q3b) Relationships

A bus company owns a number of buses. Each bus is allocated to a particular route, although some routes may have several buses. Each route passes through a number of towns. One or more drivers are allocated to each stage of a route, which corresponds to a journey through some or all of the towns on a route. Some of the towns have a depot where buses are kept – each bus always returns to its allocated depot at the end of the day.

①

1. Route “operated by” Bus one-to-many

Q3b) Relationships

A bus company owns a number of buses. Each ① bus is allocated to a particular route, although some routes may have several buses. Each route passes through a number of towns. One or more ② drivers are allocated to each stage of a route, which corresponds to a journey through some or all of the towns on a route. Some of the towns have a depot where buses are kept – each bus always returns to its allocated depot at the end of the day.

1. Route "operated by" Bus — one-to-many
2. Driver "allocated to" Stage — many-to-many

Q3b) Relationships

A bus company owns a number of buses. Each (1) bus is allocated to a particular route, although some routes may have several buses. Each route passes through a number of towns. One or more (2) drivers are allocated to each (3) stage of a route, which corresponds to a journey through some or all of the towns on a route. Some of the towns have a depot where buses are kept – each bus always returns to its allocated depot at the end of the day.

1. Route “operated by” Bus	one-to-many
2. Driver “allocated to” Stage	many-to-many
3. Stage “part of” Route	one-to-many

Q3b) Relationships

A bus company owns a number of buses. Each (1) bus is allocated to a particular route, although some routes may have several buses. Each route passes through a number of towns. One or more (2) drivers are allocated to each (3) stage of a route, which corresponds to a journey (4) through some or all of the towns on a route. Some of the towns have a depot where buses are kept – each bus always returns to its allocated depot at the end of the day.

1. Route “operated by” Bus	one-to-many
2. Driver “allocated to” Stage	many-to-many
3. Stage “part of” Route	one-to-many
4. Stage “passes through” Town	many-to-many

Q3b) Relationships

A bus company owns a number of buses. Each (1) bus is allocated to a particular route, although some routes may have several buses. Each route passes through (3) a number of towns. One or more (2) drivers are allocated to each stage of a route, which corresponds to a journey (4) through some or all of the towns on a route. Some of the (5) towns have a depot where buses are kept – each bus always returns to its allocated depot at the end of the day.

1. Route “operated by” Bus	one-to-many
2. Driver “allocated to” Stage	many-to-many
3. Stage “part of” Route	one-to-many
4. Stage “passes through” Town	many-to-many
5. Town “contains” Depot	one-to-one

Q3b) Relationships

A bus company owns a number of buses. Each (1) bus is allocated to a particular route, although some routes may have several buses. Each route passes through (3) a number of towns. One or more (2) drivers are allocated to each stage of a route, which corresponds to a journey (4) through some or all of the towns on a route. Some of the (5) towns have a depot where buses are kept – each (6) bus always returns to its allocated depot at the end of the day.

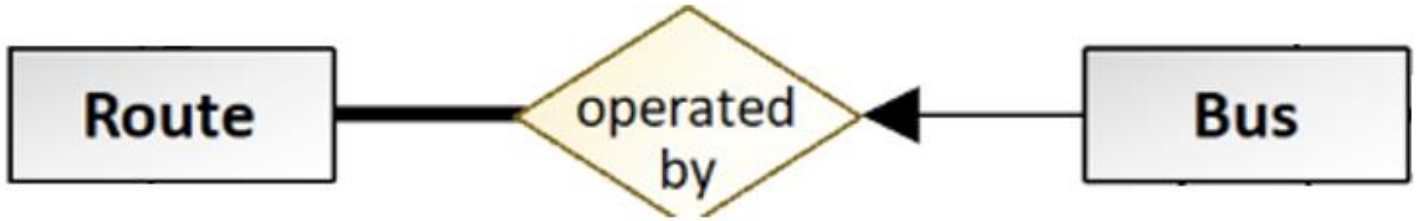
1. Route “operated by” Bus	one-to-many
2. Driver “allocated to” Stage	many-to-many
3. Stage “part of” Route	one-to-many
4. Stage “passes through” Town	many-to-many
5. Town “contains” Depot	one-to-one
6. Bus “allocated to” Depot	one-to-many

Q3b) Relationships

Route “operated by” Bus

Participation constraints:

- The participation of Bus in the relationship ‘operated by’ is **partial** as at some point the bus could be under repair instead of being assigned to a route. However, the participation of Route is **total** as every route should have a bus assigned.

