Advanced Integrity Constraints
Constraints review

- Constraints:
  - ???
Referential triggered actions

- **Trigger conditions:**
  - ON DELETE
  - ON UPDATE

- **Actions:**
  - CASCADE
  - SET NULL
  - SET DEFAULT

```
CREATE TABLE Students
  ( ID INTEGER,
    Name VARCHAR(20),
    Major VARCHAR(10),
    GPA DECIMAL(3,2),
    CONSTRAINT Students_PK PRIMARY KEY (ID)
  )
)

CREATE TABLE Enrollment
  ( Stud_ID INTEGER,
    Course VARCHAR(15),
    CONSTRAINT Enrollment_FK FOREIGN KEY (Stud_ID) REFERENCES Students(ID)
    ON DELETE CASCADE
  )
```
The chicken and the egg problem...

- CREATE TABLE Chicken (ID INT PRIMARY KEY,
  eID INT REFERENCES Egg(ID));

CREATE TABLE Egg(ID INT PRIMARY KEY,
  cID INT REFERENCES Chicken(ID));

- How can we insert into either table??
  - We can't even create these tables using these commands!
  - Need to treat two inserts into both tables as one logical unit of work...
Basic outline of transactions in SQL

- SET TRANSACTION READ {WRITE|ONLY} NAME '<trname>';
- COMMIT;
- ROLLBACK;
Transaction properties

- ???
Constraints within a transaction

- Demo time

  - `CREATE TABLE Students
    ( ID INTEGER,
      Name VARCHAR(20),
      Major VARCHAR(10),
      GPA DECIMAL(3,2),
      CONSTRAINT Students_PK
        PRIMARY KEY (ID)
    );`

  - `CREATE TABLE Enrollment
    ( Stud_ID INTEGER,
      Course VARCHAR(15),
      CONSTRAINT Enrollment_FK
        FOREIGN KEY (Stud_ID) REFERENCES Students(ID)
        ON DELETE CASCADE
    );`
Solving our problem

- DEFERRABLE or NOT DEFERRABLE?
  - Constraints that are NOT DEFERRABLE are immediately evaluated after each SQL statement
  - DEFERRABLE constraints are evaluated after the transaction is ended, before committing
    - If DEFERRABLE, constraint can INITIALLY be:
      - DEFERRED
      - IMMEDIATE
    - Initial setting can be changed within a transaction
      - SET CONSTRAINT[S] \{<cname>|ALL\} \{DEFERRED|IMMEDIATE\};
● Demo time
  o CREATE TABLE Students
    ( ID INTEGER, Name VARCHAR(20), Major VARCHAR(10), GPA DECIMAL(3,2),
      CONSTRAINT Students_PK PRIMARY KEY (ID), DEFERRABLE INITIALLY DEFERRED
    )
  o CREATE TABLE Enrollment
    ( Stud_ID INTEGER, Course VARCHAR(15),
      CONSTRAINT Enrollment_FK FOREIGN KEY (Stud_ID) REFERENCES Students(ID) ON DELETE CASCADE
      DEFERRABLE INITIALLY DEFERRED
    )
Reflections on these demos
CREATE TABLE Chicken (ID INT PRIMARY KEY, eID INT);
CREATE TABLE Egg (ID INT PRIMARY KEY, cID INT);
ALTER TABLE Chicken ADD CONSTRAINT Chicken_FK
FOREIGN KEY (eID) REFERENCES Egg(ID)
INITIALLY IMMEDIATE DEFERRABLE;
ALTER TABLE Egg ADD CONSTRAINT Egg_FK
FOREIGN KEY (cID) REFERENCES Chicken(ID)
INITIALLY IMMEDIATE DEFERRABLE;