

IFB105: Database Management

Tutorial 3 – ORM (steps 4-7)



Outline

Part 1: Lecture 2 Summary & Quiz

Part 2: Tasks (CSDP step 4 ~ 6)





Part 1 – Week 3 Summary

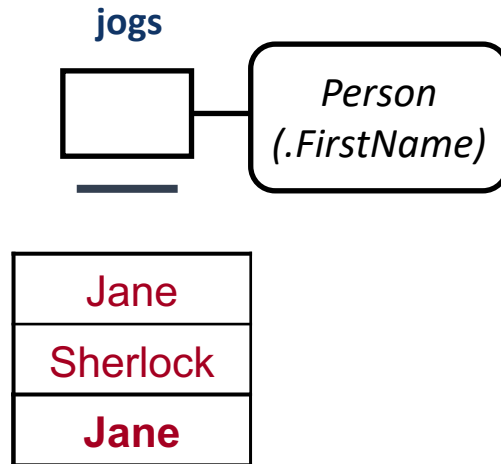
() makes a conceptual model to avoid () simplifying updates and preserving integrity of the model.

Q2. Yes or No

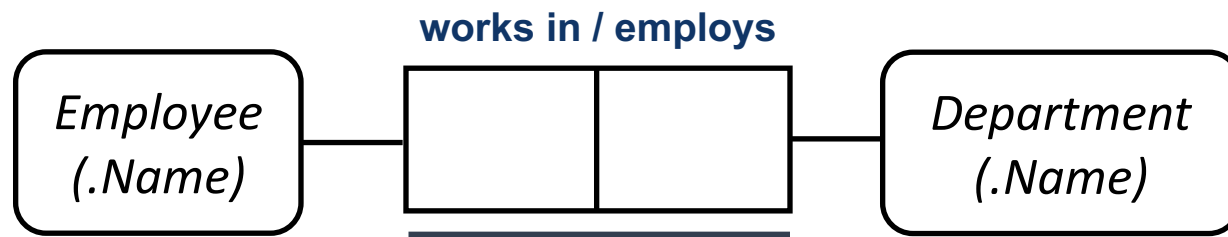
1. () is represented as “bar” over or below the fact role(s) to show the role(s) can be repeated.
2. Constrains apply to all possible populations of the fact types.

Activity 1

Q3. Can I add “Jane” to this conceptual schema? Why?



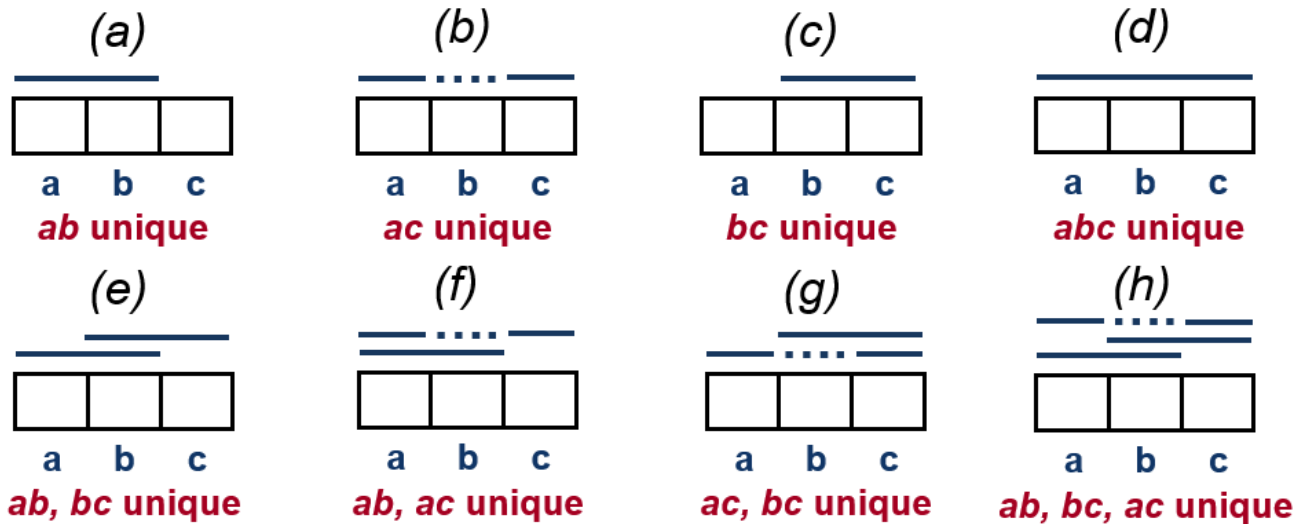
Q4. What entities are required to *uniquely* identify each fact in this diagram?



Activity 1

Q4. Select fact types (see (a) ~ (h)).

1. An n-ary fact type has exactly one UC that spans the whole fact type.
2. At least one UC which spans at least n-1 roles.



Q5. If n-1 rule is violated, what should you do?

