

CS3101 - Databases  
Assignment: P1 - DB Design

Matriculation Number: 160001362

29/10/2018

# Contents

<b>1</b>	<b>E-R Model</b>	<b>4</b>
1.1	E-R Diagram . . . . .	4
1.2	Underlying Assumptions . . . . .	4
1.3	Justification of Design Decisions . . . . .	4
1.3.1	Primary Keys . . . . .	4
1.3.2	Types of Attributes . . . . .	5
1.3.3	Participation and Cardinality . . . . .	5
1.3.4	Modelling Relationships (e.g. entity set vs relationship set vs an attribute) . . . . .	6
1.3.5	Placement of Attributes . . . . .	6
1.3.6	Specialisation/Generalisation . . . . .	7
<b>2</b>	<b>Relational Schema</b>	<b>7</b>
2.1	Derived Relational Schema . . . . .	7
2.2	Justification of Design Decisions . . . . .	7
2.2.1	Type of Attributes . . . . .	7
2.2.2	Placement of Foreign Keys . . . . .	7
2.2.3	Translation of Specialised/Generalised Entities . . . . .	7
<b>3</b>	<b>Normalisation</b>	<b>7</b>
3.1	Design Methodology . . . . .	7
3.2	Functional Dependencies . . . . .	7
3.3	Discussion of Normal Form . . . . .	7
<b>4</b>	<b>Extensions</b>	<b>7</b>
4.1	Analysis . . . . .	7



Figure 1: E-R diagram modelling ConMan conference management system.

# 1 E-R Model

## 1.1 E-R Diagram

See figure 1 for the entity-relationship diagram modelling the conference management scenario.

## 1.2 Underlying Assumptions

- The assumption has been made that all layouts can be utilised by all rooms (with varying capacities).
- The assumption has been made that an individual can have a multiple affiliations at a time, but that the institutions also share an affiliation with the conference the individual attends so that if the individual changes institutions, the old affiliation will still be reflected in the 'affiliated with' relationship.
- The assumption has been made that 'chair' and 'author' are distinct from the roles carried out by an organiser.

## 1.3 Justification of Design Decisions

### 1.3.1 Primary Keys

- The candidate key 'conf\_code' and 'year' was selected as the primary key for conference due to conference codes being unique year to year. The conf\_code attribute allows any conference to be unique within a year, and the year allows it to be identifiable across any year.
- The candidate key 'name' was selected as the primary key for the venue entity as the name is unique according to the specification.
- The entity 'room' is a weak entity set. The attribute 'name' has been taken to be the discriminator (or partial key). The primary key of room is the discriminator 'name' combined with the name of the venue which is the primary key of the venue entity. This decision was made as the specification states that a room has a unique name in the context of its venue.
- The 'type' attribute of layout has been made the primary key of the entity, as it seems unrealistic to have two layouts with the same type.
- The 'id' attribute has been added to individual as the primary key as there is otherwise no convenient unique identifier as multiple people with the same people can attend the same institution.
- The candidate key of 'institution', 'name' and 'location', has been made the primary key of the entity as presumably there can be no institution

with the same name in the same location. For example two University of St Andrews in the United Kingdom, however there is a St Andrews University in North Carolina. Location rather than country allows for the specification of US states and other territories which people often use as descriptors.

- An id attribute has been added to the 'session' entity to avoid a large number of attributes being used as a combined primary key.
- The entity 'activity' is a weak entity set. The discriminator 'position' has been selected as the partial key as position is unique in the context of an academic session.

### 1.3.2 Types of Attributes

- The discriminator 'name' has been chosen in the 'room' entity as each room has a unique name in the context of the venue.
- A composite attribute has been used for the address of the 'venue' entity, as address can compose values such as number, street, town, and postcode.
- The 'role' attribute of the relationship 'organises' has been made a multivalued attribute as an organiser can have multiple roles within a single conference.
- The 'duration' attribute of 'session' is an attribute derived from start\_time and end\_time.

