CSE 560 Project1: TinyPiazza

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Entities:

- User management
  1) User
  2) Teaching User (TU)
  3) Student User (SU)

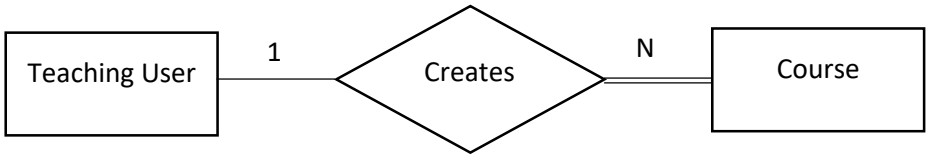
     Teaching User and Student Users are overlapping subtypes of User as a User can be both a student user and a teaching.

- Course Management
  1) Course

- Post Management
  1) Post (I did not create a separate table for Post)
  2) Question Post
  3) Answer Post

Relationships

- User-Course relationships
  1) Teaching User and Course (Creates)



Cardinality Constraints: The cardinality relation between TU and Course is (1:N) as one TU can create multiple courses and one course can be related only to one Teaching User

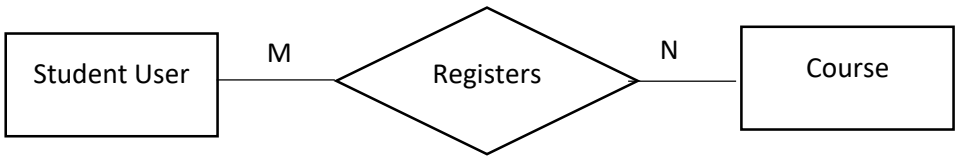
Participation Constraints: As a Course cannot independently exist without a Teaching User it totally participates in the relationship (creates) whereas the Teaching User partially participates in this relationship.

2) Teaching User and Course (Updates)

Cardinality Constraints: The cardinality relation between TU and Course is (M:N) as a Course can be updated by multiple Teaching User and one Teaching User can update many Courses.

Participation Constraints: Both Teaching User and Course partially participate in the Updates relationship.

3) Student User and Course (Registers)



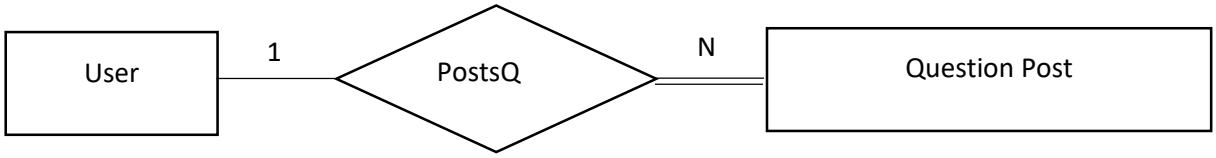
Cardinality Constraints: The cardinality relation between SU and Course is (M:N) as a Course can be registered by multiple Student Users and one Student User can register for many Courses.

Participation Constraints: Assumptions (A Student User can exist without registering for any course. And a Course can exist with no students registered in it).

Following the above assumptions, Student User and Course partially participate in the Registers relationship.

- User-Post relationships

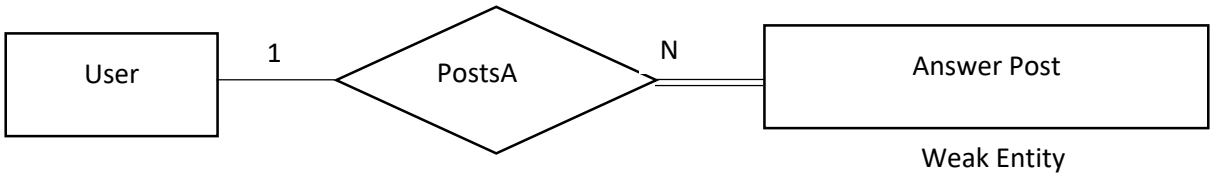
1) User and Question Post (PostsQ)



Cardinality Constraints: The cardinality relation between User and Question Post is (1:N) as a user can create multiple Question Post but one Question Post can be related to only one User.

Participation Constraints: As a Question Post cannot exist without a User it totally participates whereas the User partially participates in the PostsQ relationship.

2) User and Answer Post (PostsA)

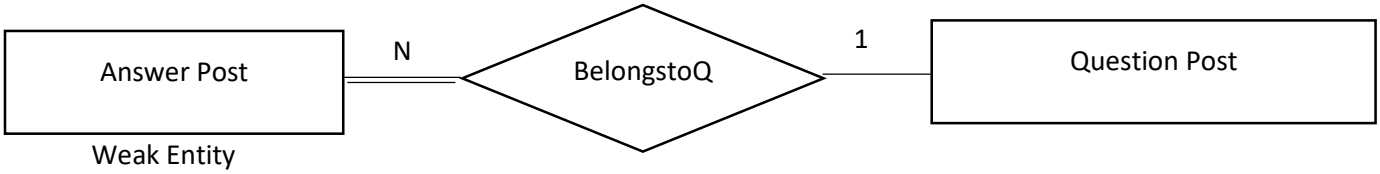


Cardinality Constraints: The cardinality relation between User and Answer Post is (1:N) as a user can create multiple Answer Post but one Answer Post can be related to only one User.

Participation Constraints: As a Answer Post cannot exist without a User it totally participates whereas the User partially participates in the PostsA relationship.