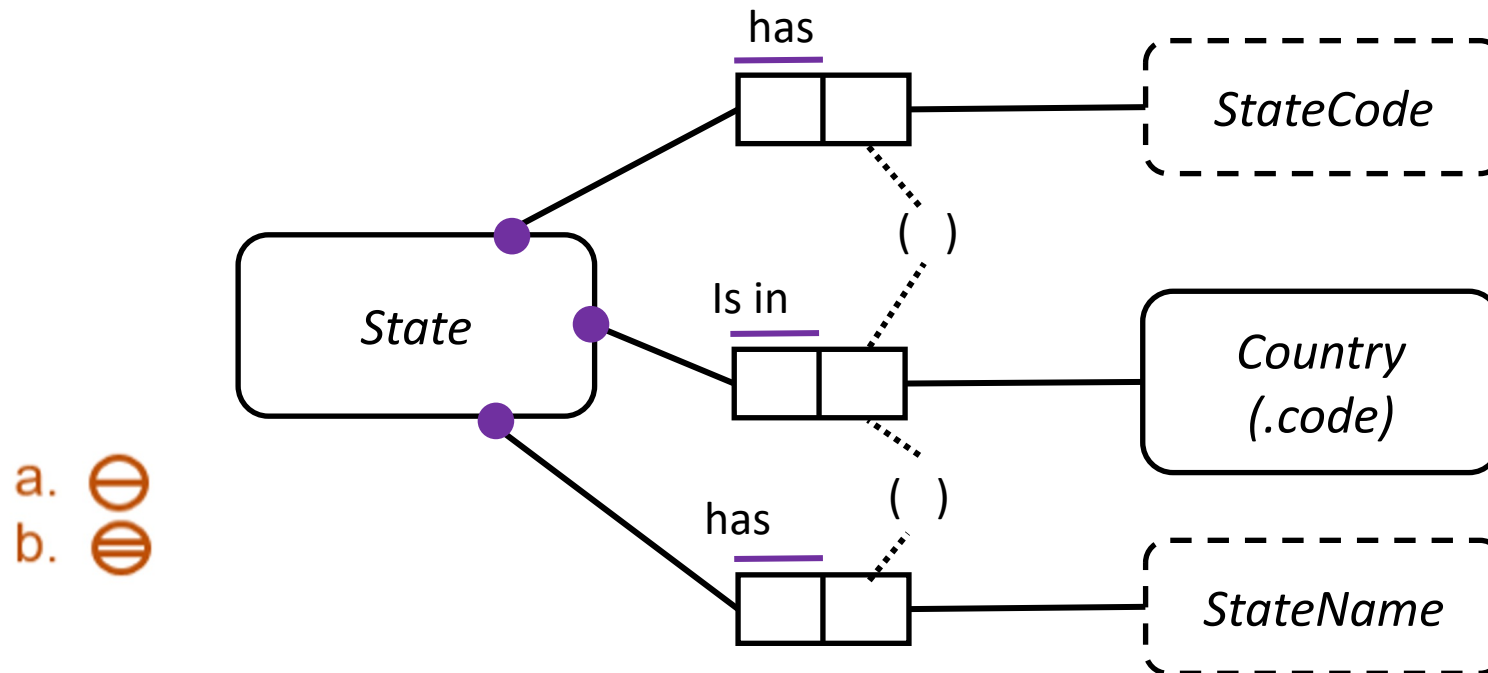
Activity 1

Q6. Fill in the blank

UC is applied to roles. If one fact type is involved, it is () UC.

If it is applied to roles from different predicates (two or more facts), we call it () UC.

Q7. Select a correct symbol for the following facts

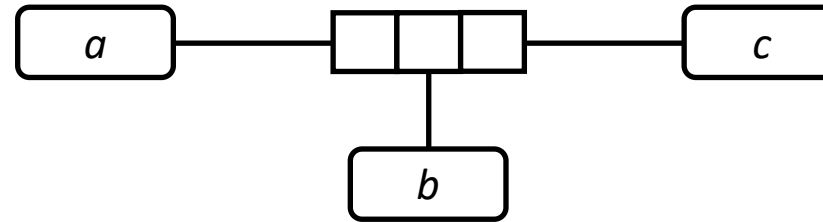


Activity 1

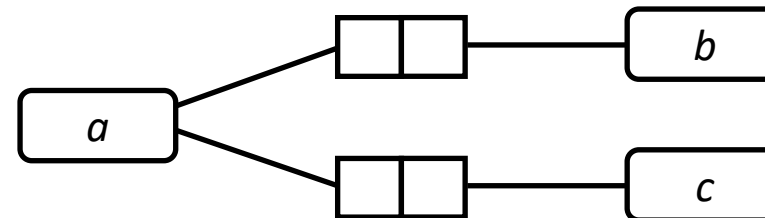
Q8. Answer the following question

There is an example table which has three columns (a, b and c). How to check the arity (length) of the fact type? Explain two different ways.

a	b	c



OR



Activity 1 – Revision: Arity of Fact Types

Check if the length is too short by joining the two fact tables and comparing the new output with the original output.

