SQL DML, Physical Data Organization

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- CO6:Explain various types of NoSQL databases (Cognitive Knowledge Level: Understand)

EMPLOYEE FNAME MINIT LNAME SSN **BDATE ADDRESS** SEX SALARY SUPERSSN DEPARTMENT DNAME DNUMBER **MGRSSN MGRSTARTDATE** DEPT LOCATIONS **DNUMBER** DLOCATION **PROJECT PNAME PNUMBER PLOCATION** DNUM WORKS ON **ESSN HOURS PNO** DEPENDENT **ESSN** DEPENDENT NAME SEX **BDATE** RELATIONSHIP

DNO

Figure: Company Schema

EMPL	OVEE

:	FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO
	John	В	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	М	30000	333445555	5
	Franklin	Т	Wong	333445555	1955-12-08	638 Voss, Houston, TX	М	40000	888665555	5
	Alicia	J	Zelaya	999887777	1968-07-19	3321 Castle, Spring, TX	F	25000	987654321	4
	Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
	Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	М	38000	333445555	5
	Joyce	Α	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
	Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	М	25000	987654321	4
	James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	М	55000	null	1

DEPT_LOCATIONS	DNUMBER	DLOCATION	
	1	Houston	
	4	Stafford	
MGRSTARTDATE	5	Bellaire	
1988-05-22	5	Sugarland	
1995-01-01	5	Houston	

DEPARTMENT	DNAME	DNUMBER	MGRSSN	MGRSTARTDATE
	Research	5	333445555	1988-05-22
	Administration	4	987654321	1995-01-01
	Headquarters	1	888665555	1981-06-19

OI II O_OI V	LOOIY	1110	1100110
	123456789	1	32.5
	123456789	2	7.5
	666884444	3	40.0
	453453453	1	20.0
	453453453	2	20.0
	333445555	2	10.0
	333445555	3	10.0
	333445555	10	10.0
	333445555	20	10.0
	999887777	30	30.0
	999887777	10	10.0
	987987987	10	35.0
	987987987	30	5.0
	987654321	30	20.0
	987654321	20	15.0
	000005555	-00	

PROJECT	PNAME	PNUMBER	PLOCATION	DNUM
	ProductX	1	Bellaire	5
	ProductY	2	Sugarland	5
	ProductZ	3	Houston	5
	Computerization	10	Stafford	4
	Reorganization	20	Houston	1
	Newbenefits	30	Stafford	4

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The general form of SQL

➤ SELECT column
FROM table
WHERE predicate on rows
GROUP BY columns
HAVING predicate on groups
ORDER BY columns

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- Similar to a SELECT-PROJECT-JOIN of relational algebra operations:
 - ► The SELECT clause specifies the projection attributes
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- A query that refers to two or more attributes with the same name must qualify the attribute name with the relation name by prefixing the relation name to the attribute name
 - ▶ DNUMBER is both DEPARTMENT and DEPT_LOCATIONS.
 - Qualify by relationname: DEPARTMENT.DNUMBER, DEPT_LOCATIONS.DNUMBER

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- ► The join condition MGRSSN=SSN relates the controlling department to the employee who manages that department

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 - SELECT E.FNAME, E.LNAME, S.FNAME, S.LNAME FROM EMPLOYEE AS E, EMPLOYEE AS S WHERE E.SUPERSSN=S.SSN

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 - SELECT SELECT DISTINCT SALARY FROM EMPLOYEE

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- ► The comparison operator IN compares a value v with a set (or multi-set) of values V, and evaluates to TRUE if v is one of the elements in V

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- Evaluated once for each tuple in the outer query

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- Retreive names of all employees whose salary is greater than the salary of all employees in department 5
 - ► SELECT FNAME, LNAME FROM EMPLOYEE WHERE SALARY ≥ ALL (SELECT SALARY FROM EMPLOYEE WHERE DNO=5)

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For each employee tuple, evaluate the nested query, which retrieves all DEPENDENT tuple with same SSN, sex and first name as the EMPLOYEE tuple, if at least one tuple EXISTS in the result of the nested query, then select the EMPLOYEE tuple.

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 - ► SELECT E.FNAME, E.LNAME FROM EMPLOYEE WHERE NOT EXISTS (SELECT * FROM DEPENDENT WHERE E.SSN = ESSN)
- ► For each EMPLOYEE tuple, the subquery selects all DEPENDENT tuples whose ESSN value matches the EMPLOYEE SSN. If subquery results is empty, select the EMPLOYEE tuple and retrieve FNAME, LNAME.

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 AND
 EXISTS (SELECT *
 FROM DEPARTMENT
 WHERE SSN = MGRSSN);

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EXISTS (SELECT *
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- Two nested correlated subqueries:
 - ▶ 1. Select all DEPENDENT tuples related to EMPLOYEE
 - 2. Select all DEPARTMENT tuples managed by the EMPLOYEE
 - ▶ If at least one tuple each first and second subquery exists, then that EMPLOYEE tuple is selected.

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- ► Two nested correlated subqueries:
 - ▶ 1. Select all projects controlled by department 5
 - 2. Select all projects that the particular employee being works on
 - ► If the set difference of first minus second subquery is empty, then that employee works on all projects

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- ► There are several types of join
 - NATURAL JOIN: No join conditions is specified between the relations R and S; an implicite EQUIJOIN condition for each pair of attributes with the same name from R and S are created
 - OUTER JOIN: When the user wants to keep all tuples of R, or all those tuples in S, or all those in both relations in the result of the JOIN, regardless of whether or not they have matching tuples in other relations

Joined Tables: NATURAL JOIN

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The above correlated query retieves number of dependents of the employee, which used in the WHERE clause of outer query.



