

# Introduction to Database

Part 2

# ER Diagram

- This design could also be represented using an Entity-Relationship diagram, also known as an E-R diagram.

Student			
MatricNo	Name	Gender	CivicsClass
1	Adam	M	18S12
2	Adrian	M	18S12
3	Adam	M	18A10
4	Bala	M	18A10
5	Bee Lay	F	18A10

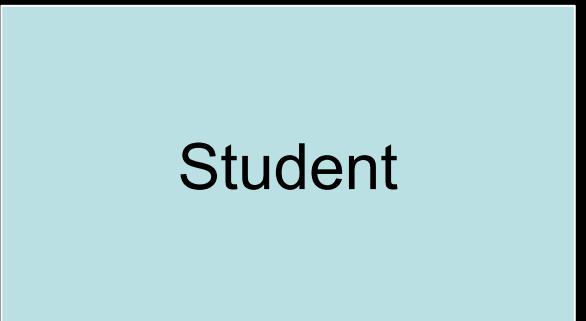
Civics		
CivicsClass	CivicsTutor	HomeRoom
18S12	Peter Lim	TR1
18A10	Pauline Lee	TR2

CCAIInfo	
CCAName	CCATeacherIC
Tennis	Adrian Tan
Choir	Adeline Wong
Student Council	David Leong
Rugby	Andrew Quah
Badminton	Lilian Lim
Chess Club	Edison Poh

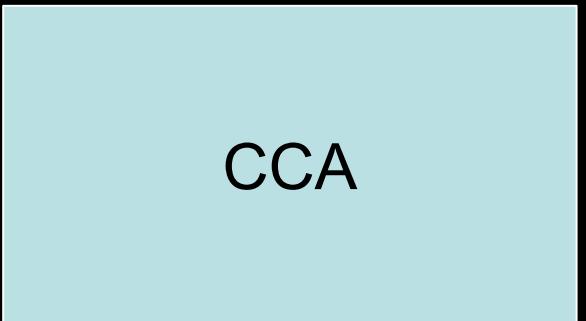
StudentCCA	
MatricNo	CCAName
1	Tennis
2	Choir
2	Student Council
3	Rugby
4	Badminton
5	Choir
5	Chess Club

# ER Diagram - Entity

- An **entity** is a specific object of interest.
- Collective nouns or nouns are usually used to name entities (e.g. Student, CCA, Customer).
- Entities are represented by rectangles.



Student



CCA

# Identifying entities

- A school wants a simple application to keep track of their students, their Civics Class and the CCA they join.
- The application must also keep records of all the CCAs in the school, the students joining the CCAs, and Civics Class assigned to each student.

Nouns:

- School
- Application
- Student
- Civics Class
- CCA

Nouns that are of interest:

- |              |   |  |
|--------------|---|--|
| School       | } | Not object of interest, no tabulated data to keep track of |
| Application  |   |  |
| Student      | } | Entities   |
| Civics Class |   |  |
| CCA          |   |  |

# ER Diagram - Relationships

**Relationship** describe a link between two entities.

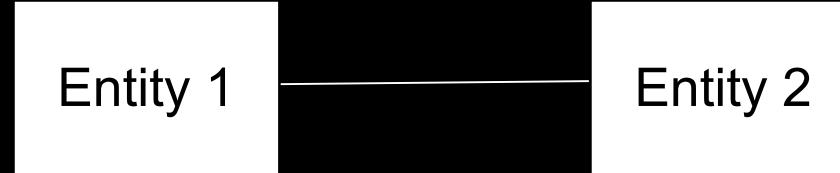
One of the following three relationships can exist between two entities.

