Introduction To Databases

Team 6

ZhangBank - The place for notes
Part 4

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Contents

1 Description

Our application seeks to fill the needs of students everywhere. ZhangBank's goal is to organize class material study guides; basically anything that can help the class rise up and meet the expectations of their Professors. Identifiable entities include user accounts, Roles, Documents (in many formats), Courses, Professors, and semesters. An organized way to find and view Documents will be implemented, as well as add content. A user's profile will keep track of which Courses students are taking or are interested in. An interesting problem would be correctly displaying each arbitrary Document. Data for our application can be generated from our own Courses and other free online Courses.

2 Design

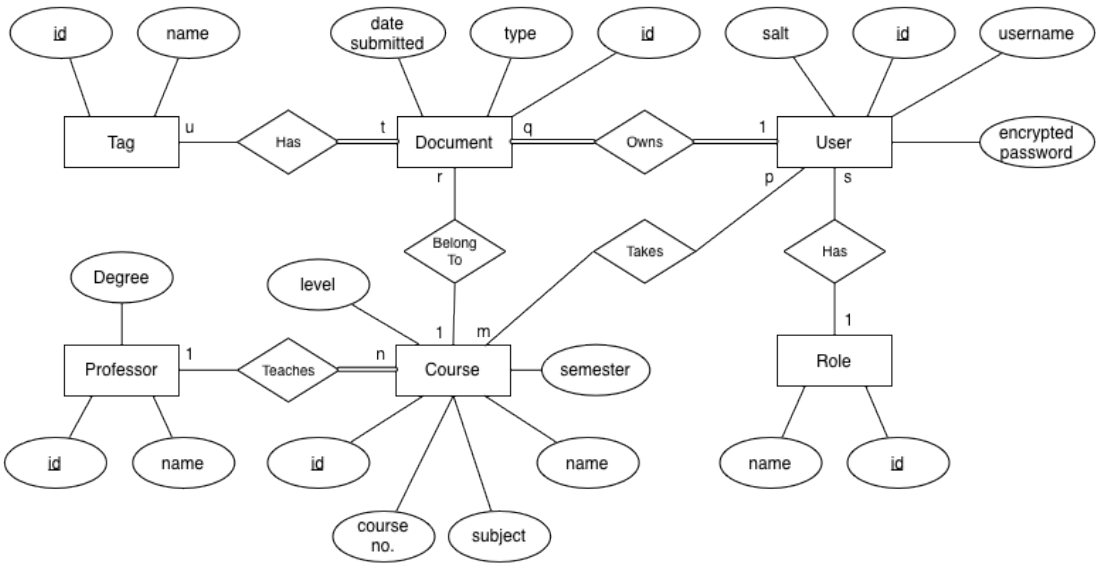

Figure 1: ER Diagram

2.1 Users

Each User creates a username a password during account creation, a security salt is also generated with each account. User can be identified uniquely by an assigned id.

All Users have one Role associated with it to allow authorization of application management. All Users can take many Courses which will allow Users to keep track of the Documents of the Courses they're taking. Each User can upload many Documents. The Documents they own can be managed by them.

2.2 Roles

A list of Roles is maintained, each with different capabilities in our application. Normal Users can add and manage their own Documents. An admin can manage all Documents, Courses, and Professors. It's identified by a generated id and a provided name.

Each Role can have many Users to allow roll based authorization.

2.3 Documents

Each Document has a type associated with it to allow the application to display Documents appropriately. It stores the date submitted to help with organization in the application and can be uniquely identified by a generated id.

All Documents are owned by one User each, the original uploader. All Documents belong to one Course each. This allows for the indexing of Documents by Course. All Documents can have many tags each. This allows documents to be organized in a tag based fashion.

2.4 Tags

Each tag has a provided name and an id. This allows for an indexing of tags by name. Every tag has multiple Documents each. This allows Documents to be organized for each course.

2.5 Professors

The Professor entity has two primary attributes, a provided name and a generated id.

Each Professor entity Teaches many Courses. This will allow Users to run a search on a specific Professor to view Documentation for any Course that he may have previously taught.

2.6 Courses

The Course entity has four primary attributes; a provided name, a generated id, the semester the course is held, and a provided course number.

All Courses are Taught by one Professor each to allow the indexing of Documents based on Professor. Each Course has many Documents to provide indexing of Documents based on each Course. All Courses are Taken by many Users each. This allows for Users to save which classes they're taking.

