

A5: Relational schema, validation and schema refinement

Our project, answerly, is a web application for collaborative questions and answers.

This artifact contains the Relational Schema obtained by mapping from the Conceptual Data Model. The Relational Schema includes the relation schema, attributes, domains, primary keys, foreign keys and other integrity rules: UNIQUE, DEFAULT, NOT NULL, CHECK...

1. Relational Schema

Relation Reference	Relation Compact Notation
R01	user(id , first_name <i>NN</i> , last_name <i>NN</i> , email <i>UK NN</i> , bio, username <i>UK NN</i> , password <i>NN</i> , score <i>DF 0</i>)
R02	label(id , name <i>NN</i>)
R03	notification(id , content <i>NN</i> , date <i>DF Now</i> , viewed <i>DF False</i> , user_id → user <i>NN</i>)
R04	user_management(id , status <i>NN</i> , user_id → user <i>UK NN</i>)
R05	vote(id , vote, user_id → user <i>NN</i> , question_id → question, answer_id → answer <i>CK question_id = NN XOR answer_id = NN</i>)
R06	question(id , user_id → user <i>NN</i> , title <i>NN</i> , description <i>NN</i> , nr_likes <i>NN DF 0</i> , nr_dislikes <i>NN DF 0 CK nr_likes >= 0 AND nr_dislikes >= 0</i> , question_date <i>NN DF Now</i>)
R07	answer(id , user_id → user <i>NN</i> , question_id → question <i>NN</i> , answer_date <i>NN DF Now</i> , content <i>NN</i> , nr_likes <i>NN DF 0</i> , nr_dislikes <i>NN DF 0 CK nr_likes >= 0 AND nr_dislikes >= 0</i> , marked_answer <i>NN DF FALSE</i>)
R08	comment(id , user_id → user <i>NN</i> , question_id → question, answer_id → answer <i>CK question_id = NN XOR answer_id = NN</i> , content <i>NN</i> , comment_date <i>NN DF Now</i>)
R09	report(id , user_id → user, question_id → question, answer_id → answer, comment_id → comment <i>CK user_id = NN XOR question_id = NN XOR answer_id = NN XOR comment_id = NN</i>)
R10	report_status(id , report_id → report, state <i>NN DF unresolved CK state IN States</i> , comment, responsible_user → user <i>NN</i>)
R11	following(user_id → user, label_id → label)
R12	about(question_id → question, label_id → label)

- UK means UNIQUE KEY
- NN means NOT NULL
- DF means DEFAULT
- CK means CHECK

2. Domains

Specification of additional domains:

Domain Name	Domain Specification
Now	DATE DEFAULT CURRENT_TIMESTAMP_
Report States	ENUM ('unresolved', 'reviewing', 'resolved')
User Status	ENUM ('user', 'moderator', 'administrator', 'banned')

3. Functional Dependencies and schema validation

In the following tables, all relations are in the Boyce-Codd Normal Form, since for each non trivial functional dependency $A \rightarrow B$, A is a (super)key of the relation.

Table R01 (user)

Keys: {id}, {username}, {email}	
Functional Dependencies	
FD0101	{id} \rightarrow {first_name, last_name, email, bio, username, password, score}
FD0102	{username} \rightarrow {user_id, first_name, last_name, email, bio, password, score, marked_answer}
FD0103	{email} \rightarrow {user_id, first_name, last_name, bio, username, password, score}
NORMAL FORM	BCNF

Table R02 (label)

Keys: {id}	
Functional Dependencies	
FD0201	{id} \rightarrow {name}
NORMAL FORM	BCNF

Table R03 (notification)

Keys: {id}	
Functional Dependencies	
FD0301	{id} \rightarrow {content, date, viewed, user_id}
NORMAL FORM	BCNF

Table R04 (user_management)**Keys:** {id}**Functional Dependencies**

FD0401 {id} → {status, user_id}

NORMAL FORM BCNF**Table R05 (vote)****Keys:** {id}**Functional Dependencies**

FD0501 {id} → {vote, user_id, question_id, answer_id}

NORMAL FORM BCNF**Table R06 (question)****Keys:** {id}**Functional Dependencies**

FD0601 {id} → {user_id, title, description, nr_likes, nr_dislikes, question_date}

NORMAL FORM BCNF**Table R07 (answer)****Keys:** {id}**Functional
Dependencies**FD0701 {id} → {user_id, question_id, answer_date, content, nr_likes, nr_dislikes,
marked_answer}**NORMAL FORM** BCNF**Table R08 (comment)****Keys:** {id}**Functional Dependencies**

FD0801 {id} → {user_id, question_id, answer_id, content, comment_date}

NORMAL FORM BCNF**Table R09 (report)****Keys:** {id}

Table R09 (report)

Functional Dependencies	
FD0901	{id} → {user_id, question_id, answer_id, comment_id}
NORMAL FORM	BCNF

Table R10 (report_status)

Keys: {id}	
Functional Dependencies	
FD1001	{id} → {report_id, state, comment, responsible_user}
NORMAL FORM	BCNF

Table R11 (following)

Keys: {user_id, label_id}	
Functional Dependencies	
(none)	
NORMAL FORM	BCNF

Table R12 (about)

Keys: {question_id, label_id}	
Functional Dependencies	
(none)	
NORMAL FORM	BCNF

4. SQL Code

```

DROP TABLE IF EXISTS "user" CASCADE;
DROP TABLE IF EXISTS label CASCADE;
DROP TABLE IF EXISTS notification CASCADE;
DROP TABLE IF EXISTS user_management CASCADE;
DROP TABLE IF EXISTS question CASCADE;
DROP TABLE IF EXISTS answer CASCADE;
DROP TABLE IF EXISTS comment CASCADE;
DROP TABLE IF EXISTS vote CASCADE;
DROP TABLE IF EXISTS report CASCADE;
DROP TABLE IF EXISTS report_status CASCADE;
DROP TABLE IF EXISTS following CASCADE;
DROP TABLE IF EXISTS about CASCADE;

-- Table: user