Original output report

Student Nr.	Unit	Grade
045678	ITN100	6
045678	ITN200	6
011223	ITN300	6
123456	ITN300	6
123456	ITN400	4

3. Checking

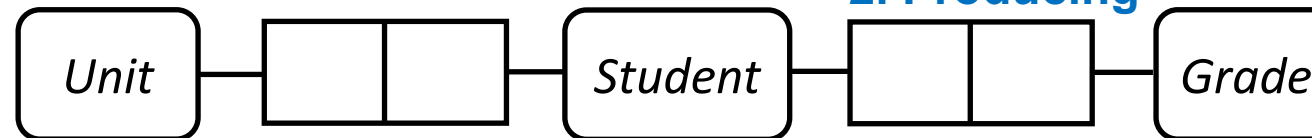


Not
Matched!

New output report

Student Nr.	Unit	Grade
045678	ITN100	6
045678	ITN200	6
011223	ITN300	6
123456	ITN300	6
123456	ITN300	4
123456	ITN400	6
123456	ITN400	4

1. Modeling



2. Producing

ITN100 045678
INT200 045678
INT300 011223
INT300 123456
INT400 123456

045678 6
~~045678 6~~
011223 6
123456 6
123456 4

Activity 1

Q9. Read the following and choose correct answer

QUT collects data from students and store the data in the database. There are some rules set by the data modelling team.

- 1. A student table has four columns including student number, student name, address, and phone number.*
- 2. Every student has a student number and it is unique.*
- 3. A student should provide the name and address, and therefore the columns always have values.*
- 4. A student can provide his/her phone number if he/she wants.*

What constraints can we identify from the scenario?

Activity 1

Q10. Apply the CSDP steps to generate an ORM diagram with the required uniqueness and mandatory constraints

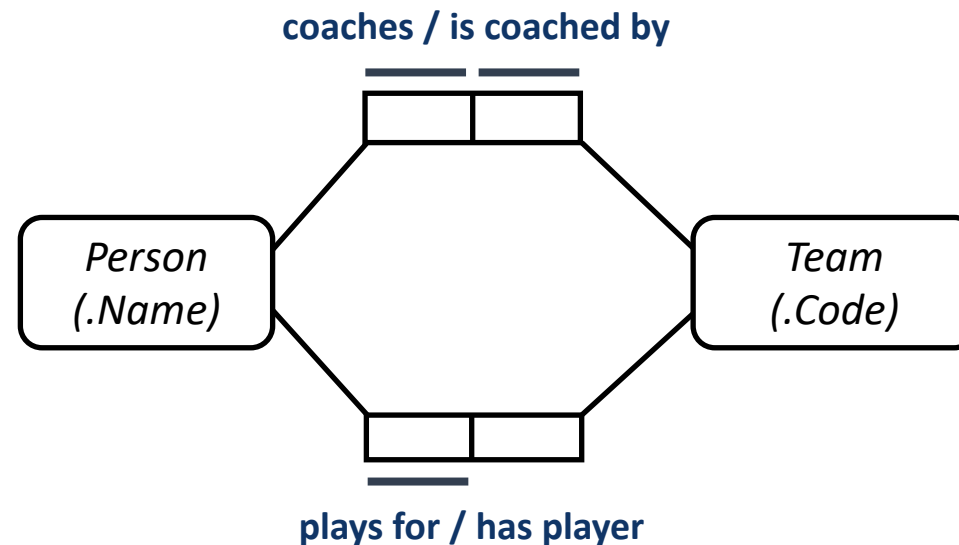
Student Number	Name	Address	Phone Number
001	Tom	77 Grey Street	0490 456 789
002	Bread	1 Queen Street	?
003	Tony	2 Logan Road	0482 443 245
004	Jane	100 Wondall Road	?
005	Bruce	22 Figtree Place	0490 642 262

Activity 1

Q11. There are two fact types which include Person and Team entity types. If each person must play one or two roles for a team, what constraints do we need to add to the fact types?

For example,

Each person must coach a team, play for a team or both coach and play for a team.



Activity 1

Q12. Read the following requirements and explain how to add value constraints

1. Gender should have only 'M' or 'F'.

2. Customer can give rating score between 1 and 7.

3. We define the available ages for enrolment between 0 and 10, and 30 and 40.

Activity 1

Q13. Find the right ORM representation for

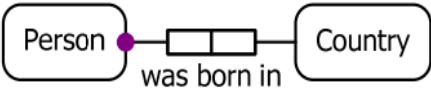
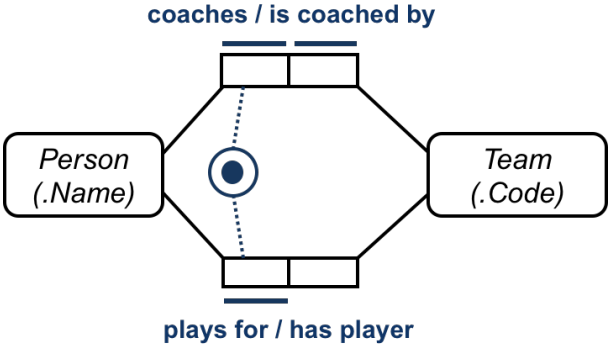
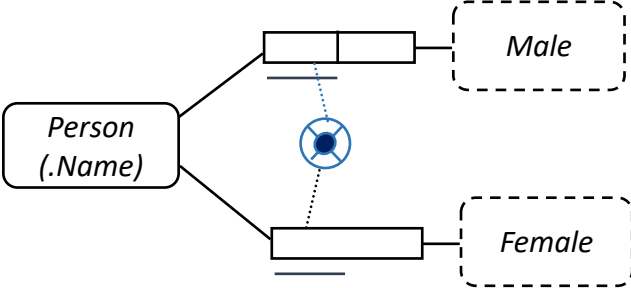
a. Exclusion constraint