3 Relational Schema

3.1 User Table

Table 1: User Table

id	username	password	salt

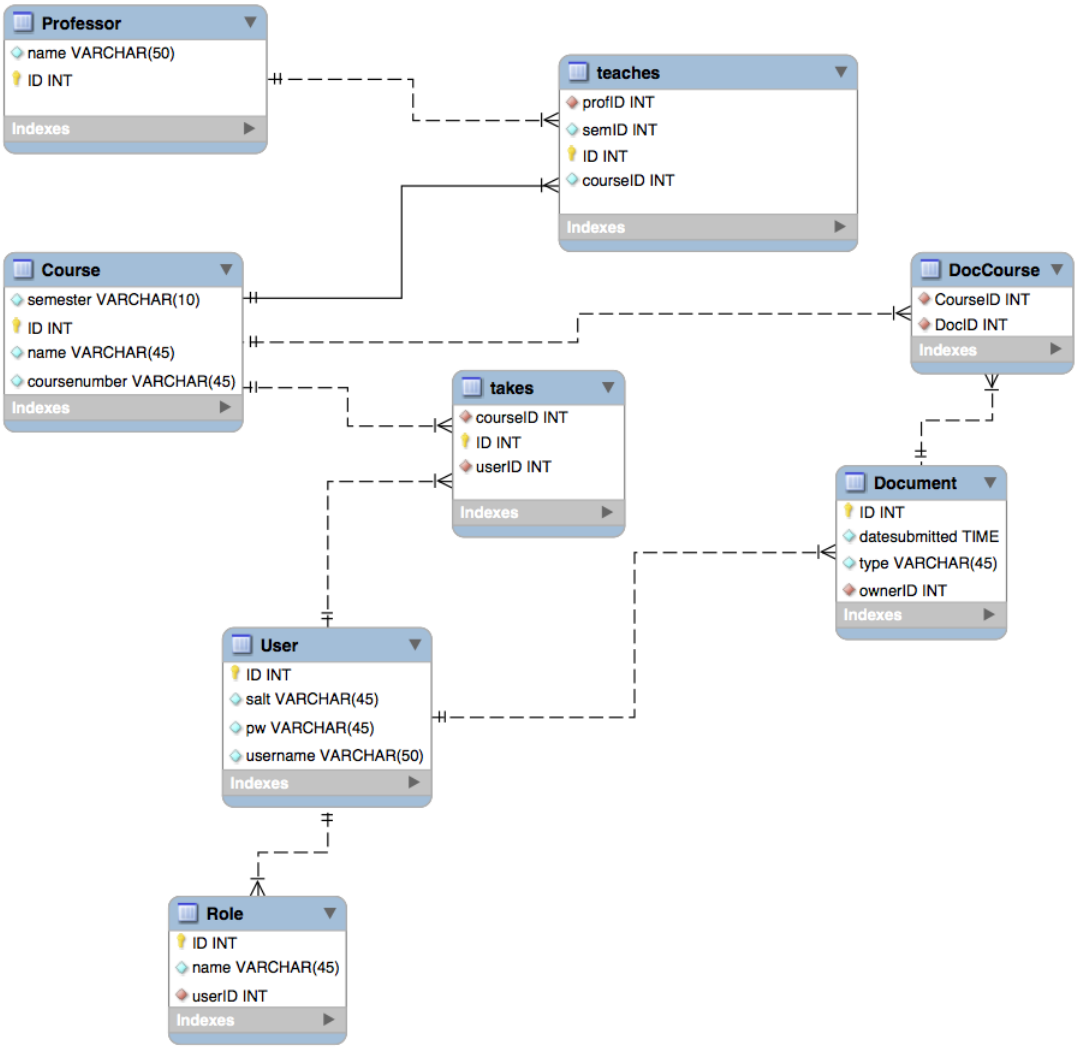

Figure 2: Schema Diagram

3.1.1 Keys

Primary key: id
Candidate keys: id, username

3.1.2 Functional Dependencies

id → username, password, salt
username → id, password, salt

3.1.3 Normal Form

BCNF

3.2 Role Table

Table 2: Role Table

id	name

3.2.1 Keys

Primary key: id
Candidate keys: id, name

3.2.2 Functional Dependencies

id → name

3.2.3 Normal Form

BCNF

3.3 UserRoles Table

Table 3: UserRole Table

user_id	**role_id**

3.3.1 Keys

Primary key: user_id
Candidate keys: user_id
Foreign keys: user_id → User.id, role_id → Role.id