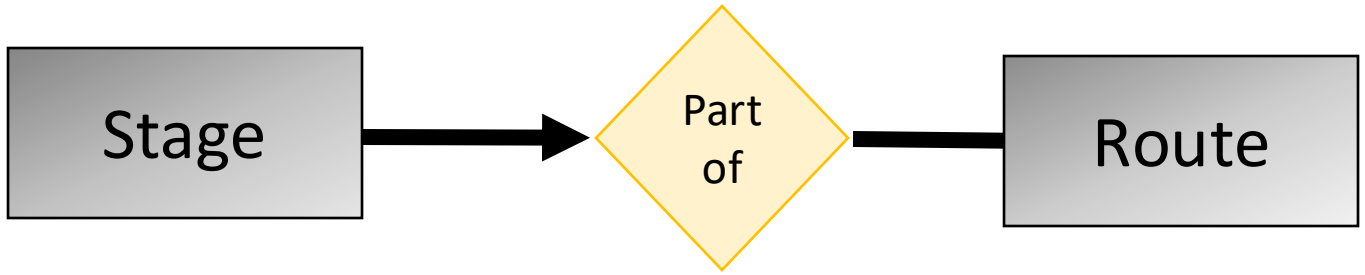


Q3b) Relationships

Participation constraints:

Stage “part of” Route

- The participation of Route and Stage is **total** in the relationship between the two entities.

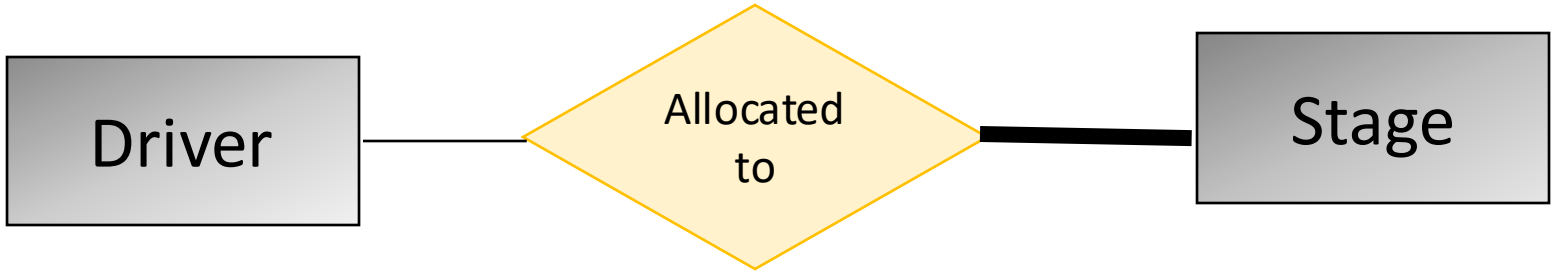


Q3b) Relationships

Participation constraints:

Driver “allocated to” Stage

- The participation of Stage is **total** in the relationship ‘allocated to’ as each stage must have a driver allocated, but the participation of driver is **partial** to accommodate newly appointed or on-leave drivers.

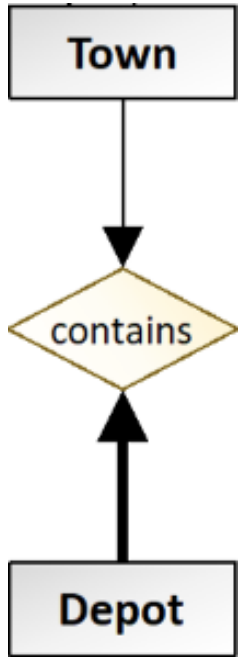


Q3b) Relationships

Participation constraints:

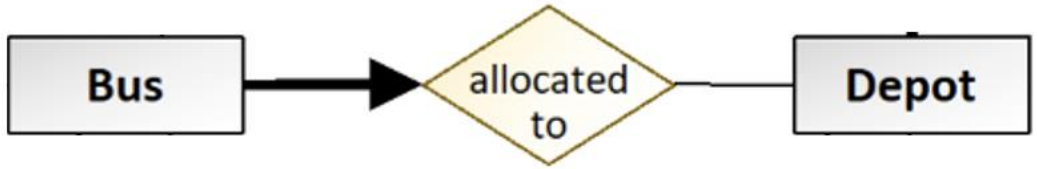
Town “contains” Depot

- The participation of Depot is **total** and Town is **partial** in ‘contains’ as not every town has a depot.