- Other Relationships

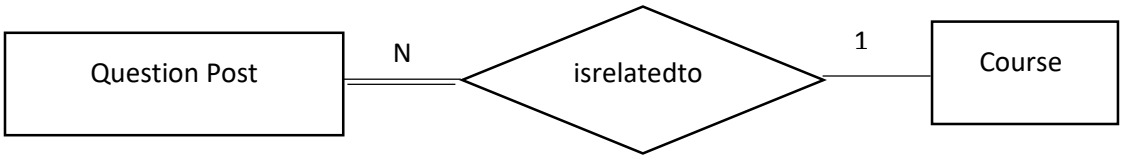
1) Answer Post and Question Post (belongstoQ)



Cardinality Constraints: The cardinality relation between Answer Post and Question Post is (N:1) as one Question Post can have multiple Answer Post but one Answer Post can be related to only one Question Post.

Participation Constraints: As an Answer Post cannot exist without a Question Post it totally participates whereas the Question Post partially participates in the BelongstoQ relationship.

2) Question Post and Course (isrelatedto)



Cardinality Constraints: The cardinality relation between Question Post and Course is (N:1) as one Course can have multiple Question Post but one Question Post can be related to only one Course.

Participation Constraints: As an Question Post cannot exist without a Course it totally participates whereas the Question Post partially participates in the isrelatedto relationship.

- Mappings of Relationships into Relational Model

Entity 1	Entity 2	Relationship Name	Cardinality	Relational Schema Representation
Teaching User	Course	Create	1:N	An attribute email id added to Course Table
Teaching User	Course	Update	M:N	Separate Table 'Update' created with primary keys of both entities
Student User	Course	Register	M:N	Separate Table 'Register' created with primary keys of both entities
User	Question Post	PostQ	1:N	An attribute email id added to Question Post Table
User	Answer Post	PostA	1:N	An attribute email id added to Answer Post Table
Question Post	Course	isrelatedto	N:1	Primary keys of course are added to question post table.
Answer Post	Question Post	belongstoQ	N:1	As Answer Post is a weak entity, it borrows primary keys of Question Post

Relational Schema

1) User (Emailid, password, displayname)
2) Teaching User (Emailid, password, displayname)
3) Student User (Emailid, password, displayname)
4) Emailid ref Teaching User(Emailid) =>
   Course (Course Number, University Name, Semester, Year, Course Name, Emailid)
5) Emailid ref Teaching User(Emailid) =>
   Update (Emailid, Course Number, University Name, Semester, Year)
6) Emailid ref Student User(Emailid)=>
   Register (Emailid, Course Number, University Name, Semester, Year)
7) Course Number, University Name, Semester, Year ref Course (Course Number, University Name, Semester, Year), Emailid ref User(Emailid) =>
   Question Post (Postid, Course Number, University Name, Semester, Year, Time, Emailid, Title, Description,)
8) Course Number, University Name, Semester, Year ref Question Post (Course Number, University Name, Semester, Year), Emailid ref User(Emailid), Postid ref QuestionPost (Postid) =>
   Answer Post (Postid, Course Number, University Name, Semester, Year, Emailid, Time, Answer)

Requirements:

- User management

  User sign up:
  User will be able to sign up with the help of User table.
  Email addresses uniquely represent the users as it has been set as the primary key in the table.
  Other attributes like displayname and password cannot be null anytime.
  All the attributes in the User table are single valued attributes. No multivalued attribute used.

  Teaching User and Student User table is an overlapping subtype of User table which ensures that the user can act as Teaching as well as Student User.

- Course management

  The course table contains University name, Year, Semester,Course name and Course number with University name, Year, Semester and Course number acting as primary key. And this attribute cannot be null.

- Post management

  Two separate tables for Question Post and Answer post are created. Answer post is related to a Question post with belongstoQ relationship. This relationship makes sure that each answer post is related to a question post as stated in the requirement document.

- User-Course relationship management

  Teaching users can create and update many courses. This requirement is fulfilled by creating a separate table for Update and for create the emailid of the Teaching User is attached to the Course Table which uniquely identifies who created the course. The register functionality of student user is fulfilled by creating a separate table for it as the cardinality constraints where M:N.

- User-Post relationship management

  No separate table for Post was created. Instead two separate relationships PostQ and PostA where created to meet the requirement. This made sure that the table created kept the track of posts created and updated in to the tiny piazza.

- Advantages

    1. The above model satisfies the functionalities stated in the requirement document.
    2. Relationships are correctly mapped and converted to relational schemas without any significant loss of data.

- Disadvantages
    1. The design of ER diagram is complex and cannot be easily comprehended.
    2. The model above has data redundancy. This model can be further improved using Normalization to minimize data redundancies.
    3. Post Management functionalities can be improved with efficient design of schema.

Bonus Question

Consider the schema R(ABCD), the set of functional dependencies F = {A → BCD} and the decomposition (R1, R2) = (ABC, ABD).

Questions: 1. Are R1 and R2 in BCNF? Which dependencies are preserved by the decomposition?

Given the functional dependency F = { A → BCD}, we could understand that the primary key is A. Now consider decomposition

R1(ABC)	R2 (ABD)
A-> B	A-> B
A-> C	A->D

As 'A' is a superkey we could say that decomposition (R1, R2) are in BCNF. And functional dependencies are preserved by the decomposition.