1. One to One
2. One to Many
3. Many to Many

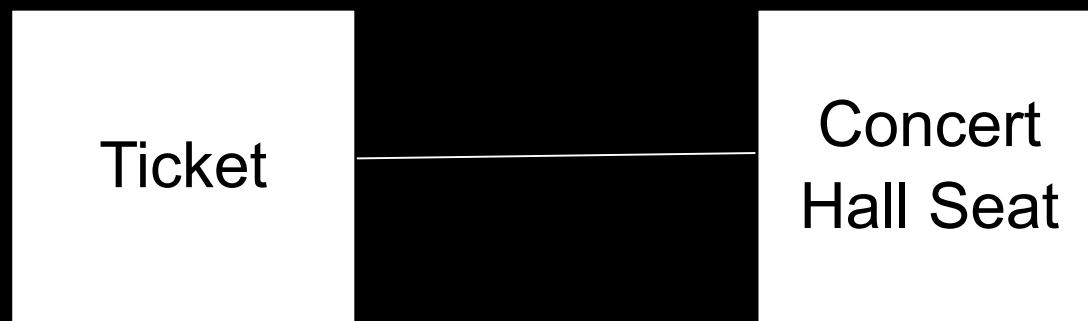
# ER Diagram : One-One

## 1. One to One

- This can be represented by:



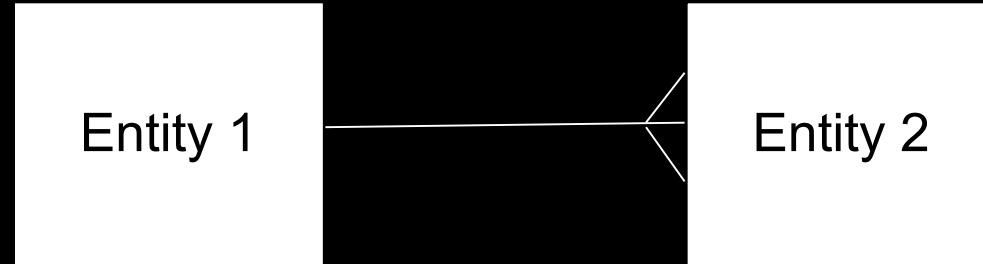
- For example, at a concert each ticket entitles you to a particular seat and each seat is linked to only one ticket.



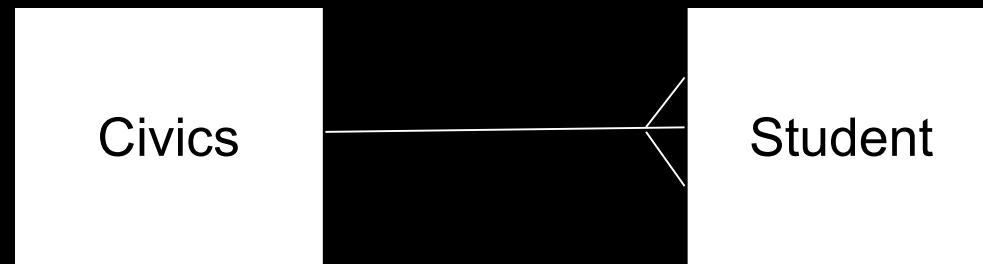
# ER Diagram : One-Many

## 2. One to Many

- This can be represented by:



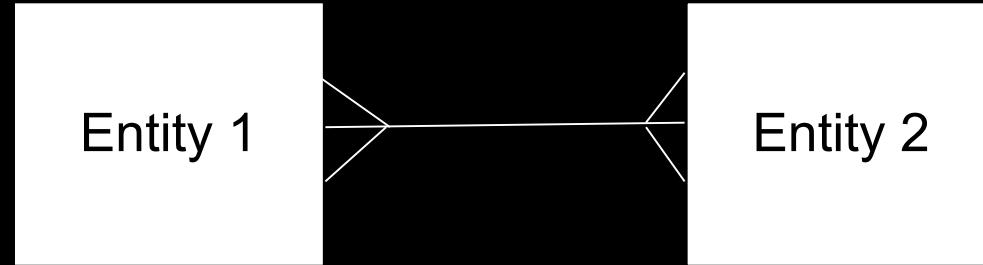
- For example, a student can belong to only one civics class but a civics class can have many students.