Q3b) Relationships

Participation constraints:



Bus “allocated to” Depot

- The participation of Depot in relationship ‘allocated to’ is **partial**. However, the participation of Bus is **total**, as each bus will be associated with a depot where it is stored when not in use.

Q3b) Relationships

Participation constraints:

Stage “passes through” Town

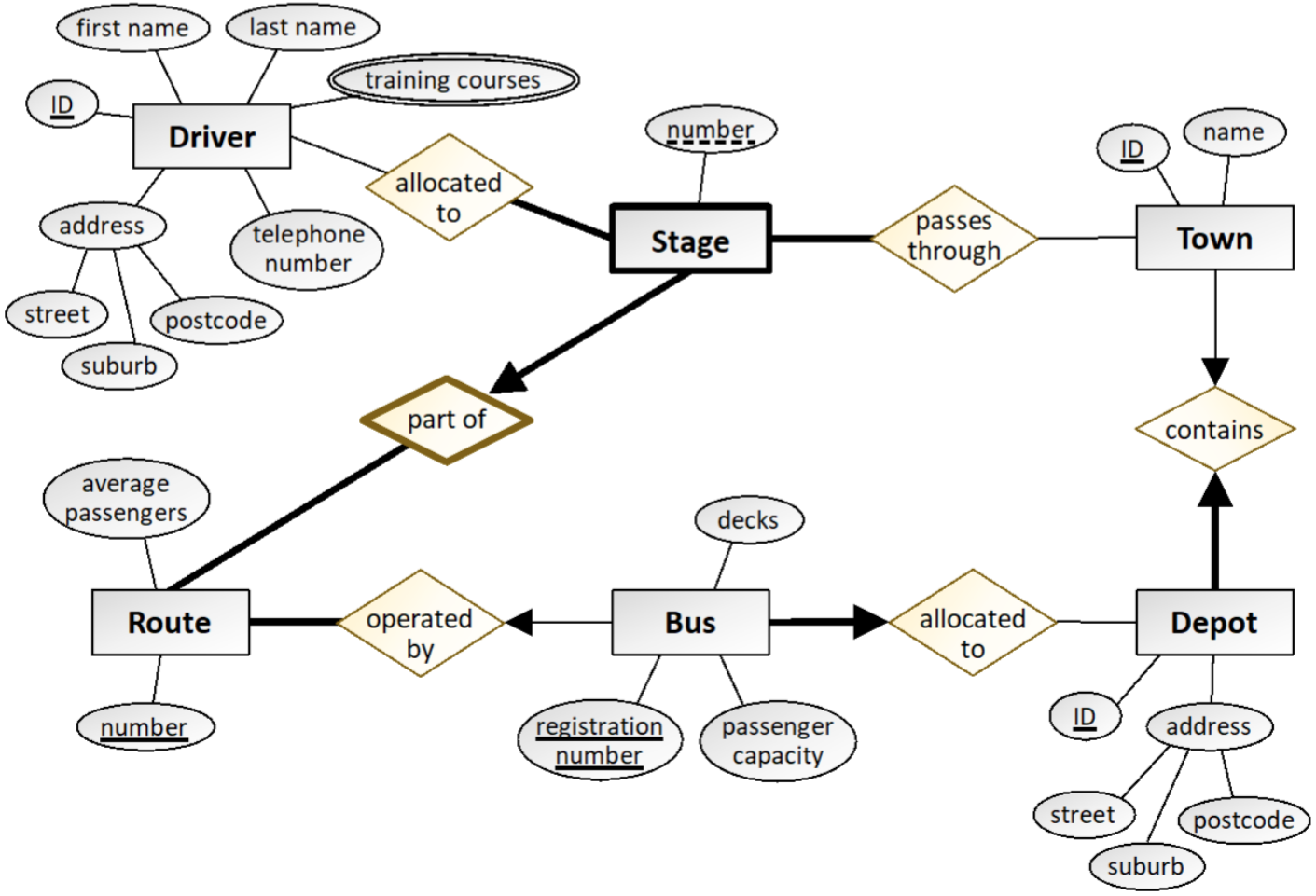
- Stage is **totall**y participating in relationship ‘passes through’ as each stage has to pass through at least one town. However, each Town does not necessarily have a stage (perhaps it only has a depot), hence **partial** participation.