3.3.2 Functional Dependencies

user_id → role_id

3.3.3 Normal Form

BCNF

3.4 Professor Table

Table 4: Professor Table

id	name

3.4.1 Keys

Primary key: id
Candidate keys: id

3.4.2 Functional Dependencies

id $\rightarrow$ name

3.4.3 Normal Form

BCNF

3.5 Course Table

Table 5: Course Table

id	course_no.	name	semester

3.5.1 Keys

Primary key: id
Candidate keys: id

3.5.2 Functional Dependencies

id $\rightarrow$ course_no, name, semester

3.5.3 Normal Form

BCNF

Table 6: Takes Table

id	**course_id**	**user_id**

3.6 Takes Table

3.6.1 Keys

Primary key: id
Candidate keys: id
Foreign keys: course_id → Course.id, user_id → User.id

3.6.2 Functional Dependencies

id → course_id, user_id

3.6.3 Normal Form

BCNF

3.7 Teaches Table

Table 7: Teaches Table

course_id	**professor_id**

3.7.1 Keys

Primary key: course_id
Candidate keys: course_id
Foreign keys: course_id → Couse.id , professor_id → Professor.id

3.7.2 Functional Dependencies

id → course_id, professor_id

3.7.3 Normal Form

BCNF

Table 8: Document Table

id	type	date_submitted

3.8 Document Table

3.8.1 Keys

Primary key: id
Candidate keys: id

3.8.2 Functional Dependencies

id → type, date_submitted

3.8.3 Normal Form

BCNF

3.9 UserDocs Table

Table 9: UserDoc Table

document_id	**user_id**

3.9.1 Keys

Primary key: document_id
Candidate keys: document_id
Foreign keys: document_id → Document.id, user_id → User.id

3.9.2 Functional Dependencies

document_id → user_id

3.9.3 Normal Form

BCNF

3.10 Tag Table

3.10.1 Keys

Primary key: id
Candidate keys: id, name

Table 10: Tag Table

id	name

3.10.2 Functional Dependencies

id → name

3.10.3 Normal Form

BCNF

3.11 DocTag Table

Table 11: DocTag Table

id	**document_id**	**tag_id**

3.11.1 Keys

Primary key: id
Candidate keys: id
Foreign keys: document_id → Document.id, tag_id → Tag.id

3.11.2 Functional Dependencies

id → document_id, tag_id

3.11.3 Normal Form

BCNF

4 Database

4.1 User

```
1  CREATE TABLE  "USERS"
2     (    "ID" NUMBER NOT NULL ENABLE,
3          "SALT" VARCHAR2(45) NOT NULL ENABLE,
4          "PW" VARCHAR2(45) NOT NULL ENABLE,
5          "USERNAME" VARCHAR2(50) NOT NULL ENABLE,
6           CONSTRAINT "USERS_PK" PRIMARY KEY ("ID") ENABLE
7     )
8  /
9
```

```
CREATE OR REPLACE TRIGGER  "BI_USERS"
  before insert on "USERS"
  for each row
begin
    select "USERS_SEQ".nextval into :NEW.ID from dual;
end;

/
ALTER TRIGGER  "BI_USERS" ENABLE
/
```

4.2 Role

```
CREATE TABLE  "ROLE"
   (    "ID" NUMBER,
        "NAME" VARCHAR2(45),
         CONSTRAINT "ROLE_PK" PRIMARY KEY ("ID") ENABLE
   )
/

CREATE OR REPLACE TRIGGER  "BI_ROLE"
  before insert on "ROLE"
  for each row
begin
    select "ROLE_SEQ".nextval into :NEW.ID from dual;
end;

/
ALTER TRIGGER  "BI_ROLE" ENABLE
/
```

