# DBMS Week 3 TA Session

# Nested Subquery

- A subquery is a `select-from-where` expression that is nested within another query.

# Some Clause

- `5 > some(0, 5, 6)` - **True**
- `5 = some(0, 5, 6)` - **True**

# All Clause

- `7 > all(0, 5, 6)` - **True**
- `5 = all(0, 5, 6)` - **False**

# Subqueries in `Where` Clause

```
select distinct course_id
from section
where semester ='Fall' and year = 2009 and
        course_id in ( select course_id
                       from section
                       where semester ='Spring'
                       and year = 2010
                     )
```

# Subqueries in `Where` Clause (Continued)

```
select name
from instructor
where salary > all (select salary
                    from instructor
                    where dept_name = 'Biology')
```

```
select name
from instructor
where salary > some (select salary
                     from instructor
                     where dept_name = 'Biology')
```

# Exist Clause

- Returns only `True` or `False`

```sql
select course_id
from section as S
where semester = 'Fall' and year = 2009 and
exists (select *
        from section as T
        where semester = 'Spring' and year = 2010
        and S.course_id = T.course_id)
```

# Subqueries in From Clause

```
select dept_name, avg_salary
from (select dept_name, avg (salary)
      from instructor
      group by dept_name) as dept_avg (dept_name,avg_salary)
where avg_salary > 42000
```

# With Clause

- Used to define a temporary table that we can use in our sql

```sql
with dept_total(dept_name, value) as (
    select dept_name, sum(salary)
    from instructor
    group by dept_name
)
```

```sql
select dept_name
from dept_total
where dept_name='Finance'
```

Here, `dept_total` is a temporary table.

# Modification of Database

## DELETE

```
delete from instructor
where dept_name in (select dept_name
                    from department
                    where building = 'Watson')
```

## INSERT

```
INSERT into takes values (1, 'C001', 'CS', 'spring', '2022', 'S')
```

```
INSERT into takes (ID, course_id, sec_id, semester, year_, grade)
values ('1', 'C001', 'CS', 'spring', '2022', 'S')
```

# Modification of Database (Continued)

## UPDATE

```
update instructor
set salary = salary * 1.03
where salary <= 100000
```

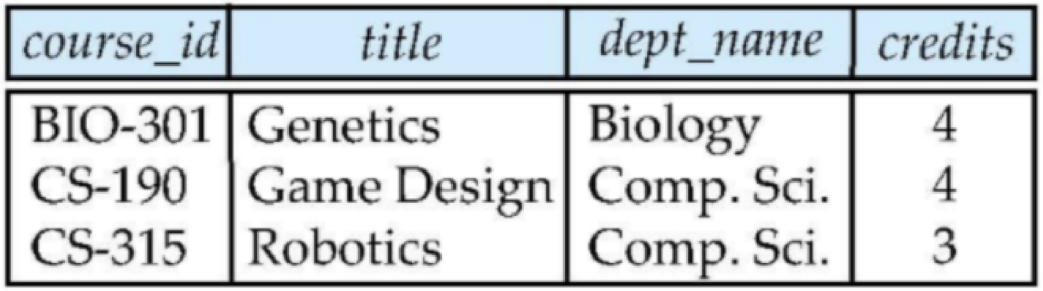
```
update instructor
set salary = case
    when salary <= 100000
    then salary * 1.05
    else salary * 1.03
end
```

# Types of Joins

- Cross Join
- Inner Join
- Natural Join
- Left Outer Join
- Right Outer Join
- Full Outer Join
- Self Join

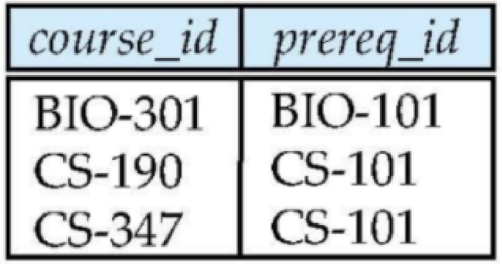
# Example Table

- Relation *course*



| *course_id* | *title* | *dept_name* | *credits* |
|---|---|---|---|
| BIO-301 | Genetics | Biology | 4 |
| CS-190 | Game Design | Comp. Sci. | 4 |
| CS-315 | Robotics | Comp. Sci. | 3 |

- Relation *prereq*



| *course_id* | *prereq_id* |
|---|---|
| BIO-301 | BIO-101 |
| CS-190 | CS-101 |
| CS-347 | CS-101 |

# Cross Join

- `CROSS JOIN` returns the Cartesian product of rows from tables in the join

```
select *
from course cross join prereq
```

```
select *
from course, prereq
```

# Inner Join

- In Inner Join, we have to specifically mention on what attribute, we are going to join the two tables

```
select *
from course c inner join prereq p on c.course_id=p.course_id
```

```
select *
from course c inner join prereq p using(course_id)
```

# Natural Join

- Join the two tables based on the common attribute name

```
select *
from course c natural join prereq p
```

# Left Outer Join

- A Left outer join returns all the tuples from the left table and matching tuples from the right table.

```
select *
from course c left join prereq p
on e.course_id = d.course_id
```

# Right Outer Join

- A Right outer join returns all the tuples from the right table and matching tuples from the left table.

```
select *
from course c right join prereq p
on e.course_id = d.course_id
```

# Full Outer Join

- A Full outer join returns all the tuples from the left table and right table.

```sql
select *
from course c full join prereq p
on e.course_id = d.course_id
```

## Note

- To Perform Outer Join, atleast one tuple should match in both the tables.