Q3b) Relationships

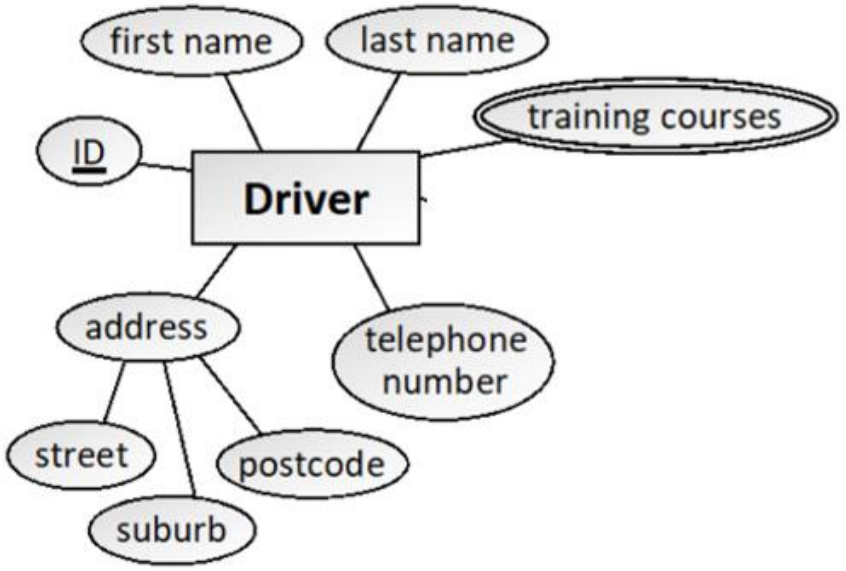
Participation constraints:

Routed "operated by" Bus	• The participation of Bus in the relationship 'operated by' is **partial** as at some point the bus could be under repair instead of being assigned to a route. However, the participation of Route is **total** as every route should have a bus assigned.
Stage "part of" Route	• The participation of Route and Stage is **total** in the relationship between the two entities.
Driver "allocated to" Stage	• The participation of Stage is **total** in the relationship 'allocated to' as each stage must have a driver allocated, but the participation of driver is **partial** to accommodate newly appointed or on-leave drivers.
Town "contains" Depot	• The participation of Depot is **total** and Town is **partial** in 'contains' as not every town has a depot.
Bus "allocated to" Depot	• The participation of Depot in relationship 'allocated to' is **partial**. However, the participation of Bus is **total**, as each bus will be associated with a depot where it is stored when not in use.
Stage "passes through" Town	• Stage is **total**ly participating in relationship 'passes through' as each stage has to pass through at least one town. However, each Town does not necessarily have a stage (perhaps it only has a depot), hence **partial** participation.

Q3c)