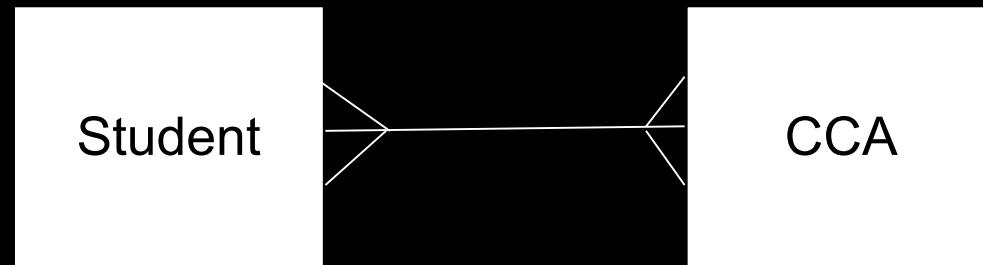
# ER Diagram : Many-Many

## 3. Many to Many

- This can be represented by:



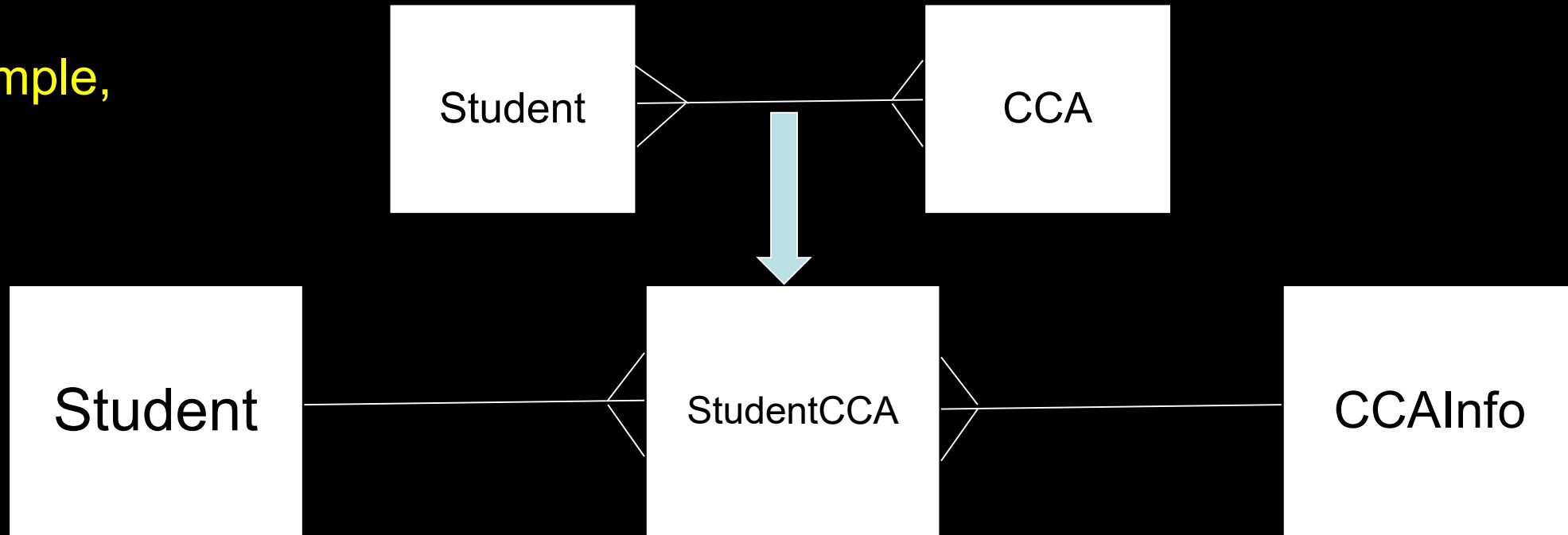
- For example, a student can join many CCAs and one CCA can have many students.



# ER Diagram : Many-Many

- To implement a many-to-many relationship in a database system, we will usually decompose a many-to-many relationship into two (or more) one-to-many relationships. This is because, many-many relationships may be indicative of transitive dependencies that must be removed for 3NF.

- For example,



- We call **StudentCCA** the link entity.

