
Homework 2

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1. Normalization [20 points]

The table shown below displays the details of the roles played by actors/actresses in films.

filmNo	fTitle	dirNo	director	actorNo	aName	role	timeOnScreen
F1100	Happy Days	D101	Jim Alan	A1020	Sheila Toner	Jean Simson	15.45
		D101	Jim Alan	A1222	Peter Watt	Tom Kinder	25.38
		D101	Jim Alan	A1020	Sheila Toner	Silvia Simpson	22.56
F1109	Snake Bite	D076	Sue Ramsay	A1567	Steven McDonald	Tim Rosey	19.56
		D076	Sue Ramsay	A1222	Peter Watt	Archie Bold	10.44

- (a) [5 points] Describe why the table shown below is not in first normal form and second normal form.

ANSWER:

1NF REQUIREMENT: There should be NO MULTI-VALUED ATTRIBUTES in Entities if it has to be in first normal form, all the rows should be unique with the Primary key identified. But the table above has multiple values in the fields such as dirNo, director, actorNo, aName, role, timeOnScreen. So is there reason the tables is not in 1NF.

2NF REQUIREMENT: A table should meet the requirements of 1NF + the table should have NO PARTIAL DEPENDENCIES in it. But the table above didn't meet the 1NF requirements + the table has partial dependencies in it such as – actorName is dependent on actorNo. And actorNo is part pf candidate key if filmNo and actorNo together taken as a candidate key.

- (b) [15 points] Re-design the tables to make them meet BCNF; you do not need to draw ERD, but you need to show the final design by drawing data tables in Word document and explain why it meets BCNF. Just List the tables, attributes and keys. Use * to indicate Primary Key, use # to indicate foreign key.

Example: Student (StudentID *, Name, DeptID #)

Director

dirNo * (PK)	director
D 101	Jim Alan
D 076	Sue Ramsay

FILM

filmNo. * (PK)	fTitle	dirNo # (FK)
F 1100	Happy Days	D 101
F 1109	Snake Bite	D 076

ACTOR

actorNo * (PK)	aName
A1020	Sheila Toner
A1222	Peter Watt
A1222	Peter Watt
A1567	Steven McDonald

ROLE

Role ID * (PK)	filmNo. # (FK)	actorNo. # (FK)	role	timeOnScreen
1	F 1100	A1020	Jean Simson	15.45
2	F 1100	A1222	Tom Kinder	25.38
3	F 1100	A1020	Silvia Simpson	22.56
4	F 1109	A1567	Tim Rosey	19.56
5	F 1109	A1222	Archie Bold	10.44

Explanation: First, second, third, and BCNF form compliance are all met by the database design described above. There are no partial or transitive dependencies in any table, nor are there multiple valued attributes. Every table has One candidate key .

2. Identify issues in DB design [25 points]

Assume that the primary key of this relation in the data below consists of two components: Author's ID (AID) and book number (BNbr). The relation includes data regarding authors, books and publishers. In addition, it tells what an individual author's per book royalty amount is in the case of multi-authored books

TABLE 4-9 Author Book Royalties

AID	ALname	AFname	Alnst	BNbr	BName	BPublish	PubCity	BPrice	AuthBRoyalty
10	Gold	Josh	Sleepy Hollow U	106	JavaScript and HTML5	Wall & Vintage	Chicago, IL	\$62.75	\$6.28
				102	Quick Mobile Apps	Gray Brothers	Boston, MA	\$49.95	\$2.50
24	Shippen	Mary	Green Lawns U	104	Innovative Data Management	Smith and Sons	Dallas, TX	\$158.65	\$15.87
				106	JavaScript and HTML5	Wall & Vintage	Indianapolis, IN	\$62.75	\$6.00
32	Oswan	Jan	Middlestate College	126	Networks and Data Centers	Grey Brothers	Boston, NH	\$250.00	\$12.50
				180	Server Infrastructure	Gray Brothers	Boston, MA	\$122.85	\$12.30
				102	Quick Mobile Apps	Gray Brothers	Boston, MA	\$45.00	\$2.25

1). Identify the normal forms in the DB design above, and explain why [10 points]

ANSWER:

The Table has multi-valued attributes in it(Alnst, BNbr, BName). So, it is not in First Normal Form(1NF)

The Table has Partial dependencies in it where BName is dependent on BNbr(bookNumber). So, It is not in Second Normal Form(2NF)

The Table had Transitive dependencies in it where Bname is dependent on AuthorName based on BNbr.

So the table above don't have any normal forms in it.

3). Take actions (if necessary) to convert the relations into the 3rd normal form. Show your steps how did you fix the issues [15 points]

ANSWER:

The table above is not in 3NF. To fix this:

First the table need to get converted into 1NF: Remove all the multi value attributes by creating a separate records for each repeated values.