4.3 UserRoles

```
CREATE TABLE  "USERROLE"
   (    "USER_ID" NUMBER NOT NULL ENABLE,
        "ROLE_ID" NUMBER NOT NULL ENABLE,
         CONSTRAINT "USERROLE_PK" PRIMARY KEY ("USER_ID") ENABLE,
         CONSTRAINT "USERROLE_FK" FOREIGN KEY ("USER_ID")
          REFERENCES  "USERS" ("ID") ENABLE,
         CONSTRAINT "USERROLE_FK2" FOREIGN KEY ("ROLE_ID")
          REFERENCES  "ROLE" ("ID") ENABLE
   )
/

CREATE OR REPLACE TRIGGER  "BI_USERROLE"
  before insert on "USERROLE"
  for each row
begin
    select "USERROLE_SEQ".nextval into :NEW.USER_ID from dual;
end;

/
ALTER TRIGGER  "BI_USERROLE" ENABLE
/
```

4.4 Professor

```
CREATE TABLE  "PROFESSOR"
   (    "NAME" VARCHAR2(50) NOT NULL ENABLE,
        "ID" NUMBER(*,0) NOT NULL ENABLE,
        "DEGREE" VARCHAR2(45),
         PRIMARY KEY ("ID") ENABLE
   )
/
```

4.5 Course

```
CREATE TABLE  "COURSE"
   (    "SEMESTER" VARCHAR2(10) NOT NULL ENABLE,
        "ID" NUMBER(*,0) NOT NULL ENABLE,
        "TITLE" VARCHAR2(45) NOT NULL ENABLE,
        "COURSENUMBER" VARCHAR2(45) NOT NULL ENABLE,
        "ACADEMICLEVEL" NUMBER,
        "SUBJECT" VARCHAR2(50) NOT NULL ENABLE,
         PRIMARY KEY ("ID") ENABLE
   )
/
```

4.6 Takes

```
CREATE TABLE  "TAKES"
   (    "COURSEID" NUMBER NOT NULL ENABLE,
        "ID" NUMBER NOT NULL ENABLE,
        "USERID" NUMBER NOT NULL ENABLE,
         CONSTRAINT "TAKES_PK" PRIMARY KEY ("ID") ENABLE,
         CONSTRAINT "TAKES_FK" FOREIGN KEY ("COURSEID")
          REFERENCES  "COURSE" ("ID") ENABLE,
         CONSTRAINT "TAKES_FK2" FOREIGN KEY ("USERID")
          REFERENCES  "USERS" ("ID") ENABLE
   )
/

CREATE OR REPLACE TRIGGER  "BI_TAKES"
  before insert on "TAKES"
  for each row
begin
    select "TAKES_SEQ".nextval into :NEW.ID from dual;
end;

/
ALTER TRIGGER  "BI_TAKES" ENABLE
/
```

4.7 Teaches

```
CREATE TABLE  "TEACHES"
   (    "PROFID" NUMBER NOT NULL ENABLE,
        "COURSEID" NUMBER NOT NULL ENABLE,
         CONSTRAINT "TEACHES_FK" FOREIGN KEY ("PROFID")
          REFERENCES  "PROFESSOR" ("ID") ENABLE,
         CONSTRAINT "TEACHES_FK2" FOREIGN KEY ("COURSEID")
          REFERENCES  "COURSE" ("ID") ENABLE
   )
/

```

```
CREATE OR REPLACE TRIGGER  "BI_TEACHES"
  before insert on "TEACHES"
  for each row
begin
    select "TEACHES_SEQ".nextval into :NEW.ID from dual;
end;

/
ALTER TRIGGER  "BI_TEACHES" ENABLE
/
```

4.8 UserDocs

```
CREATE TABLE  "USERDOC"
   (    "DOCUMENT_ID" NUMBER NOT NULL ENABLE,
        "USER_ID" NUMBER NOT NULL ENABLE,
         CONSTRAINT "USERDOC_PK" PRIMARY KEY ("DOCUMENT_ID") ENABLE,
         CONSTRAINT "USERDOC_FK" FOREIGN KEY ("DOCUMENT_ID")
          REFERENCES  "DOCUMENT" ("ID") ENABLE,
         CONSTRAINT "USERDOC_FK2" FOREIGN KEY ("USER_ID")
          REFERENCES  "USERS" ("ID") ENABLE
   )
/

CREATE OR REPLACE TRIGGER  "BI_USERDOC"
  before insert on "USERDOC"
  for each row
begin
    select "USERDOC_SEQ".nextval into :NEW.DOCUMENT_ID from dual;
end;

/
ALTER TRIGGER  "BI_USERDOC" ENABLE
/
```