b. Mandatory role constraint combined with an exclusion constraint

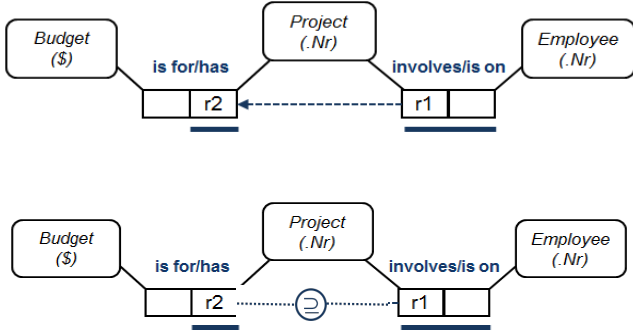
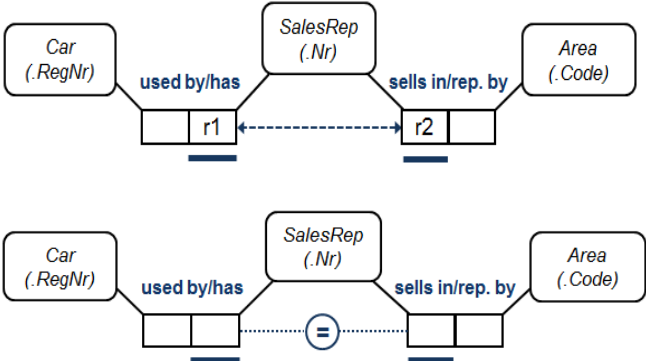
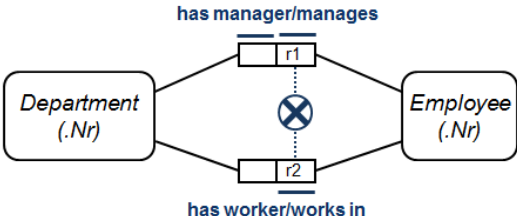
Summary of Constraints

Uniqueness Constraint (UC)		Each object instance plays role zero or one times
External UC		Combination of objects playing roles is unique
Composite Reference Mode		Combination of objects playing roles is unique AND That combination can be used as a reference for the object involved in both facts

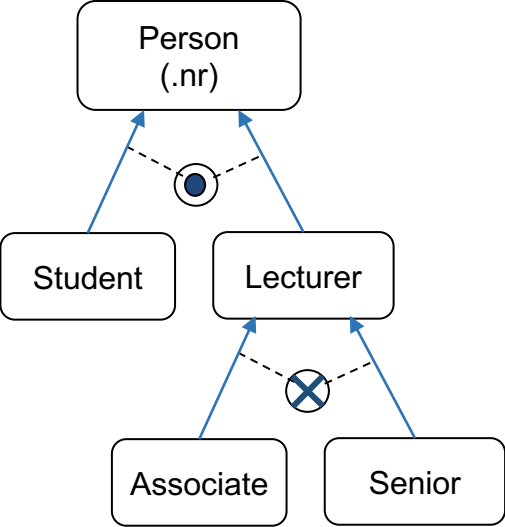
Summary of Constraints

Mandatory Role Constraint		Each object instance must play role one or more times * May affect external entities *
Disjunctive Mandatory Role Constraint		Each object instance must play one role, or the other role, or both roles, one or more times
Mandatory role constraint combined with an exclusion constraint		Each object instance must play one of the roles (not both)

Summary of Constraints

<p>Subset constraint</p>		<p>All objects playing role ($r1$) must also play role ($r2$) but not necessarily vice versa</p>
<p>Equality Constraint</p>		<p>All objects playing role ($r1$) must also play role ($r2$)</p>
<p>Exclusion Constraint</p>		<p>An object that plays one role must not also play the other role</p>

Summary of Constraints

Value constraint	<div><div><div>Gender (.Code)</div><div>GenderCode: {'M', 'F'}</div></div><div><div>Rating (.Nr)</div><div>RatingNr: {'1' .. '7'}</div></div><div><div>ExtremeTemperature (°C:)</div><div>ExtremeTemperature: {-100 .. -20, 40 .. 100}</div></div></div>	An object has a value which is allowed by the definition of a valid set of values
Subtype constraint		Some entity types need to be combined (e.g., Person), but one or more specific roles are played only by a given subtype (e.g., Lecturer)



Part 2 - Conceptual Schema Design

Task 1 – N-1 Roles

Which of the following fact types are definitely splittable?

Rule: An **n**-ary fact type should have at least one UC which spans at least **n-1** roles.



Task 2.1 – Add Constraints

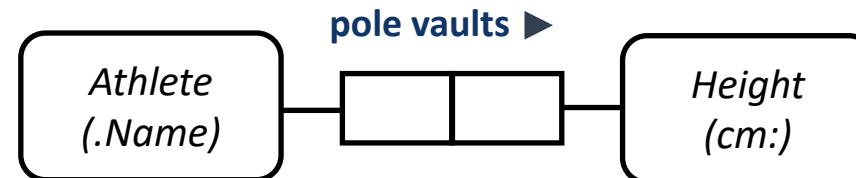
Add a UC to the diagram.