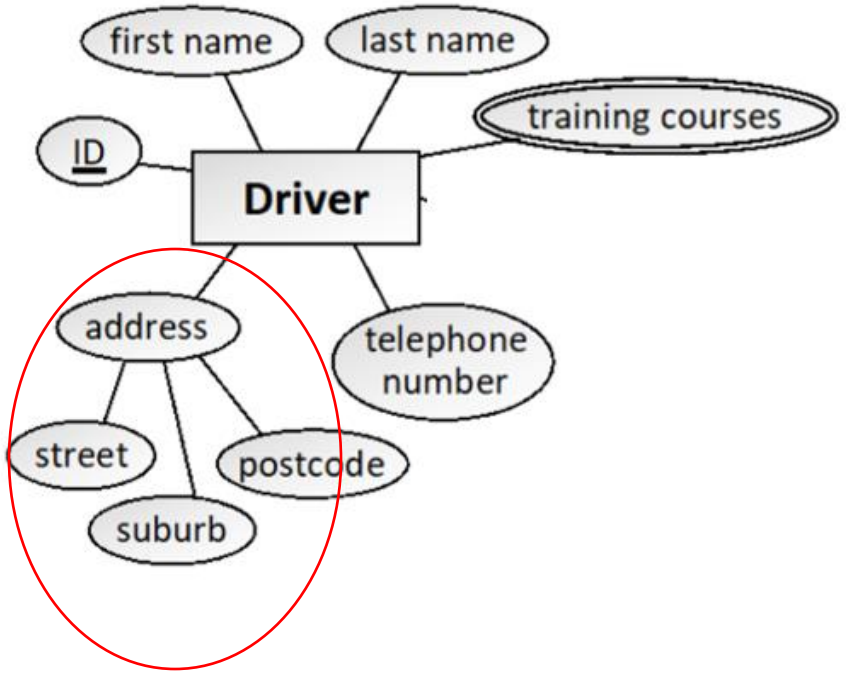

first name
last name
training courses
ID
Driver
allocated to
number
ID
name
address
telephone number
Stage
passes through
Town
street
postcode
suburb
part of
contains
average passengers
decks
Route
operated by
Bus
allocated to
Depot
number
registration number
passenger capacity
ID
address
street
postcode
suburb

