Lab 5
Views and Roles

CSE 4308

DATABASE MANAGEMENT SYSTEMS LAB

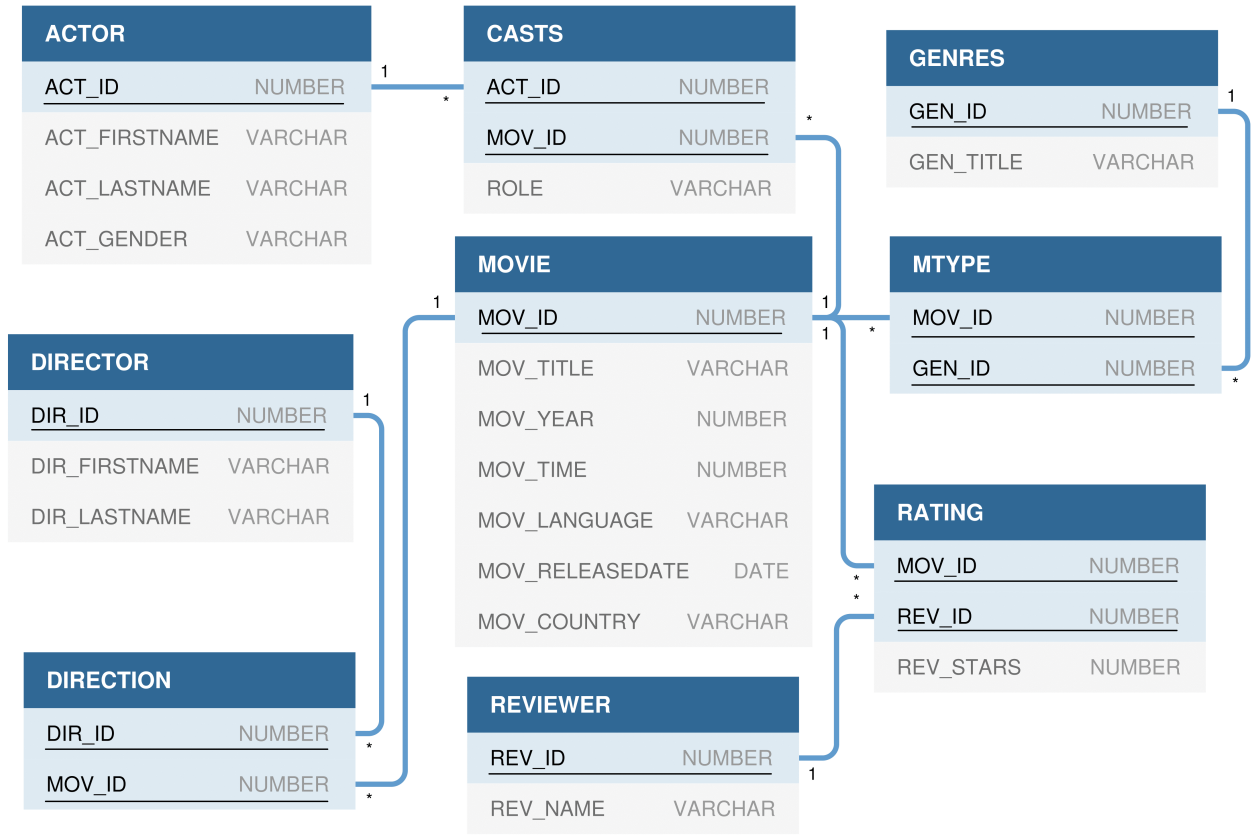
SEPTEMBER 14, 2023

1 View

An Oracle VIEW, in essence, is a virtual table that does not physically exist. Rather, it is created by a query joining one or more tables. It is stored in Oracle data dictionary. It derives its data from the tables on which it is based. Views are very powerful and handy since they can be treated just like any other table but do not occupy the space of a table. The syntax for creating view in Oracle is:

```
CREATE [OR REPLACE] VIEW view_name AS
    SELECT columns
    FROM tables
    [WHERE conditions];
```

Unlike a table, a view does not store any data. To be precise, a view only behaves like a table. And it is just a named query stored in the database. This is why sometimes a view is referred to as a named query.
Consider the following schema for a movie database:



If we want to create a view showing showing only the ID, title, and language of the movies, we can create a view as follows:

```
CREATE OR REPLACE VIEW MOVIE_SUMMARY AS
SELECT MOV_ID, MOV_TITLE, MOV_LANGUAGE
FROM MOVIE;
```

Now we can query data from the view:

```
SELECT DISTINCT MOV_LANGUAGE
FROM MOVIE_SUMMARY;
```

Behind the scenes, Oracle finds the stored query associated with the name MOVIE_SUMMARY and executes the following query:

```
SELECT DISTINCT MOV_LANGUAGE
FROM (SELECT MOV_ID, MOV_TITLE, MOV_LANGUAGE
      FROM MOVIE);
```