Then the table needs to get converted into 2NF: The table is in 1NF now + **Remove** all the partial dependencies that are existing in the table.

Here, AID and BNbr together is the primary as it is already mentioned in the question. So AuthBRoyalty is the only non-key attribute that is dependent on the entire primary key (AID+BNbr) So AuthBRoyalty will stay with AID and BNbr in the original table.

AUTHBRoyalty

AID (foreign key)
BNbr (foreign key)
AuthBRoyalty

ALname , AFName, AInst are(non-key attributes) that are partially dependent on only AID (part of the primary key) so remove ALname, AFName and AInst from the original table and create a separate table along with AID & name that NEW table as AUTHOR table.

Set AID in the new table as Primary key and as a foreign key in the old table.

AUTHOR

AID (Primary key)
ALname
AFName
AInst

And, BName, BPublish, PubCity, BPrice are partially dependent on BNbr, create a NEW TABLE with all of these and remove (BName, BPublish, PubCity, BPrice) from the old table.Name that NEW TABLE as BOOK table

Set BNbr as a primary key in the new table and as a foreign key in the original table.

BOOK

BNbr (primary key)
BName
BPublish
PubCity,
BPrice)

There is transitive dependency in BOOK table. And the design is in 2NF but not in 3NF.

So The table need to get converted in to 3NF: Remove transitive dependencies in the BOOK table in which PubCity is indirectly dependent on BNbr through BPublish.

So create a new table with BPublish & PubCity and name that table as PUBLISHER

Set BPublish as a Primary key in new table.

Remove Pubcity in Older table.

Set BPublish as foreign key in older table.

Hence the design we get :

BOOK

BNbr (primary key)
BName
BPublish (foreign key)
BPrice

PUBLISHER

BPublish (primary key)
PubCity

Here is the final design in 3NF:

AUTHORBOOKROYALTY(AID*, BNbr*, AuthBRoyalty)

AID references AUTHOR(AID)

BNbr references BOOK(BNbr)

AUTHOR(AID*, ALName, AFName, AInst)

BOOK(BNbr*, BName, BPublish, BPrice)

BPublish references PUBLISHER(BPublish)

PUBLISHER(BPublish*, PubCity)

3. Database Design [55 points]

Complete conceptual and logical DB design, and show your answers step by step

Note: do not need to draw ERD, just show tables, attributes, and keys

Example: Student (StudentID *, Name, DeptID #)

Descriptions:

IIT wants to build a DB to collect faculties' publications.

- Faculties may be from different departments.
- A publication should have title, publication date, and publication venue (such as a conference or a journal). There are only two publication types: conference publications or Journal publications. A publication may have more than one authors.
- A full-time faculty is expected to have at least 2 publications per year.

1). Complete conceptual DB design, by listing entities and indicating their relationships [15]

ANSWER:

The entities we have are:

1. Faculty
2. Department
3. Publication (Title, p_date, p_venue, p_type)

Relationship between faculty and Department:

faculty → Department

from left to right: 1 faculty can be in many departments. So the relationship between faculty and department from left to right is 1(mandatory) : M(optional)

From right to left: 1 department should have at least 1 faculty. So the relationship between department and faculty from right to left is 1(mandatory) : 1

So, the relation between faculty and department is 1(mandatory) : M(optional)

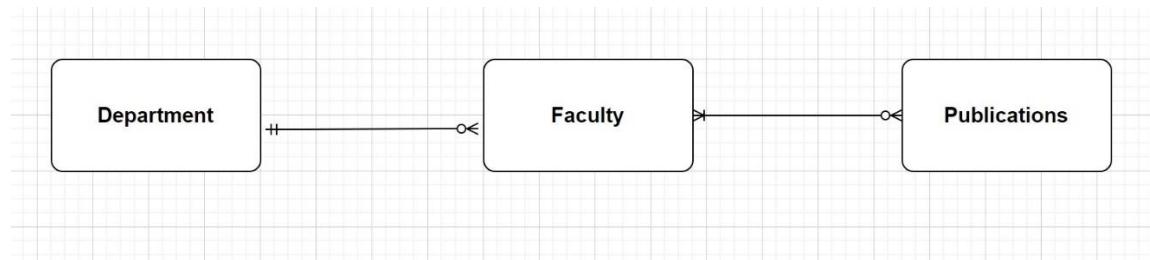
Relationship between faculty and Publication:

faculty → Publication

from left to right: 1 faculty can have many publications or No publications. So the relationship between faculty and publication from left to right is 1(mandatory) : M(optional)

From right to left: 1 publication should have at least 1 faculty or many. So the relationship between publication and faculty from right to left is 1(mandatory) : Many (optional)