<i>Athlete</i>	<i>Height</i>
Jones EM	400
Pie QT	450
Smith JA	550

The **Athlete** with name 'Jones EM' *pole vaults* the **Height** of 400 cm.

The **Athlete** with name 'Pie QT' *pole vaults* the **Height** of 450 cm.

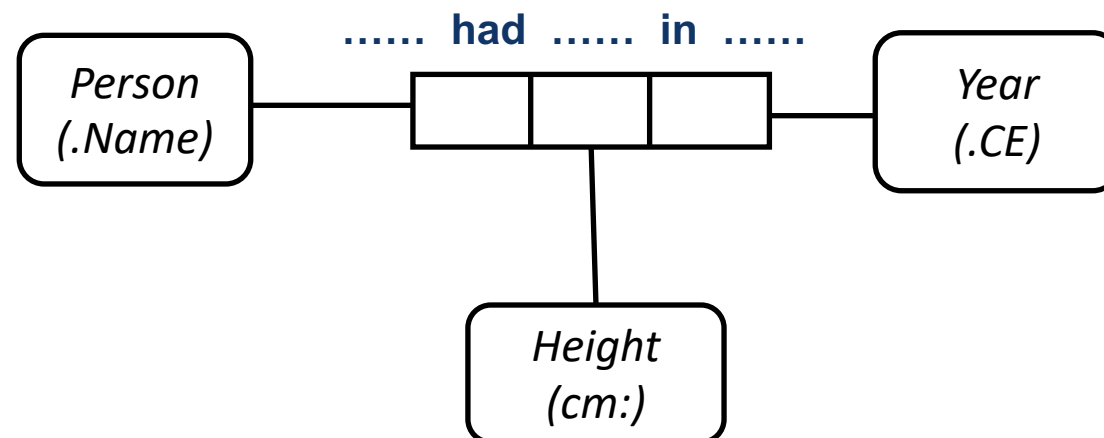
The **Height** of 550 cm. *was vaulted by* the **Athlete** with name 'Smith JA'



Task 2.2 – Add Constraints

Add a UC to the diagram.

<i>Person</i>	<i>Height (cm)</i>	<i>Year</i>
Jones EM	160	1970
Jones EM	166	1980
Jones EM	166	1990

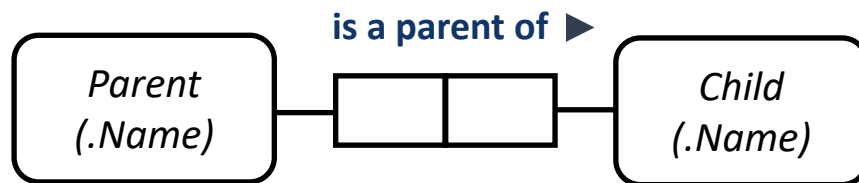


Task 2.3 – Add Constraints

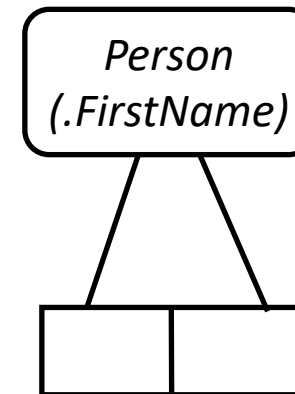
Add necessary constraints to the diagram.

<i>Parents</i>	<i>Children</i>
Ann, Bill David, Fiona	Colin, David, Eve Gus

The **Parent** with firstname 'Ann' *is a parent of* the **Child** with firstname 'Colin'.



The **Person** with firstname 'Ann' *is a parent of* the **Person** with firstname 'Colin'.