# Views

- A view provides a mechanism to hide certain data from the view of certain users.
- It's virtual table. Using this we can hide some information while giving it the users.

```
create view faculty as
    select ID, name, dept_name
    from instructor
```

```
select *
from faculty
where dept_name='Biology'
```

```
insert into faculty values ('30765', 'Green', 'Music');
```

In the above query, faculty is a virtual table.

# Materialized Views

- creates a copy of table (physically) containing all the tuples in the result of the query defining the view
- Able to access fater than `views` but have to update manually

```
CREATE materialized view faculty as
select ID, name, dept_name
from instructor
```

# Integrity Constraints

- Integrity constraints guard against accidental damage to the database, by ensuring that authorized changes to the database do not result in a loss of data consistency.

- **not null**
- **primary key**
- **unique**
- **check(P)**, where P is Predicate

# Integrity Constraints (Continued)

```sql
CREATE TABLE takes (
    ID varchar(5),
    roll_no varchar(10) unique,
    course_id varchar(8),
    sec_id varchar(8),
    semester varchar(8) not null,
    year_ numeric(4, 0),
    grade varchar(2),
    primary key (ID),
    foreign key (ID) references student,
    foreign key (course_id, sec_id, semester, year_) references section
    check semester in ('Fall', 'Winter', 'Summer', 'Spring')
)
```

# Referential Integrity

- Ensures that a value that appears in one relation for a given set of attributes also appears for a certain set of attributes in another relation

## Example

- If 'Biology' is a department name appearing in one of the tuples in the instructor relation, then there exists a tuple in the department relation for 'Biology'

# Referential Integrity (Continued)

```
create table course (
    course_id char(5) primary key,
    title varchar(20),
    dept_name varchar(20)
    foreign key (dept_name) references department
    on delete cascade
)
```

# SQL Data-types

## Built in Data Types

- `date` - '2005-07-27'
- `time` - '09:25:30'
- `timestamp` - '2005-07-27 09:25:30'
- `interval` - '1' day

- `interval` can be obtained by adding or subtracting from `date, time, timestamp` data types

# Create a Data type

```
create type Dollars as numeric (12,2) final
```

- `final` is the keyword to denote user-defined data-type.

```
create table department (
    dept_name varchar (20),
    building varchar (15),
    budget Dollars
)
```

# Domains

```
create domain person_name char(20) not null
```

```
create table Person (
    name person_name,
    email varchar(50) unique not null,
    mobile numeric(10, 0) unique not null,
    address varchar(300)
)
```

Here, `person_name` user defined custom domain.

# Large Binary Objects

### BLOB (Binary Large Objects)

- BLOBs are used to store binary data, such as images, audio/video files, documents, or any other type of binary data.

### CLOB (Character Large Objects)

- CLOBs are used to store large amounts of character data, such as text documents, XML data, JSON data, or any other type of textual data.

# Authorization

## Previleges in SQL

- **select** - allows read access to relation, or the ability to query using the view
- **insert** - the ability to insert tuples
- **update** - the ability to update using the SQL update statement
- **delete** - the ability to delete tuples.
- **all privileges** - used as a short form for all the allowable privileges

# Authorization (Continued)

## grant

```
grant <privilege list>
on <relation_name or view_name> to <user list>
```

## revoke

```
revoke <privilege list>
on <relation_name or view_name> from <user list>
```

# Authorization (Continued)

## Roles

```
create role instructor
```

```
grant instructor to <user>
```

## Views

```
create view instructor_view as (
    select *
    from instructor
    where subject='DBMS'
)
```

```
grant select, update, delete on instructor_view to instructor
```

# Example of SQL function

```
create function instructor_of(dept name char(20))
returns table (
        ID varchar(5),
        name varchar(20),
        dept name varchar(20)
        salary numeric(8, 2)
    )
returns table
    (
        select ID, name, dept_name, salary
        from instructor
        where instructor.dept_name = instructor_of.dept_name
    )
```

```
select *
from table (instructor_of('Music'))
```

# Triggers

- A trigger defines a set of actions that are performed in response to an insert, update, or delete operation on a specified table.

There are two types of triggers.

- **Row level trigger** - trigger fires once for each row that is affected by a triggering event.
- **Statement level trigger** - trigger fires only once for each statement.

# Syntax of Trigger

```
create trigger <trigger_name>
before insert on <table_name>
for each <row>/<statement>
execute procedure <call_function>;
```