### 1.3.3 Participation and Cardinality

- The relationship 'holds' between venue and conference is one-to-many from venue to conference. This is because a single venue may hold many conferences, but a conference must be held at a single venue.
- The relationship 'has' between venue and rooms is one-to-many from venue to room, as a venue must have one or more rooms but a room must belong to one venue.
- The relationship 'held in' is many-to-many from 'session' to 'room' as sessions must be held in a room at some point in the day and rooms can (but do not have to) host many sessions throughout the day.
- The relationship 'configured in' between 'room' and 'layout' is many-to-one as many rooms must be configured in one of many particular layouts and a single layout can be used by many rooms.
- The relationship 'organises' between the 'organiser' and 'conference' entities is many-to-many as an organiser must organise one or more conferences (as the individual would otherwise not be an instance of organiser) and a conference must be organised by at least one organiser.

- The relationship 'affiliated with' is a ternary relationship between institution, individual and conference, and in all cases is many-to-many, as an individual can optionally have many affiliations with institutions and can attend many conferences, a conference can be affiliated with many institutions via the individuals that attend, and institutions can be affiliated with many individuals and many conferences via its attending staff.
- The relationship 'belongs to' between conference and session is one-to-many from conference to session. This is because a unique id is assigned to session so it must belong to a single conference, but a conference must be made up of a series of sessions.
- The 'chairs' relationship between 'chair' and 'academic' (session) is a one-to-many relationship. An academic session must have exactly one chair leading it, but a chair may lead many academic sessions (and must lead at least one, otherwise they would not be a chair).
- The relationship 'has' between 'academic' and 'activity' is one-to-many as each academic session must be associated with one or more activities, and an activity must be associated with one session.
- The relationship 'written by' between 'activity' and 'author' is many-to-many. An author must have written one or more activities (otherwise they wouldn't be made an author) and an activity must have one or more authors.

#### **1.3.4 Modelling Relationships (e.g. entity set vs relationship set vs an attribute)**

- The role of an organiser has been made an attribute of the relationship 'organises' between the organiser and the conference as it is related to both entities.
- The ternary relationship 'affiliated with' has been used to model the relationship between institutions, individuals, and conferences, in order to allow an individual to be affiliated with many institutions at once and across time while enabling the conference to still be associated with the individual and their old affiliation.

#### **1.3.5 Placement of Attributes**

- The attribute 'capacity' has been placed on the relationship 'configured in' as the capacity of a room relies on the layout that it utilises.
- The multi-valued attribute 'role' has been placed on the relationship 'organises' as roles relate both to the organiser who will undertake them but also to the conference which creates the need for the role and which the role also enables.

### 1.3.6 Specialisation/Generalisation

- The entities chair, organiser, and author are all specialisations of the generalised individual entity representing people involved in the conference. The completeness constraint for the inheritance is total, as all of the individuals modelled in the conference data in the specification are either chairs, authors, or organisers. Therefore there is no need to allow individuals to be instantiated. The inheritance is overlapping as entities can belong to more than one subclass entity set - this is modelled using multiple arrows.
- The entities 'academic' and 'social' are specialisations of the entity 'session' and have disjointed inheritance as a session can be either academic or social. The completeness constraint of the inheritance is total, as all sessions are academic or social sessions. This inheritance makes use of one arrow which splits off to academic and social as a result of the disjointed inheritance.

## 2 Relational Schema

### 2.1 Derived Relational Schema

### 2.2 Justification of Design Decisions

#### 2.2.1 Type of Attributes

#### 2.2.2 Placement of Foreign Keys

#### 2.2.3 Translation of Specialised/Generalised Entities

## 3 Normalisation

### 3.1 Design Methodology

REFLECT ON APPROACH DISCUSSED HERE: [https://studres.cs.st-andrews.ac.uk/CS3101/Lectures/L4\\_E](https://studres.cs.st-andrews.ac.uk/CS3101/Lectures/L4_E)

### 3.2 Functional Dependencies

### 3.3 Discussion of Normal Form

## 4 Extensions

### 4.1 Analysis