Q3d) Logical modelling of Driver entity

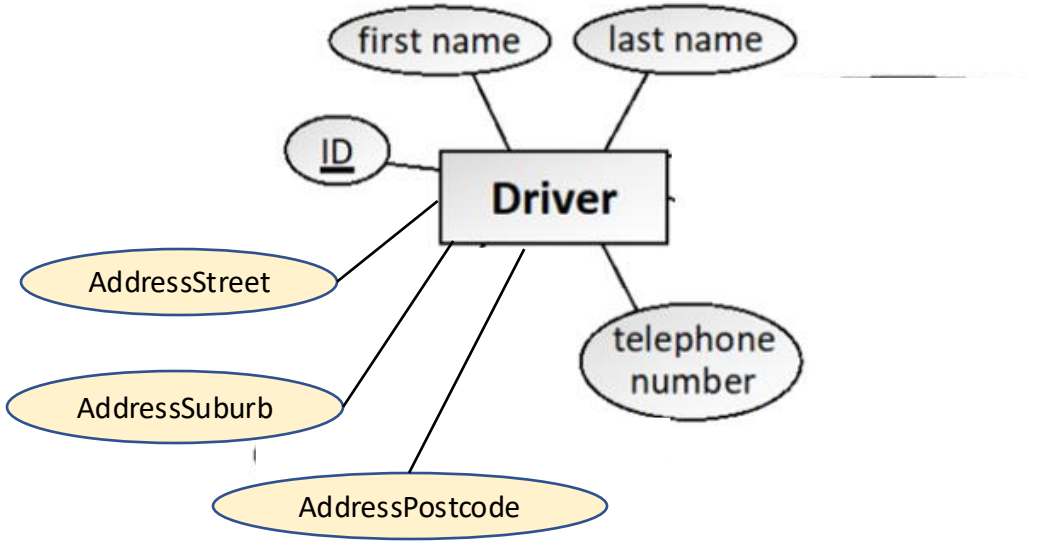


- Resolve composite attributes
- Resolve multivalued attributes

Q3d) Logical modelling of Driver entity

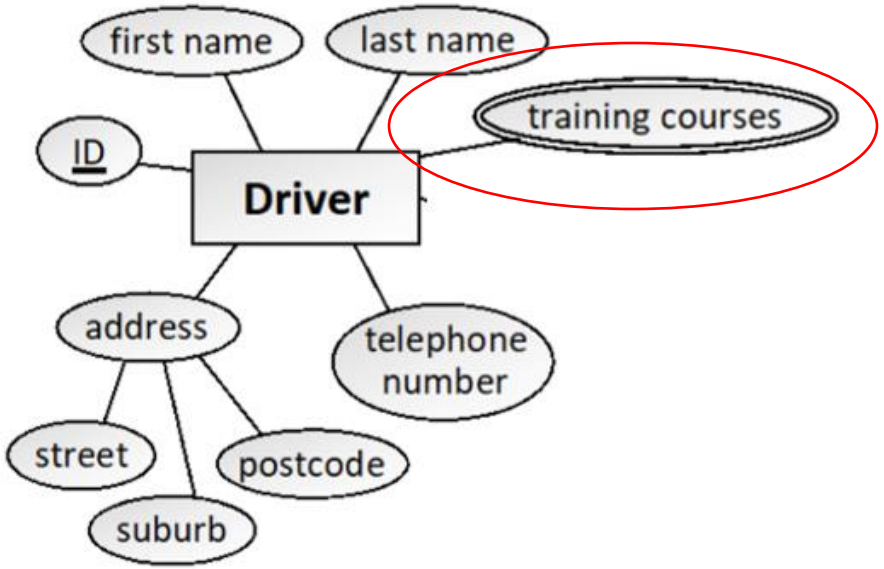


Composite Attribute



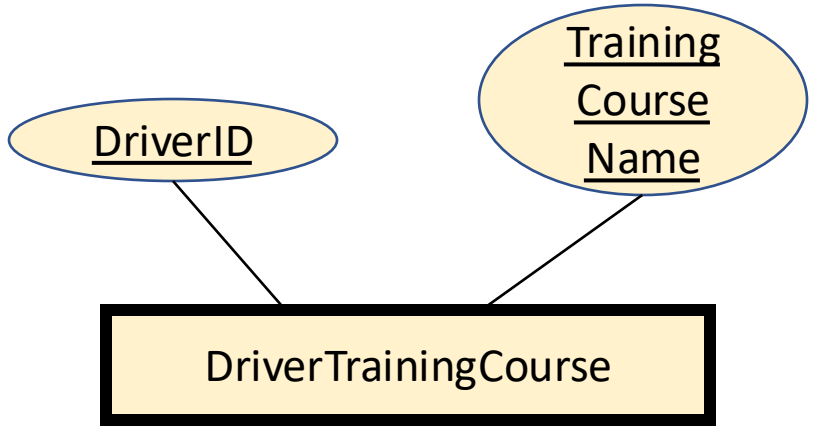
Driver (DriverID, FirstName, LastName, AddressStreet, AddressSuburb, AddressPostcode, PhoneNumber)

Q3d) Logical modelling of Driver entity

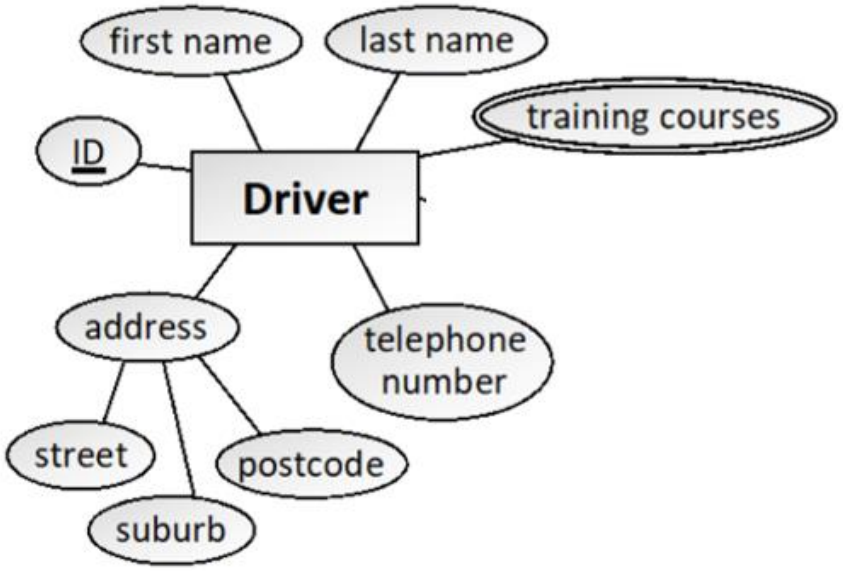


Multivalued Attribute

FK
DriverTrainingCourses (DriverID, TrainingCourseName)



Q3d) Logical modelling of Driver entity



Driver (DriverID, FirstName, LastName, AddressStreet, AddressSuburb, AddressPostcode, PhoneNumber)

DriverTrainingCourses (DriverID, TrainingCourseName)
FK