# Entity-Entity Matrix

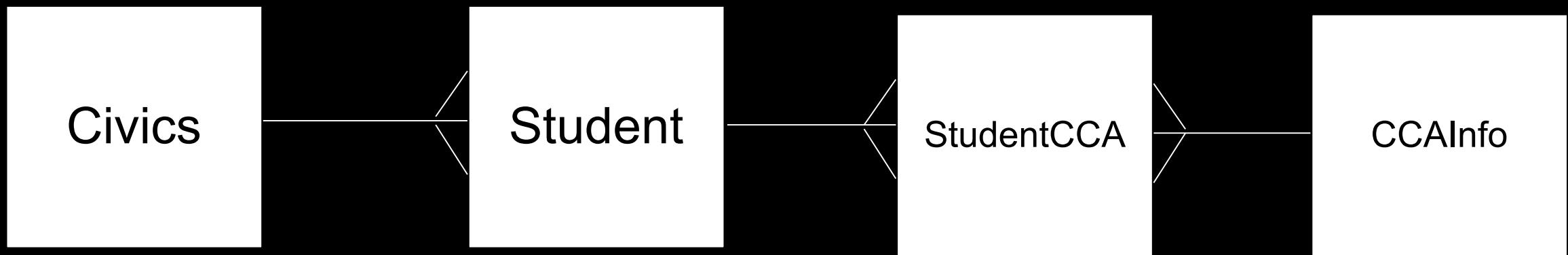
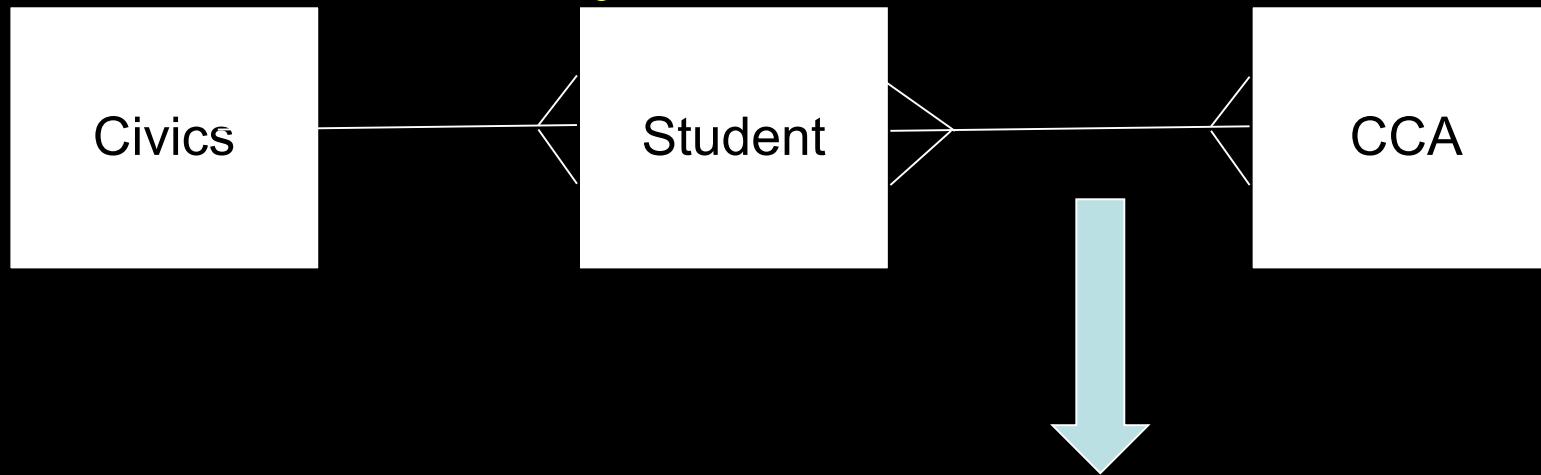
- An entity-entity matrix is useful in discovering all possible relationships between entities.