The result set returned from the view depends on the data of the underlying table. That means, modifying data from the MOVIE table will modify the results shown by querying MOVIE_SUMMARY view.
There are two types of views. One is the **Simple view** and the other one is the **Complex view**. The key differences between Simple and Complex types of Views are as follows:

Simple View	**Complex View**
Contains only one single base table or is created from only one table.	Contains more than one base table or is created from more than one table.
Simple view does not contain aggregated function,group by, distinct, pseudo column like rownum, columns defined by expressions.	It can contain aggregated function, group by, distinct, pseudocolumn like rownum, columns defined by expressions.
Does not include NOT NULL columns from base tables.	NOT NULL columns that are not selected by simple view can be included in complex view.

In case of complex views, views cannot be updated and they cannot be used to modify the parent table they are generated from. However, in case you are working with simple views, they can be used to update/modify the parent table. That is, any change you perform in your simple view will be reflected in your parent table.
As MOVIE_SUMMARY is a simple view, we can modify it. For example,

```
INSERT INTO MOVIE_SUMMARY
VALUES('935', 'Emily the Criminal', 'English');

UPDATE MOVIE_SUMMARY
SET MOV_ID = '934'
WHERE MOV_ID = '935';

DELETE FROM MOVIE_SUMMARY
WHERE MOV_TITLE = 'Emily the Criminal';
```

Views can be dropped using the following syntax:

```
DROP VIEW view_name;
```

One of the major use cases for views (complex view) is for simplifying data retrieval. For example, the following query can be used to determine the genres where actors are preferred to actresses:

```
SELECT GEN_TITLE
FROM GENRES G
WHERE (SELECT COUNT(*)
FROM ACTOR NATURAL JOIN CASTS NATURAL JOIN MTYPE NATURAL JOIN
   GENRES
WHERE ACT_GENDER = 'M' AND GEN_TITLE = G.GEN_TITLE
GROUP BY GEN_TITLE) > (SELECT COUNT(*)
```

```
FROM ACTOR NATURAL JOIN CASTS NATURAL JOIN MTYPE NATURAL JOIN
   GENRES
WHERE ACT_GENDER = 'F' AND GEN_TITLE = G.GEN_TITLE
GROUP BY GEN_TITLE);
```

However, by adding the line:

```
CREATE OR REPLACE VIEW SEXIST_GENRES AS
```

before the query, we can create a view which can then be used to simplify other queries.
Another benefit of using views can be providing an additional security layer. They help us to hide certain columns and rows from the underlying tables and expose only needed data to the appropriate users. For example, a STUDENT table may store the student ID, name, department, CGPA of different students. But we might want to share only the student ID and department of the student with the instructors.

2 Roles

Role-Based Access Control (RBAC) enables us to restrict system access to authorized users based on their assigned roles. Using the RBAC model, permissions to perform specific system operations are assigned to specific roles, and system users are granted permission to perform specific operations only through their assigned roles. This simplifies system administration because users do not need to be assigned permissions directly, and instead acquire them through their assigned roles.
The general syntax for creating and deleting roles are as follows:

```
CREATE ROLE role_name;
```

```
DROP ROLE role_name;
```

Roles can be granted privileges on specific tables:

```
GRANT privilege_name ON table_name TO role_name [WITH GRANT OPTION];
```

All privileges granted to one role can be granted to another role directly:

```
GRANT role_name_1 TO role_name_2;
```