```

```
CREATE TABLE "user" (  
    id SERIAL PRIMARY KEY,  
    first_name TEXT NOT NULL,  
    last_name TEXT NOT NULL,  
    email TEXT NOT NULL UNIQUE,  
    bio TEXT,  
    username TEXT NOT NULL UNIQUE,  
    password TEXT NOT NULL,  
    score INTEGER NOT NULL DEFAULT 0  
);  
  
-- Table: label  
CREATE TABLE label (  
    id SERIAL PRIMARY KEY,  
    name TEXT NOT NULL  
);  
  
-- Table: notification  
CREATE TABLE notification (  
    id SERIAL PRIMARY KEY,  
    content TEXT NOT NULL,  
    date DATE DEFAULT 'Now' NOT NULL,  
    viewed BOOLEAN DEFAULT FALSE NOT NULL,  
    user_id INTEGER REFERENCES "user" (id) NOT NULL  
);  
  
-- Table: user_management  
CREATE TABLE user_management (  
    id SERIAL PRIMARY KEY,  
    status TEXT DEFAULT 'user' NOT NULL,  
    user_id INTEGER REFERENCES "user" (id) NOT NULL UNIQUE  
);  
  
-- Table: question  
CREATE TABLE question (  
    id SERIAL PRIMARY KEY,  
    user_id INTEGER REFERENCES "user" (id) NOT NULL,  
    title TEXT NOT NULL,  
    description TEXT NOT NULL,  
    nr_likes INTEGER DEFAULT 0 NOT NULL,  
    nr_dislikes INTEGER DEFAULT 0 NOT NULL,  
    question_date DATE DEFAULT 'Now' NOT NULL,  
    CHECK (  
        nr_likes >= 0 AND nr_dislikes >= 0  
    )  
);  
  
-- Table: answer  
CREATE TABLE answer (  
    id SERIAL PRIMARY KEY,  
    user_id INTEGER REFERENCES "user" (id) NOT NULL,  
    question_id INTEGER REFERENCES "question" (id) NOT NULL,  
    answer_date DATE DEFAULT 'Now' NOT NULL,  
    content TEXT NOT NULL,
```

```
nr_likes      INTEGER      DEFAULT 0 NOT NULL,
nr_dislikes   INTEGER      DEFAULT 0 NOT NULL,
marked_answer BOOLEAN      DEFAULT FALSE NOT NULL,
CHECK (
    nr_likes >= 0 AND nr_dislikes >= 0
)
);

-- Table: comment
CREATE TABLE comment (
    id          SERIAL          PRIMARY KEY,
    user_id     INTEGER         REFERENCES "user" (id) NOT NULL,
    question_id INTEGER         REFERENCES "question" (id),
    answer_id   INTEGER         REFERENCES "answer" (id),
    comment_date DATE          DEFAULT 'Now' NOT NULL,
    content     TEXT            NOT NULL,
    CHECK (
        (question_id IS NOT NULL AND answer_id IS NULL) OR
        (question_id IS NULL AND answer_id IS NOT NULL)
    )
);

-- Table: vote
CREATE TABLE vote (
    id          SERIAL          PRIMARY KEY,
    "vote"      BOOLEAN         NOT NULL,
    user_id     INTEGER         REFERENCES "user" (id) NOT NULL,
    question_id INTEGER         REFERENCES "question" (id),
    answer_id   INTEGER         REFERENCES "answer" (id),
    CHECK (
        (question_id IS NOT NULL AND answer_id IS NULL) OR
        (question_id IS NULL AND answer_id IS NOT NULL)
    )
);

-- Table: report
CREATE TABLE report (
    id          SERIAL          PRIMARY KEY,
    user_id     INTEGER         REFERENCES "user" (id),
    question_id INTEGER         REFERENCES "question" (id),
    answer_id   INTEGER         REFERENCES "answer" (id),
    comment_id  INTEGER         REFERENCES "comment" (id),
    CHECK(
        (question_id IS NOT NULL AND answer_id IS NULL AND comment_id IS
NULL) OR
        (question_id IS NULL AND answer_id IS NOT NULL AND comment_id IS
NULL) OR
        (question_id IS NULL AND answer_id IS NULL AND comment_id IS NOT
NULL)
    )
);

-- Table: report_status
CREATE TABLE report_status (
```

```
    id SERIAL PRIMARY KEY,
    report_id INTEGER REFERENCES "report" (id) ON DELETE
CASCADE NOT NULL,
    state TEXT DEFAULT 'unresolved' NOT NULL,
    comment TEXT,
    responsible_user INTEGER REFERENCES "user" (id) ON DELETE
CASCADE NOT NULL
);

-- Table: following
CREATE TABLE following (
    user_id INTEGER REFERENCES "user" (id) NOT NULL,
    label_id INTEGER REFERENCES "label" (id) NOT NULL
);

-- Table: about
CREATE TABLE about (
    question_id INTEGER REFERENCES "question" (id) NOT NULL,
    label_id INTEGER REFERENCES "label" (id) NOT NULL
);
```

Revision history

1. First submission (23/03/2020).
2. Deleted Administrator and Moderator tables. Changed all id's to "id" and other minor changes (28/03/2020).
3. Tested sql code, fixed some errors (29/03/2020).

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