4.9 Tag

```
CREATE TABLE  "TAG"
   (    "ID" NUMBER NOT NULL ENABLE,
        "NAME" VARCHAR2(45) NOT NULL ENABLE,
         CONSTRAINT "TAG_PK" PRIMARY KEY ("ID") ENABLE
   )
/

CREATE OR REPLACE TRIGGER  "BI_TAG"
  before insert on "TAG"
  for each row
begin
    select "TAG_SEQ".nextval into :NEW.ID from dual;
end;

/
ALTER TRIGGER  "BI_TAG" ENABLE
/
```

4.10 DocTag

```
CREATE TABLE  "DOCTAG"
   (    "ID" NUMBER NOT NULL ENABLE,
        "DOCUMENT_ID" NUMBER NOT NULL ENABLE,
        "TAG_ID" NUMBER NOT NULL ENABLE,
         CONSTRAINT "DOCTAG_PK" PRIMARY KEY ("ID") ENABLE,
         CONSTRAINT "DOCTAG_FK" FOREIGN KEY ("DOCUMENT_ID")
          REFERENCES  "DOCUMENT" ("ID") ENABLE,
         CONSTRAINT "DOCTAG_FK2" FOREIGN KEY ("TAG_ID")
          REFERENCES  "TAG" ("ID") ENABLE
   )
/

CREATE OR REPLACE TRIGGER  "BI_DOCTAG"
  before insert on "DOCTAG"
  for each row
begin
    select "DOCTAG_SEQ".nextval into :NEW.ID from dual;
end;

/
ALTER TRIGGER  "BI_DOCTAG" ENABLE
/
```

5 TODO Views

1. Design at least one view that accesses two or more base tables.

5.1 Takes

```
select   "COURSE"."ID" as "ID",
         "COURSE"."SEMESTER" as "SEMESTER",
         "COURSE"."TITLE" as "TITLE",
         "COURSE"."COURSENUMBER" as "COURSENUMBER",
         "COURSE"."ACADEMICLEVEL" as "ACADEMICLEVEL",
         "COURSE"."SUBJECT" as "SUBJECT",
         "TAKES"."ID" as "ID",
         "TAKES"."COURSEID" as "COURSEID",
         "TAKES"."USERID" as "USERID",
         "USERS"."ID" as "ID_1",
         "USERS"."SALT" as "SALT",
         "USERS"."PW" as "PW",
         "USERS"."USERNAME" as "USERNAME"
 from    "USERS" "USERS",
         "TAKES" "TAKES",
         "COURSE" "COURSE"
```

5.2 UserDocs

```
select   "USERS"."ID" as "ID",
         "USERS"."PW" as "PW",
         "USERS"."SALT" as "SALT",
         "USERS"."USERNAME" as "USERNAME",
         "USERDOC"."DOCUMENT_ID" as "DOCUMENT_ID",
         "USERDOC"."USER_ID" as "USER_ID",
         "DOCUMENT"."ID" as "ID",
         "DOCUMENT"."TYPE" as "TYPE"
 from    "DOCUMENT" "DOCUMENT",
```

```
10          "USERDOC" "USERDOC",
11          "USERS" "USERS"
```

5.3 Document Tags

```
1  select   "DOCUMENT"."ID" as "ID",
2           "DOCUMENT"."TYPE" as "TYPE",
3           "DOCTAG"."ID" as "ID",
4           "DOCTAG"."DOCUMENT_ID" as "DOCUMENT_ID",
5           "DOCTAG"."TAG_ID" as "TAG_ID",
6           "TAG"."ID" as "ID_1",
7           "TAG"."NAME" as "NAME"
8   from    "TAG" "TAG",
9           "DOCTAG" "DOCTAG",
10          "DOCUMENT" "DOCUMENT"
```

5.4 Professor Documents

```
1  select   "PROFESSOR"."ID" as "ID",
2           "DOCCOURSE"."COURSEID" as "COURSEID",
3           "DOCCOURSE"."DOCID" as "DOCID",
4           "COURSE"."ID" as "ID",
5           "COURSE"."SEMESTER" as "SEMESTER",
6           "COURSE"."TITLE" as "TITLE",
7           "COURSE"."COURSENUMBER" as "COURSENUMBER",
8           "COURSE"."ACADEMICLEVEL" as "ACADEMICLEVEL",
9           "COURSE"."SUBJECT" as "SUBJECT",
10          "DOCUMENT"."ID" as "ID_1",
11          "DOCUMENT"."TYPE" as "TYPE",
12          "TEACHES"."PROFID" as "PROFID",
13          "TEACHES"."COURSEID" as "COURSEID",
14          "PROFESSOR"."NAME" as "NAME",
15          "PROFESSOR"."DEGREE" as "DEGREE"
16  from    "DOCCOURSE" "DOCCOURSE",
17          "COURSE" "COURSE",
18          "DOCUMENT" "DOCUMENT",
19          "TEACHES" "TEACHES",
20          "PROFESSOR" "PROFESSOR"
21 group by PROFESSOR.ID
```