So, the relation between faculty and Publication is M(mandatory) : N(optional)
(Many mandatory: many optional)



2). Complete logical DB design by assigning attributes and PK/FK, use normalization to make sure your design meets at least 3NF [40]

ANSWER:

Logical DB Design:

Assigning attributes to the entities and assigning PK & FK in each entity:

Faculty (FacultyID -primary key, DepartmentID -foreign key, FName, LName, EmailId, Employment_Status)

Department (DepartmentID- primary key, Dept_Name)

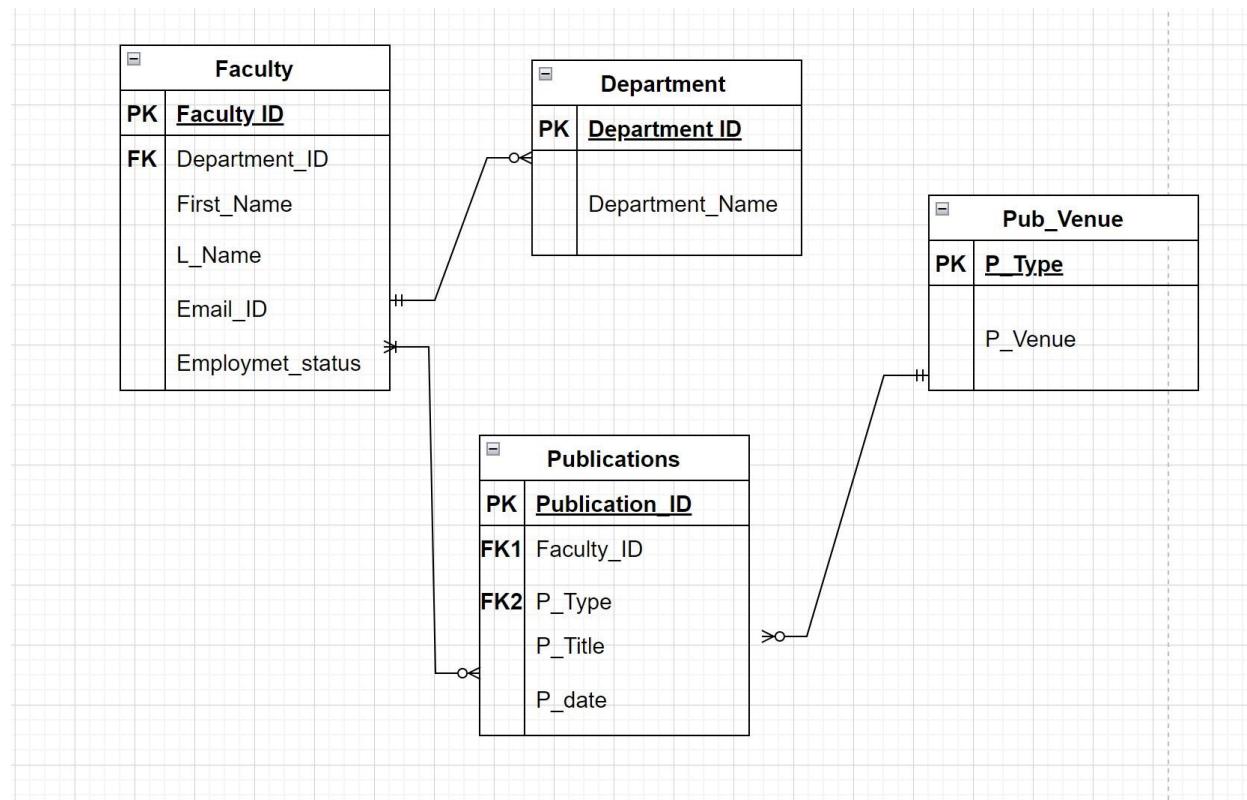
Publication (p_ID -primary key, Title, p_date, p_venue, p_type, FacultyID -foreign key)

Here we can see a transitive dependency in Publication table where, P_Type(publication_type) is dependent on Pub_ID and P_Venue(Publication_Venue) is dependent on P_Type

so, we break the table as follows:

Publications(Pub_ID - primary key, FacultyID – foreign key, P_Type – foreign key, Title, P_Date)

Pub_Venue(P_Type – primary key, P_Venue)



Result & feedback: I got 93.

3. 1. -2 Some relationship between entities are missing such as author and venue.

3. 2. -5 Critical entities such as author is missing from your design. It's possible for a single paper to have multiple authors, and these authors may not necessarily be affiliated with IIT.

Entity Venue is not designed correctly (Authors can publish work in conference or journals. For a same journal or conference, a same author may have several publications in these venues).

You can't determine whether an author of a particular publication is a faculty

Full time status of a faculty is not implemented in the DB design