is a parent of / is a child of

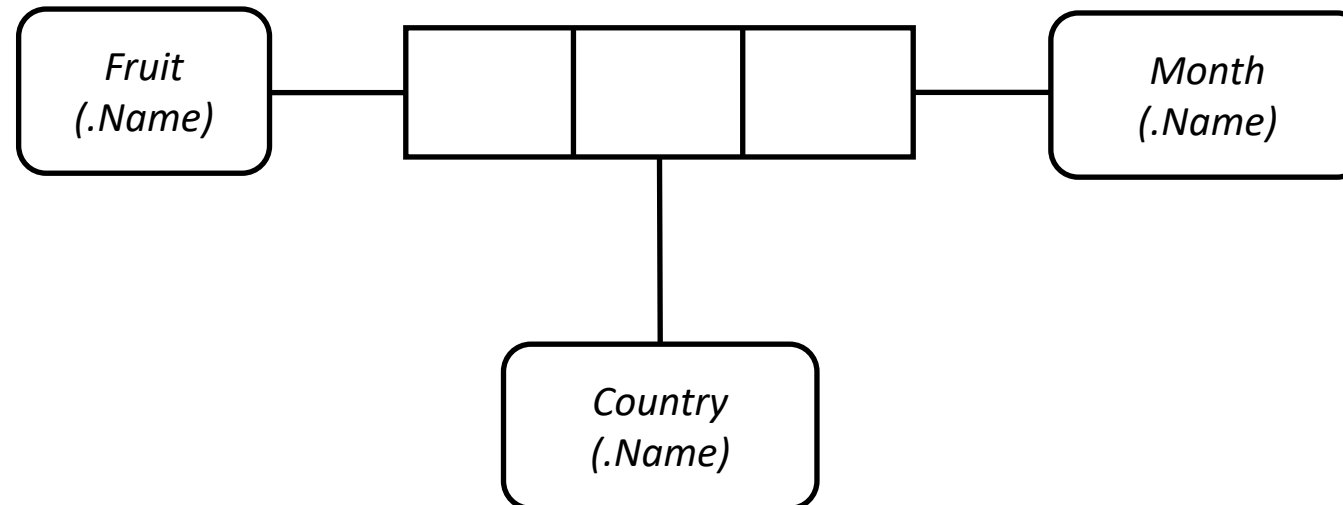
Task 2.4 – Add Constraints

Add a UC to the diagram.

Apple	Australia	Jun, Jul, Aug
	America	Oct, Dec, Jan
	Ireland	Oct, Dec
Mango	Australia	Nov, Dec, Jan, Feb
Pineapple	America	Jun, Jul
	Australia	Oct, Nov, Dec, Jan

The **Fruit** named 'Apple' is
harvested in the **Country**
named 'Australia'
in the **Month** named 'June'.

..... is harvested in in



Task 2.5 – Add Constraints

Add necessary constraints to the diagram.

<i>Medium</i>	<i>Capacity</i>	<i>Year Introduced</i>	<i>Disk Price (USD)</i>	<i>Cost per MB (USD)</i>
5.25" floppy	160KB	1981	2.60	16.25
3.5" floppy	720KB	1985	3.50	4.86
Zip Drive	100MB	1995	16.65	0.17
CD-R	650MB	1996	1.79	0.003
DVD-R	9.4GB	2002	7.89	0.0008

The **Medium** with name CD-R *has* **Capacity** 650 MB

The **Medium** with name CD-R *was introduced in* **Year** 1996 CE

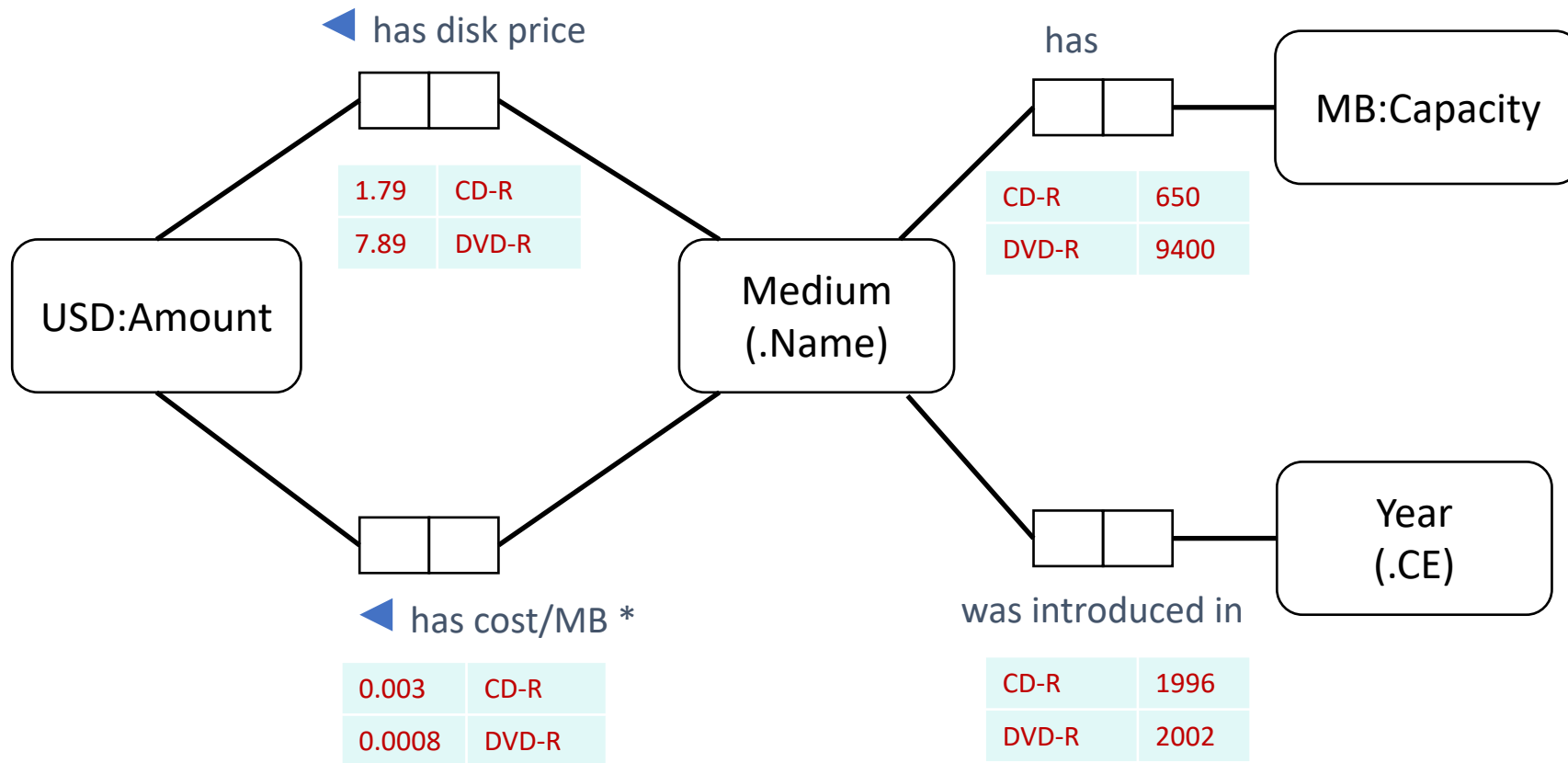
The **Medium** with name CD-R *has* **DiskPrice** 1.79 USD