5.5 Course Docuements

```
1  select   "DOCCOURSE"."COURSEID" as "COURSEID",
2           "DOCCOURSE"."DOCID" as "DOCID",
3           "DOCUMENT"."ID" as "ID_1",
4           "DOCUMENT"."TYPE" as "TYPE",
5           "COURSE"."ID" as "ID",
6           "COURSE"."SEMESTER" as "SEMESTER",
7           "COURSE"."TITLE" as "TITLE",
8           "COURSE"."COURSENUMBER" as "COURSENUMBER",
9           "COURSE"."ACADEMICLEVEL" as "ACADEMICLEVEL",
10          "COURSE"."SUBJECT" as "SUBJECT"
11  from    "COURSE" "COURSE",
12          "DOCCOURSE" "DOCCOURSE",
13          "DOCUMENT" "DOCUMENT"
```

5.6 User Roles

```
select   "USERS"."ID" as "ID",
         "USERS"."SALT" as "SALT",
         "USERS"."PW" as "PW",
         "USERS"."USERNAME" as "USERNAME",
         "USERROLE"."USER_ID" as "USER_ID",
         "USERROLE"."ROLE_ID" as "ROLE_ID",
         "ROLE"."ID" as "ID",
         "ROLE"."NAME" as "NAME"
 from    "ROLE" "ROLE",
         "USERROLE" "USERROLE",
         "USERS" "USERS"
```

