7BUIS030W Data System Concepts and Fundamentals
Tutorial 02
## Model Solutions

To answer the questions in this tutorial, please refer to Lecture-3 in Blackboard

Tutorial 02 Exercise 01

For each of the conceptual Entity Relationship Diagrams (ERDs) below justify in detail the multiplicity (i.e. participation and cardinality) by **writing 4 statements** to explain the 4 digits on both sides of the relationships.
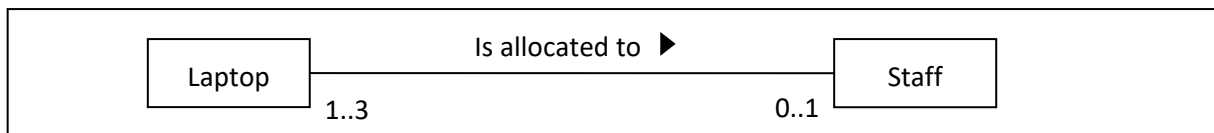
Question 1.1.

Module	◀ enrols in	Student
1..4		0..*
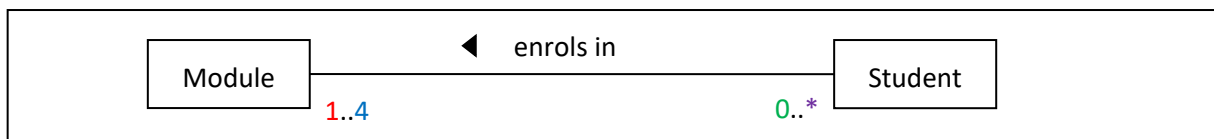
One student enrols in minimum one module- Participation
One student enrols in maximum four modules- Cardinality
One module can have minimum zero students-Participation
One module can have maximum many students- Cardinality

Question 1.2.

Lab	◀ is located in	Computer
0..1		1..*
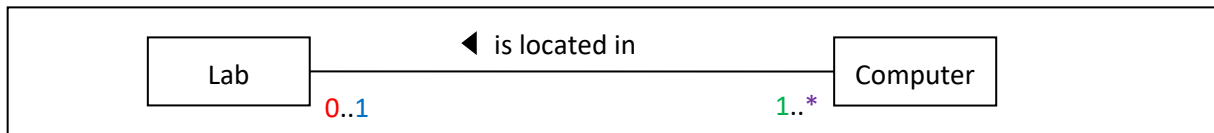
One computer is located in minimum zero labs- Participation
One computer is located in maximum one lab- Cardinality
One lab contains minimum one computer- Participation
One lab contains maximum many computers-Cardinality

Question 1.3.

Laptop	Is allocated to ▶	Staff
1..3		0..1

One laptop is allocated to minimum zero staffs- Participation
One laptop is allocated to maximum one staff- Cardinality
One staff can have minimum 1 laptop- Participation
One staff can have maximum three laptops- Cardinality

Question 1.4.

```
┌──────────────────────────────────────────────────────────────────────┐
│          ┌───────────┐          uses      ▶          ┌──────────┐      │
│          │ Employee  │──────────────────────────────│   Car    │      │
│          └───────────┘                               └──────────┘      │
│               0..2                              0..1                    │
└──────────────────────────────────────────────────────────────────────┘
```
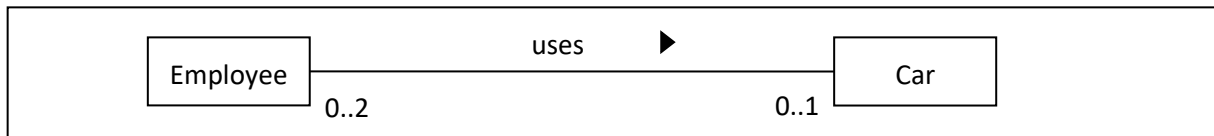
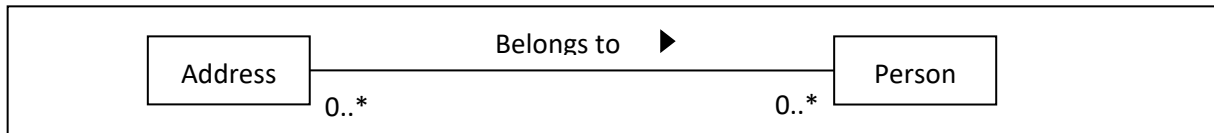One employee uses minimum zero cars- Participation
One employee uses maximum one car- Cardinality
One car is used by minimum zero employees- Participation
One car is used by maximum two employees- Cardinality

Question 1.5

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┌──────────────────────────────────────────────────────────────────────┐
│        ┌──────────┐       Belongs to     ▶         ┌──────────┐        │
│        │ Address  │──────────────────────────────│  Person  │          │
│        └──────────┘                              └──────────┘          │
│             0..*                            0..*                        │
└──────────────────────────────────────────────────────────────────────┘
```

One address belongs to minimum zero people- Participation
One address belongs to maximum many people- Cardinality
One person can have no address at all- Participation
One person can have many addresses- Cardinality

Tutorial 02 Exercise 02

Create a basic conceptual ERD for each of the following descriptions. Make sure you include the entity names, relationship names, reading directions and multiplicities (i.e. participation and cardinality).

1.1. Each bank operates 5 branches, and each branch belongs to one bank.

Bank	operates ▶	Branch
1..1		5..5

One bank operates minimum how many branches?- 5
One bank operates maximum how many branches?-5

One branch is operated by minimum how many banks?- 1
One branch is operated by maximum how many banks?- 1

1.2. Each branch in part 1.1 may have one manager, and each manager works for one branch.

Branch	has ▶	Manager
1..1		0..1

One branch has minimum how many managers?- 0
One branch has maximum how many managers?- 1

One manager manages minimum how many branches?- 1
One manager manages maximum how many branches?- 1

1.3. The manager in part 1.2 manages one or more staff, and each staff is managed by one manager.

| Manager	manages ▶	Staff
1..1		1..*

One manager manages minimum how many staffs?- 1
One manager manages maximum how many staffs?- Many

One staff is managed by minimum how many managers?- 1
One staff is managed by maximum how many managers?- 1

1.4. Each of the staff in part 1.3 may or may not have one or more dependents, and each dependent belongs to one staff.

Staff	◀ belongs to	Dependent
1..1		0..*
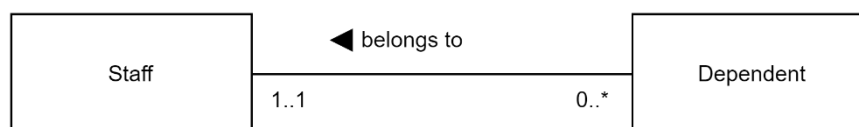
One dependent belongs to minimum how many staffs?- 1
One dependent belongs to maximum how many staffs?- 1

One staff can have to minimum how many dependents?- 0
One staff can have maximum how many dependents?- Many

1.5. Represent all the conceptual ERDs described in 1.1., 1.2., 1.3, and 1.4. as a single conceptual ERD.

Bank

bankRegNo
bankName
bankAddress
bankPhoneNo

operates ▶

1..1   5..5

Branch

branchID
branchName
branchLocation
branchExtNo

1..1

has

▼

0..1

Dependent

dependentID
dependentName
dependentAge
staffID

0..*

belongs to ▶   1..1

Staff

staffID
staffName
staffAddress
staffEmail

◀ manages

1..*   1..1

Manager

managerID
managerName
managerAddress
managerEmail