The **Medium** with name CD-R *has* **CostPerMB** 0.003 USD

Task 2.5 – Add Constraints

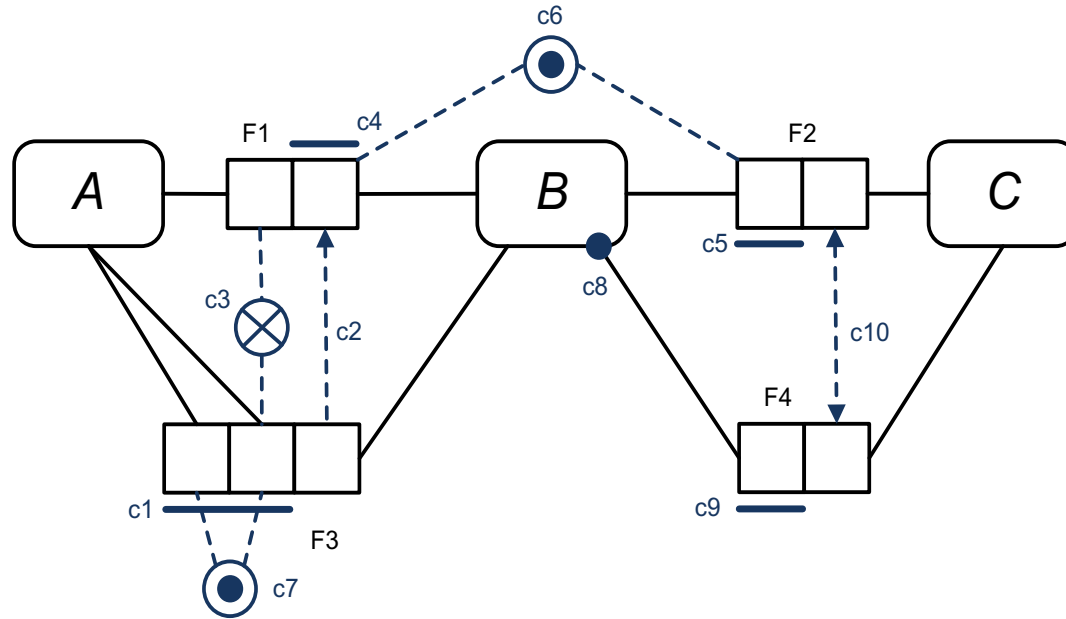
Add necessary constraints to the diagram.

* for each Medium,
cost per MB = disk price / capacity



Task 3 – Check Constraints

The following conceptual schema diagram incorporates the use of various constraints to enforce the rules of a universe of discourse.



F1

A	B
a1	b1
a1	b2

F3

A	A	B
a1	a2	b1
a4	a3	b2

F2

B	C
b3	c1
b1	c2
b4	c1

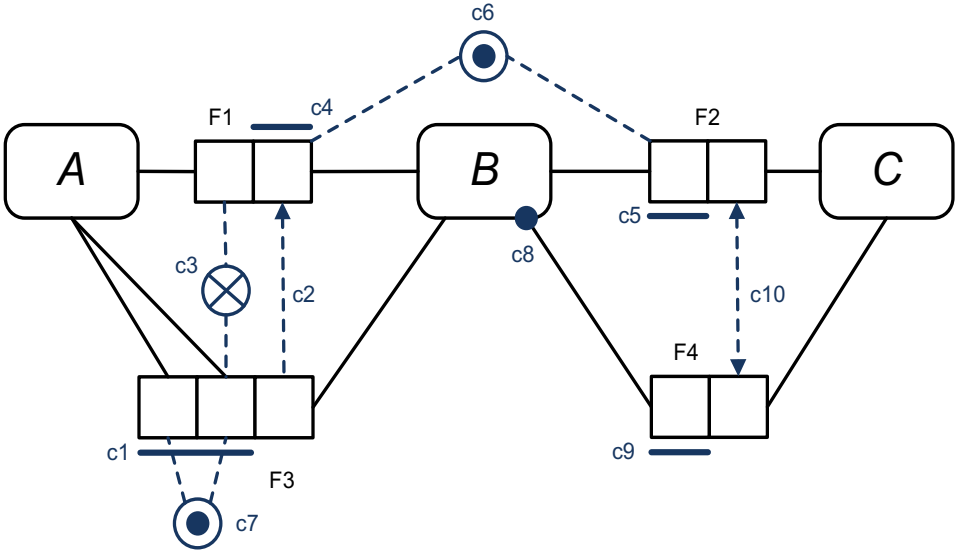
F4

B	C
b1	c1
b2	c1
b3	c2
b4	c2

Each of the following requests applies to the same population as shown above (i.e. treat each request as if it were the first to be made with this population). For each request, indicate the response. If the request is legal, write “Accept”. Otherwise write “Reject” and indicate the constraint violated.