Users can be granted a role as follows:

```
GRANT role_name TO user_name;
```

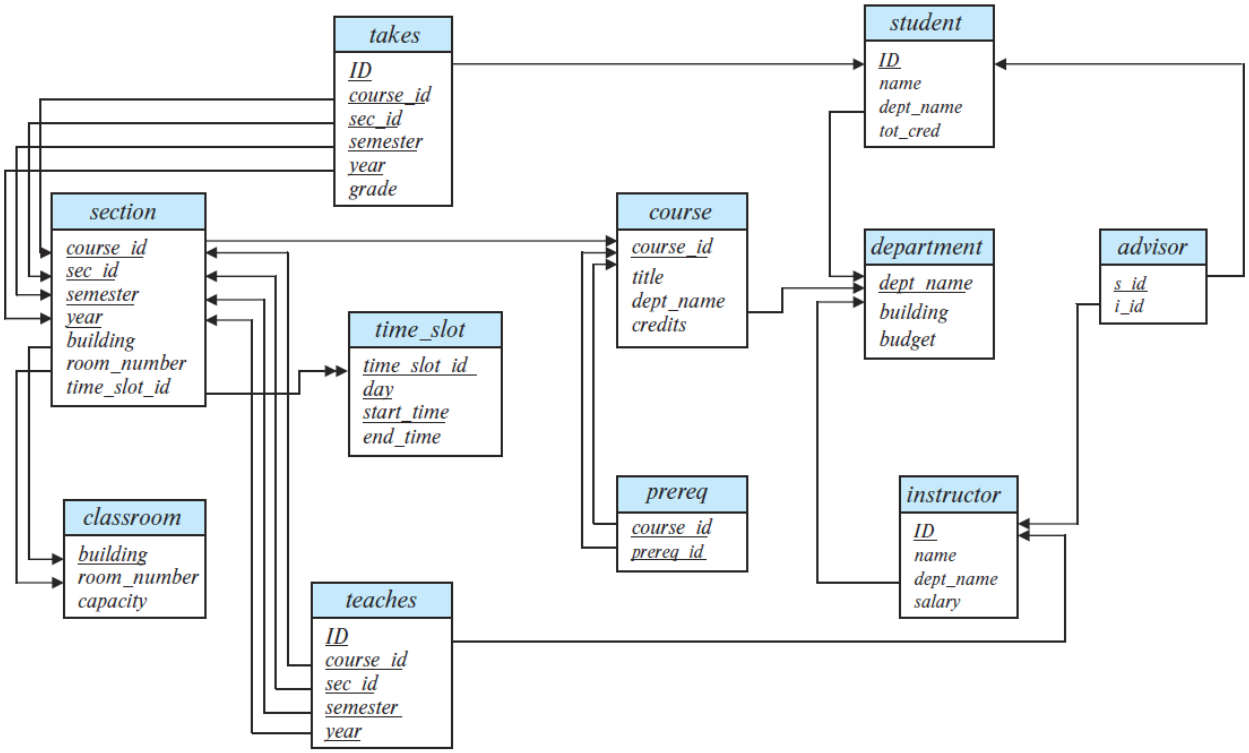
For example, we can create a role for people who want to watch movies and rating of the movies, a role for reviewers who can watch movies and rating also give ratings, and finally, an admin who can add, remove or update movie

```
CREATE ROLE Viewer;

GRANT SELECT ON [USERNAME].MOVIE TO Viewer;
GRANT SELECT ON [USERNAME].RATING TO Viewer;

---Similarly, we can give privilege on view too---
GRANT SELECT ON [USERNAME].MOVIE_SUMMARY TO Viewer;
```

```
---We can Revoke privilege too---
REVOKE SELECT ON [USERNAME].MOVIE_SUMMARY FROM Viewer;

---A role can be also granted to another role---
CREATE ROLE Reviewer;
GRANT Viewer TO Reviewer;

---Can add more privilege to a role---
GRANT INSERT ON [USERNAME].RATING TO Reviewer;

---Can add multiple privileges on a single table at a time but
    not the vice versa---
CREATE ROLE Admin;
GRANT SELECT, INSERT, UPDATE, DELETE ON [USERNAME].MOVIE TO
   Admin;
---Or---
GRANT ALL ON [USERNAME].MOVIE TO Admin;

---To have the power of granting others any privilege--
GRANT ALL ON [USERNAME].MOVIE TO Admin WITH GRANT OPTION;

---now I will create few users & grant them privileges---
drop user V_103;
drop user R_432;
drop user Admin_01;

create user V_103 identified by test123;
grant create session, resource, create tablespace to R_432;

create user R_432 identified by test123;
grant create session, resource, create tablespace to R_432;

create user Admin-01 identified by test123;
grant create session, resource, create tablespace to R_432;

---here I will assign each user a role---
grant Viewer to V_103;
grant Reviewer to R_432;
grant Admin to Admin_01;

---we can assign multiple roles to a user too---
grant Viewer, Reviewer to Admin_01;

---now connecting to a newly created user we can check his/her
    access---
connect R_432/test123;

insert into dbms.Rating values (913, 9010, 5);
```

3 Lab Task

Execute the `DDL+drop.sql` and `smallRelationsInsertFile.sql` scripts using command. It creates a set of tables along with values that maintain the following schema:



Here, the underlined attributes denote the primary keys and the arcs denote the foreign key relationships.
In this lab, you have to write all SQL statements in an editor first and save them with .sql extension. Then execute the SQL script.

1. Create a view named `Advisor_Selection` that shows the ID, name and department name of instructors.

2. Create another view named `Student_Count` using `Advisor_Selection` and `advisor` to show the name of the instructor and the number students assigned under them.

3. Four categories of users have been identified in the database:

   (a) Students should be able to view information regarding advisors and courses.

   (b) Course teachers should be able to view information about the students and courses.

   (c) Head of the Departments should have all the privileges that a course teacher has. Additionally, s/he should be able to add new instructors.

   (d) Administrator should be able to see information about department and instructors. They should also be able to update the department budget.

   Create roles for these categories and grant them appropriate privileges.

4. Create users under these roles and write relevant SQL queries to demonstrate that the imposed access control works.