6 Spool

```
SQL>   CREATE TABLE  "USERS"
  2       (    "ID" NUMBER NOT NULL ENABLE,
  3            "SALT" VARCHAR2(45) NOT NULL ENABLE,
  4            "PW" VARCHAR2(45) NOT NULL ENABLE,
  5            "USERNAME" VARCHAR2(50) NOT NULL ENABLE,
  6             CONSTRAINT "USERS_PK" PRIMARY KEY ("ID") ENABLE
  7       )
  8    /

Table created.

SQL>
SQL>   CREATE OR REPLACE TRIGGER  "BI_USERS"
  2      before insert on "USERS"
  3      for each row
  4    begin
  5        select "USERS_SEQ".nextval into :NEW.ID from dual;
  6    end;
  7
  8    /

Warning: Trigger created with compilation errors.

SQL>   ALTER TRIGGER  "BI_USERS" ENABLE
  2    /

Trigger altered.

SQL>
SQL>   CREATE TABLE  "ROLE"
  2       (    "ID" NUMBER,
  3            "NAME" VARCHAR2(45),
```

```
  4             CONSTRAINT "ROLE_PK" PRIMARY KEY ("ID") ENABLE
  5       )
  6    /

Table created.

SQL>
SQL>   CREATE OR REPLACE TRIGGER  "BI_ROLE"
  2      before insert on "ROLE"
  3      for each row
  4    begin
  5        select "ROLE_SEQ".nextval into :NEW.ID from dual;
  6    end;
  7
  8    /

Warning: Trigger created with compilation errors.

SQL>   ALTER TRIGGER  "BI_ROLE" ENABLE
  2    /

Trigger altered.

SQL>
SQL>   CREATE TABLE  "USERROLE"
  2       (    "USER_ID" NUMBER NOT NULL ENABLE,
  3            "ROLE_ID" NUMBER NOT NULL ENABLE,
  4             CONSTRAINT "USERROLE_PK" PRIMARY KEY ("USER_ID") ENABLE,
  5             CONSTRAINT "USERROLE_FK" FOREIGN KEY ("USER_ID")
  6              REFERENCES  "USERS" ("ID") ENABLE,
  7             CONSTRAINT "USERROLE_FK2" FOREIGN KEY ("ROLE_ID")
  8              REFERENCES  "ROLE" ("ID") ENABLE
  9       )
 10    /

Table created.

SQL>
SQL>   CREATE OR REPLACE TRIGGER  "BI_USERROLE"
  2      before insert on "USERROLE"
  3      for each row
  4    begin
  5        select "USERROLE_SEQ".nextval into :NEW.USER_ID from dual;
  6    end;
  7
```

```
  8    /

Warning: Trigger created with compilation errors.

SQL>   ALTER TRIGGER  "BI_USERROLE" ENABLE
  2    /

Trigger altered.

SQL>
SQL>   CREATE TABLE  "PROFESSOR"
  2       (    "NAME" VARCHAR2(50) NOT NULL ENABLE,
  3            "ID" NUMBER(*,0) NOT NULL ENABLE,
  4            "DEGREE" VARCHAR2(45),
  5             PRIMARY KEY ("ID") ENABLE
  6       )
  7    /

Table created.

SQL>
SQL> #+BEGIN_SRC sql
SP2-0734: unknown command beginning "+BEGIN_SRC..." - rest of line ignored.
SQL>   CREATE TABLE  "COURSE"
  2       (    "SEMESTER" VARCHAR2(10) NOT NULL ENABLE,
  3            "ID" NUMBER(*,0) NOT NULL ENABLE,
  4            "TITLE" VARCHAR2(45) NOT NULL ENABLE,
  5            "COURSENUMBER" VARCHAR2(45) NOT NULL ENABLE,
  6            "ACADEMICLEVEL" NUMBER,
  7            "SUBJECT" VARCHAR2(50) NOT NULL ENABLE,
  8             PRIMARY KEY ("ID") ENABLE
  9       )
 10    /

Table created.

SQL>
SQL>   CREATE TABLE  "TAKES"
  2       (    "COURSEID" NUMBER NOT NULL ENABLE,
  3            "ID" NUMBER NOT NULL ENABLE,
  4            "USERID" NUMBER NOT NULL ENABLE,
  5             CONSTRAINT "TAKES_PK" PRIMARY KEY ("ID") ENABLE,
  6             CONSTRAINT "TAKES_FK" FOREIGN KEY ("COURSEID")
  7              REFERENCES  "COURSE" ("ID") ENABLE,
  8             CONSTRAINT "TAKES_FK2" FOREIGN KEY ("USERID")
```

```
  9              REFERENCES  "USERS" ("ID") ENABLE
 10       )
 11    /

Table created.

SQL>
SQL>   CREATE OR REPLACE TRIGGER  "BI_TAKES"
  2      before insert on "TAKES"
  3      for each row
  4    begin
  5        select "TAKES_SEQ".nextval into :NEW.ID from dual;
  6    end;
  7
  8    /

Warning: Trigger created with compilation errors.

SQL>   ALTER TRIGGER  "BI_TAKES" ENABLE
  2    /

Trigger altered.

SQL>
SQL>   CREATE TABLE  "TEACHES"
  2       (    "PROFID" NUMBER NOT NULL ENABLE,
  3            "COURSEID" NUMBER NOT NULL ENABLE,
  4             CONSTRAINT "TEACHES_FK" FOREIGN KEY ("PROFID")
  5              REFERENCES  "PROFESSOR" ("ID") ENABLE,
  6             CONSTRAINT "TEACHES_FK2" FOREIGN KEY ("COURSEID")
  7              REFERENCES  "COURSE" ("ID") ENABLE
  8       )
  9    /

Table created.

SQL>
SQL>   CREATE OR REPLACE TRIGGER  "BI_TEACHES"