Task 3 – Check Constraints

Transaction	Accept/Reject	Constraint violated?
add (a5, b3) to F1		



F3

A	A	B
a1	a2	b1
a4	a3	b2

F4

B	C
b1	c1
b2	c1
b3	c2
b4	c2

F1

A	B
a1	b1
a1	b2

F2

B	C
b3	c1
b1	c2
b4	c1

Task 4 – HOMEWORK – My First Banking System

The application described here is partly based on a real-life banking system, but simplifications and changes have been made. To help you appreciate the privacy implications of a universal identification scheme, all clients and staff of the bank are identified throughout the application by their tax file number (taxNr). **Thus, all bank customers and personnel are taxpayers.**

Task 4 – HOMEWORK – My First Banking System



Queensland University
of Technology

An information system is required to manage accounts and staff records for Oz Bank, which has branches at various locations. Each branch is identified by its branch number but also has a unique name. The first table (below) is an extract from staff records of Oz Bank. Each employee works at exactly one branch and has at most one phone listed. The mark "?" denotes a null value. The mark "..." indicates "etc." (other instances exist but are not shown here).

<i>BranchNr</i>	<i>Branch name</i>	<i>Emp taxNr</i>	<i>Emp name</i>	<i>Emp phone</i>
1	Uni. of Qld	200	Jones E	3770000
		390	Presley E	?
	
2	Toowong Central	377	Jones E	?
	
3	Strathpine	222	Wong M	2051111
	

Task 4 – HOMEWORK – My First Banking System

Within the one branch, each account has a unique serial number, but different accounts in different branches may have the same serial number. Account users are identified by their TaxNr, but also have a name and possibly a phone number.

<i>Account</i>		<i>User</i>		
<i>BranchNr</i>	<i>SerialNr</i>	<i>TaxNr</i>	<i>Name</i>	<i>Phone</i>
1	55	200	Jones E	3770000
		311	Jones T	3770000
1	66	199	Megasoft	3771234
2	55	199	Megasoft	3771234
2	77	377	Jones E	?
3	44	300	Wong S	2051111

Task 4 – HOMEWORK – My First Banking System

Each account is a passbook account. Five sample passbook entries are shown. For each account, transactions are numbered sequentially 1, 2, 3, ... Dates are formatted day/month/year. For simplicity, assume each transaction is either a deposit (DEP) or withdrawal (WDL). In practice, other types of transactions are possible (e.g. interest and fees). The balance column shows the account balance after the transaction is executed.

Although the balance is derivable, for efficiency purposes the balance is stored as soon as it is derived. For example, this speeds up production of monthly statements for the bank's customers (Oz Bank has a few million customers who average several transactions each month). This derive-on-update (eager evaluation) decision contrasts with our normal derive-on-query (lazy evaluation) policy.

Task 4 – HOMEWORK – My First Banking System

Sample passbook entries (1)

OZ BANK				
BranchNr	SerialNr	Branch name: Uni. of Qld Users: Jones E; Jones T		
1	55			
TranNr	Date	Deposit	Withdrawal	Balance
1	3/1/90	1000		1000
2	5/1/90		200	800
3	5/1/90		100	700

Task 4 – HOMEWORK – My First Banking System

Sample passbook entries (2)

OZ BANK				
BranchNr	SerialNr	Branch name: Uni. of Qld Users: Megasoft		
1	66			
TranNr	Date	Deposit	Withdrawal	Balance
1	10/2/90	2000		2000
2	10/2/90		500	1500

Task 4 – HOMEWORK – My First Banking System

Sample passbook entries (3)

OZ BANK				
BranchNr	SerialNr	Branch name: Toowong Central Users: Megasoft		
2	55			
TranNr	Date	Deposit	Withdrawal	Balance
1	23/1/90	9000		9000
2	7/2/90	5000		14000
3	10/2/90		2000	12000
4	2/3/90		5000	7000

Task 4 – HOMEWORK – My First Banking System

Sample passbook entries (4)

OZ BANK				
BranchNr	SerialNr	Branch name: Strathpine Users: Wong S		
3	44			
TranNr	Date	Deposit	Withdrawal	Balance
1	5/1/90	100		100
2	12/1/90	600		700

Task 4 – HOMEWORK – My First Banking System

Sample passbook entries (5)

OZ BANK				
BranchNr	SerialNr	Branch name: Toowong Central Users: Jones E		
2	77			
TranNr	Date	Deposit	Withdrawal	Balance
1	3/1/90	500		500

Task 4 – HOMEWORK – My First Banking System

Apply the CSDP steps from 1 to 7 and show the final ORM diagram.