## ■ Views and Virtual Tables



#### CREATE OR REPLACE VIEW CSstudents AS SELECT \* FROM student WHERE Program = 'COMP-SCI'; SELECT \* FROM CSstudents; • base tables (CREATE TABLE) stored in database • views (CREATE VIEW) dependent on base tables or other views, may or may not be stored (virtual vs materialized) • temporary tables (subquery, etc.) limited lifetime

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#### Point of Views

CREATE VIEW studentview AS SELECT LastName, FirstName, SID, Career, Program FROM student; Hide information (grant access to relevant info) SELECT name FROM studentgroup WHERE name NOT IN (SELECT groupname FROM CSstudents, memberof WHERE StudentID = SID);

> Simplify queries (improve readability) -not necessarily a good reason to create a view in general, if temporary table is sufficient

#### Point of Views

CREATE VIEW enrollment(SID, LName, CID, CNR, Dpt) AS SELECT SID, LastName, CID, CourseNr, Department FROM student, enrolled, course WHERE SID = studentID AND CourseID = CID;

SELECT count(\*)
FROM enrollment
WHERE CNR = 440 AND Dpt = 'CSC';

speed up querying

## Modifying Views

DROP VIEW Csstudents;

What about other objects that depend on it (e.g other views)?How is/are the underlying base table(s) affected?

INSERT INTO CSstudents(LastName, FirstName, SID)
VALUES ('Crackenden', 'Gloria', 123);

What do INSERT, DELETE, UPDATE mean for a view?

Examples: CSstudents, Enrollment

## Updatable Views

"An updatable view is one you can use to insert, update, or delete base table rows."

#### Roughly:

- FROM contains only a single relation
- no DISTINCT, aggregation, set, calculated value
- WHERE clause may not contain a sub-query involving the relation the view is based on

Statement can still fail (e.g. if primary key is missing in INSERT)

#### Or, you use Triggers

CREATE VIEW enrollment(SID, LName, CID, CNR, Dpt) AS SELECT SID, LastName, CID, CourseNr, Department FROM student, enrolled, course WHERE SID = studentID AND CourseID = CID; CREATE TRIGGER enrollmentinsert INSTEAD OF INSERT ON enrollment FOR EACH ROW BEGIN INSERT INTO enrolled(StudentID, CourseID) VALUES (:new.SID, :new.CID); END;

Trigger can fail for f.k violations: good

#### Updatable Views: Examples

- Create a trigger that implements INSERTs into studentview
- Create a trigger that implements INSERTs into
- Csstudents
   Create a trigger that implements DELETEs on
- enrollment
- Create triggers that implement UPDATEs on enrollment

#### WITH CHECK OPTION

CREATE OR REPLACE VIEW CSstudents AS SELECT \* FROM student WHERE Program = 'COMP-SCI' WITH CHECK OPTION;

SELECT \* FROM CSstudents;

• what happens if we try inserting non-CS student?

## CHECK OPTION for Assertions

CREATE OR REPLACE VIEW v\_memberof AS SELECT StudentID, GroupID, Joined FROM memberof WHERE joined >= (SELECT started FROM student WHERE SID = StudentID)

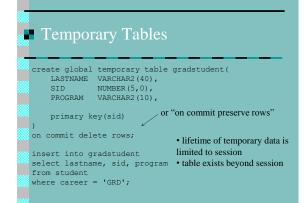
WITH CHECK OPTION;

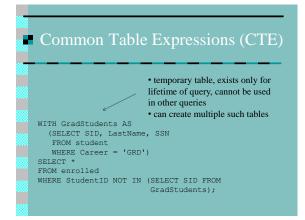
- if we use v\_memberof in place of memberof what does this enforce?
- downside: nesting views deeply is bad, so not always good replacement for base tables

## CHECK OPTION Examples

- ensure that undergraduate students do not enroll in graduate courses
- ensure that graduate students do not enroll in more than 3 courses a quarter
- limit the number of courses to at most 100
- limit the number of students each year to at most 50

# VIRTUAL TABLES





# CTE Example

WITH StudentEnrollment(SID, Quarter, Year, enr\_crs\_ct)
AS
(SELECT StudentID, Quarter, Year, count(CourseID)
FROM enrolled GROUP BY StudentID, Quarter, Year),
StudentMax(SID, max\_enr\_crs\_ct)
AS
(SELECT SID, max(enr\_crs\_ct)
FROM StudentEnrollment
GROUP BY SID)
SELECT \*
FROM student S, StudentMax SM
WHERE S.SID = SM.SID;

## CTE Examples

• List departments in which the average enrollment in courses is below 2

• For each program compute the number of Chicago students in the program but only include programs that have at least three students.