  2      before insert on "TEACHES"
  3      for each row
  4    begin
  5        select "TEACHES_SEQ".nextval into :NEW.ID from dual;
  6    end;
  7
  8    /
```

```
Warning: Trigger created with compilation errors.

SQL>   ALTER TRIGGER  "BI_TEACHES" ENABLE
  2    /

Trigger altered.

SQL>
SQL>   CREATE TABLE  "USERDOC"
  2       (    "DOCUMENT_ID" NUMBER NOT NULL ENABLE,
  3            "USER_ID" NUMBER NOT NULL ENABLE,
  4             CONSTRAINT "USERDOC_PK" PRIMARY KEY ("DOCUMENT_ID") ENABLE,
  5             CONSTRAINT "USERDOC_FK" FOREIGN KEY ("DOCUMENT_ID")
  6              REFERENCES  "DOCUMENT" ("ID") ENABLE,
  7             CONSTRAINT "USERDOC_FK2" FOREIGN KEY ("USER_ID")
  8              REFERENCES  "USERS" ("ID") ENABLE
  9       )
 10    /
            REFERENCES  "DOCUMENT" ("ID") ENABLE,
                        *
ERROR at line 6:
ORA-00942: table or view does not exist


SQL>
SQL>   CREATE OR REPLACE TRIGGER  "BI_USERDOC"
  2      before insert on "USERDOC"
  3      for each row
  4    begin
  5        select "USERDOC_SEQ".nextval into :NEW.DOCUMENT_ID from dual;
  6    end;
  7
  8    /
    before insert on "USERDOC"
                     *
ERROR at line 2:
ORA-00942: table or view does not exist


SQL>   ALTER TRIGGER  "BI_USERDOC" ENABLE
  2    /
  ALTER TRIGGER  "BI_USERDOC" ENABLE
*
ERROR at line 1:
```

```
ORA-04080: trigger 'BI_USERDOC' does not exist


SQL>
SQL>   CREATE TABLE  "TAG"
  2       (    "ID" NUMBER NOT NULL ENABLE,
  3            "NAME" VARCHAR2(45) NOT NULL ENABLE,
  4             CONSTRAINT "TAG_PK" PRIMARY KEY ("ID") ENABLE
  5       )
  6    /

Table created.

SQL>
SQL>   CREATE OR REPLACE TRIGGER  "BI_TAG"
  2      before insert on "TAG"
  3      for each row
  4    begin
  5        select "TAG_SEQ".nextval into :NEW.ID from dual;
  6    end;
  7
  8    /

Warning: Trigger created with compilation errors.

SQL>   ALTER TRIGGER  "BI_TAG" ENABLE
  2    /

Trigger altered.

SQL>
SQL>   CREATE TABLE  "DOCTAG"
  2       (    "ID" NUMBER NOT NULL ENABLE,
  3            "DOCUMENT_ID" NUMBER NOT NULL ENABLE,
  4            "TAG_ID" NUMBER NOT NULL ENABLE,
  5             CONSTRAINT "DOCTAG_PK" PRIMARY KEY ("ID") ENABLE,
  6             CONSTRAINT "DOCTAG_FK" FOREIGN KEY ("DOCUMENT_ID")
  7              REFERENCES  "DOCUMENT" ("ID") ENABLE,
  8             CONSTRAINT "DOCTAG_FK2" FOREIGN KEY ("TAG_ID")
  9              REFERENCES  "TAG" ("ID") ENABLE
 10       )
 11    /
            REFERENCES  "DOCUMENT" ("ID") ENABLE,
                        *
ERROR at line 7:
```

```
ORA-00942: table or view does not exist


SQL>
SQL>   CREATE OR REPLACE TRIGGER  "BI_DOCTAG"
  2      before insert on "DOCTAG"
  3      for each row
  4    begin
  5        select "DOCTAG_SEQ".nextval into :NEW.ID from dual;
  6    end;
  7
  8    /
    before insert on "DOCTAG"
                     *
ERROR at line 2:
ORA-00942: table or view does not exist


SQL>   ALTER TRIGGER  "BI_DOCTAG" ENABLE
  2    /
  ALTER TRIGGER  "BI_DOCTAG" ENABLE
*
ERROR at line 1:
ORA-04080: trigger 'BI_DOCTAG' does not exist


SQL> Spool off
```

7 TODO SQL Queries

1. Multiple table query;
2. Nested query (both correlated and not correlated);
3. Query using Union, Intersect, and minus
4. Query using exist, not exist, IN, NOT IN, ALL, etc.;
5. Query with aggregate functions, group by, sort by, and having; (f) Query that has a complex from clause; and
6. Query using a view.

7.1 TODO Updates

1. Insert tuples to a table (both single tuple and by a query);
2. Delete tuples from a table (both single tuple and by a query);

3. Updates that changes existing tuples (both single tuple and by a query); and

4. Updates that cause a trigger to be fired.

8 TODO Triggers

1. Design and test at least one trigger.

9 TODO Investigation Report

1. Design and perform some experiments to investigate view update. These experiments should try to perform various types of update on various type of views, and investigate if and how data can be updated through using views.

2. Test queries that can be used in your application program. Think how to retrieve data to provide services of your application program.