	<b>Student</b>	<b>Civics</b>	<b>CCA</b>
<b>Student</b>		belongs	joins
<b>Civics</b>	belongs		
<b>CCA</b>	joins		

- A student joins at least one CCA. One CCA can be joined by many students.
  - Many to Many
- A student must belongs to a Civics Class. A Civics Class can have many students.
  - One to Many

# ER Diagram (School example)

- Student-CCA: Many to Many (need to be decomposed to 2 One-Many relationship)
- Civics-Student: One to Many



# ER Diagram (School Example)

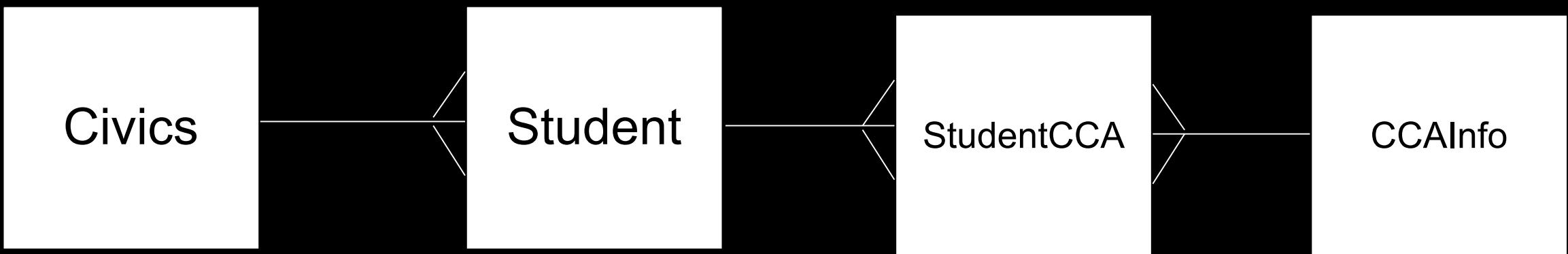
- This fully normalized database and the ER diagram representation:

Student (MatricNo, Name, Gender, CivicsClass)

Civics (CivicsClass, CivicsTutor, HomeRoom)

StudentCCA (MatricNo, CCAName)

CCAInfo (CCAName, CCATeacherIC)





# Relational Database Management System (RDBMS)

- **Database management system (DBMS) software**
- A DBMS is a software which enables the definition, creation and querying of a large collection of data.
- The software provides features for the maintenance of the data including:
  - backup
  - security
  - interrogation of the data with SQL queries
  - controlled access to the data with views with views which are only available to certain database users.
  - All aspects of the use of the DBMS software will be administered by a database administrator (DBA).

# DBMS: Concurrent Access to data

- A feature of DBMS software is control over ‘multi-user access’ to the data with techniques such as record locking and file or table locking.
- A lock may be applied to the entire database, preventing activity from all other users.
- Total locking is used when the entire database is involved in some activity such as rebuilding the indexes or deleting data marked as deleted.

# DBMS: Concurrent Access to data

- A less severe lock is table-level locking, leaving other tables free for access by other users. However, as many transactions involve more than one table, table-level locking can also result in severe delays when one of the required tables is locked.
- Locking individual records will cause the least delay. A single row of a table (i.e. record) is locked.
- The scenario which must be considered is when two different users attempt to concurrently update the same record. What could happen is that one of the updates will be lost.

# DBMS: Data Security

Backup is a centralised task administered by the database administrator (DBA).

Since all data is centrally held within the DBMS, strategies for controlling the security are much easier to implement than with a file-based approach.

A database backup saves a database to a file on a hard disk or other storage medium. To protect a database from power failure, a disk crash or other potential data loss, the DBA will regularly back up the database.

# DBMS: Data Security

- Backup and database maintenance is designed to:
  - improve database performance by performing garbage collection of space occupied by deleting records and packing the remaining data; this often reduces database size;
  - give the option of changing the database page size or distributing the database among multiple files or disks;
  - enable backups to run concurrently while other users are using the database; the DBA does not have to shut down the database;
  - create a stable snapshot of the database for archiving purposes.
  - Access rights to particular tables or views can be created by the database designer. This allows particular individuals or groups of users access to only certain data.
  - Read again the points made about concurrent access to data. The various levels of locking are effectively a security feature.