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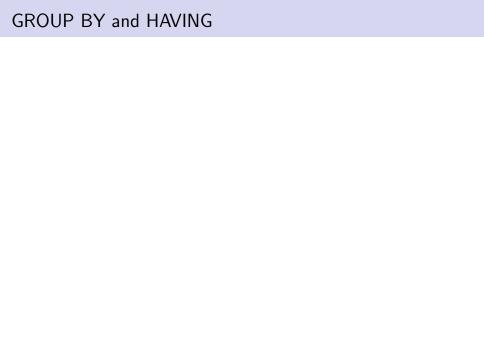
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 - ► SELECT PNUMBER, PNAME, COUNT(*)
 FROM PROJECT, WORK_ON, EMPLOYEE
 WHERE PNUMBER =PNO AND SSN=ESSN AND DNO=5
 GROUP BY PNUMBER, PNAME



 Count the total number of employees whose salary exceeds rs.40000 in each department, but only for departments where more than five employees work

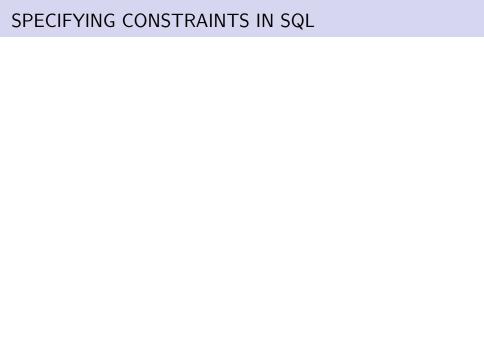
- Count the total number of employees whose salary exceeds rs.40000 in each department, but only for departments where more than five employees work
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 - ► SELECT DNAME, COUNT(*)
 FROM DEPARTMENT, EMPLOYEE
 WHERE DNUMBER =DNO AND SALARY > 40000 AND
 (SELECT DNO
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 GROUP BY DNAME
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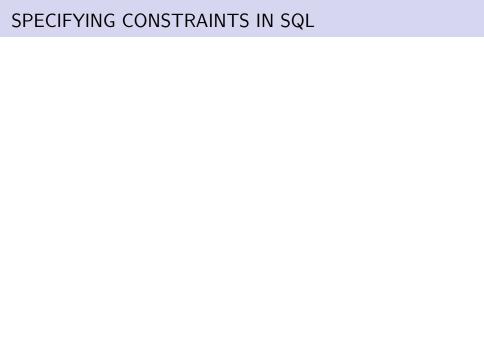
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 - ► The UNIQUE clause specifies alternate keys



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ON UPDATE CASCADE):

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- CREATE TABLE EMPLOYEE (

```
ESSN CHAR(9),
DNO INTEGER DEFAULT 1,
SUPERSSN CHAR(9),
PRIMARY KEY (ESSN),
FOREIGN KEY (DNO) REFERENCES DEPARTMENT
ON DELETE SET DEFAULT
ON UPDATE CASCADE,
FOREIGN KEY (SUPERSSN) REFERENCES
EMPLOYEE
ON DELETE SET NULL
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- Specify a constraint that the salary of an employee must not be greater than the salary of the manager of the department that the employee works for
- ► CREATE ASSERTION SALARY_CONSTRAINT CHECK (NOT EXISTS(SELECT *
 FROM EMPLOYEE E, EMPLOYEE M,
 DEPARTMENT D
 WHERE E.Salary > M.Salary
 AND E.Dno =D.DNumber
 AND D.Mgr_ssn =M.Ssn))

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 BEFORE INSERT OR UPDATE OF
 SALARY, SUPERVISOR_SSN ON EMPLOYEE
 FOR EACH ROW
 WHEN (NEW.SALARY > (SELECT SALARY
 FROM EMPLOYEE
 WHERE SSN=NEW.SUPERVISON_SSN))
 INFORM_SUPERVISOR
 (NEW.SUPERVISOR_SSN, NEW.SSN);

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- ➤ **Action**: Usually sequence of SQL statements; or it can be a stored procedure. Here INFORM_SUPERVISOR

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 WHEN (NEW.Dno IS NOT NULL)
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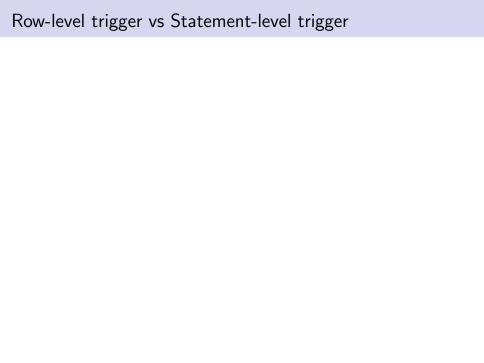
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- ► The **statement-level trigger** is triggered once for triggering statement.



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- ► The above statement could update multiple records, hence a rule using row-level semantics is required to trigger for each row. A statement-level semantics is triggered only once, which is not suitable for the above update.

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 AS SELECT Dname, COUNT(*), SUM(Salary)
 FROM DEPARTMENT. EMPLOYEE

WHERE Dnumber = Dno GROUP BY Dname

▶ We can specify SQL queries on a view

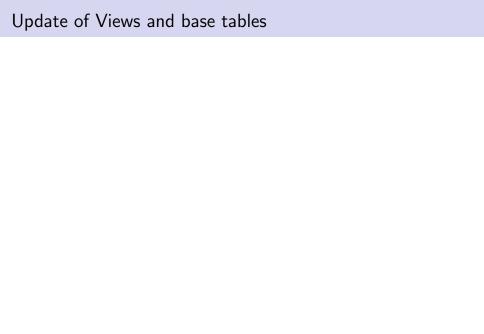
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- To dispose a view: DROP VIEW WORKS_ON



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 - Views defined using grouping and aggregate functions are not updatable.