CSE 532 Project 2 Report

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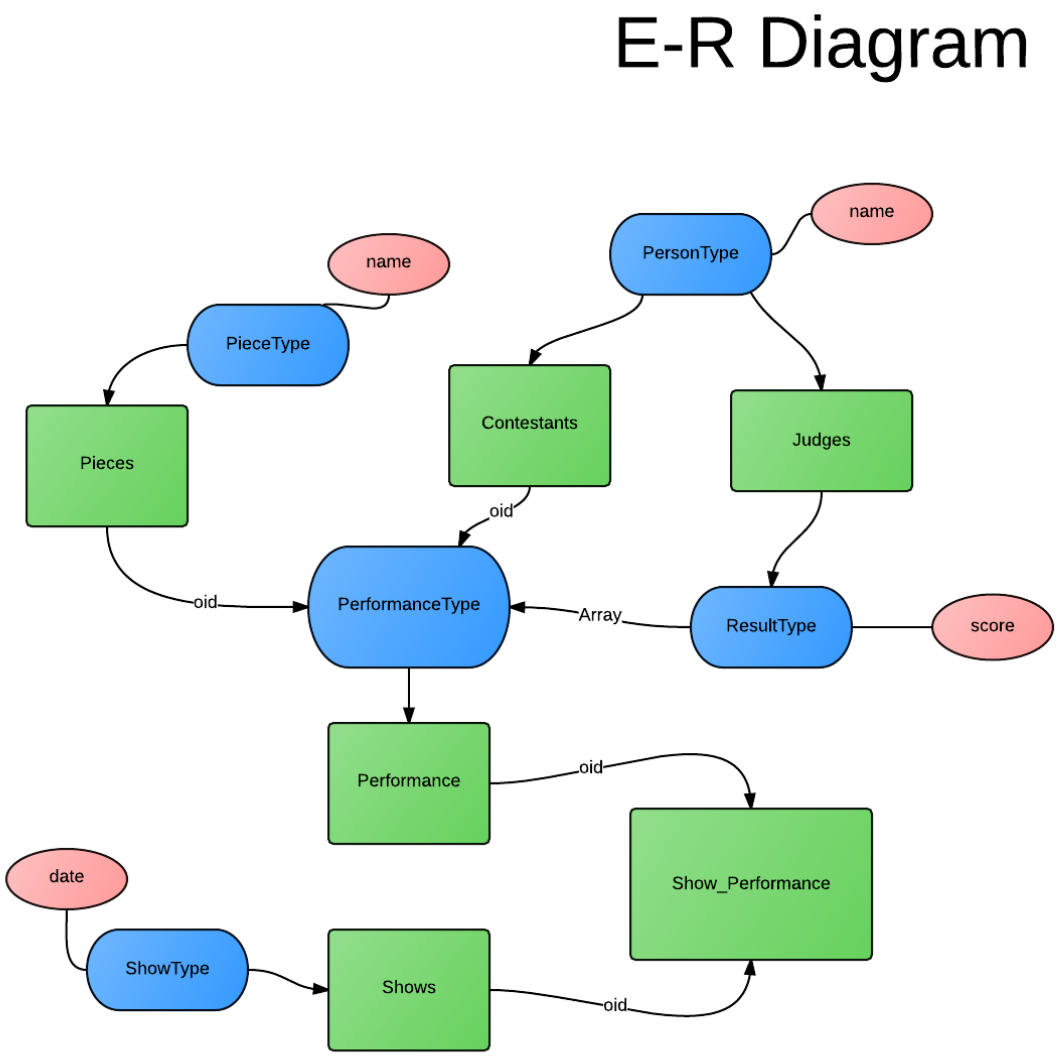
We, pledge our honor that all parts of this project were done by us alone and without collaboration with anybody else.

Entity-Relationship Diagram



Pink ovals are attributes of basic types. Green rectangles are tables. Blues polygons represents user-defined types.

Database Scheme

In this projects, we create 5 user-defined types: PERSON type, PIECE type, RESULT type, PERFORMANCE type and SHOW type

PersonType represents the person class. A person is identified by the name attribute uniquely which is of the basic type text.

PieceType represents the piece class which is identified by the name attribute uniquely.

ResultType represents the data type for the result object which involves two attributes: judge and score. This is an object that describes the result of a contestant on a piece in a performance.

PerformanceType represents the type for a performance. A performance describes the multiple results received by a contestant on a particular piece. So it contains an array of objects of ResultType in the attribute results. It makes the database more object-relational.

ShowType represents the type for a show which is uniquely identified by the date.

Also, create 5 typed tables: Contestants, Judges, Pieces, Shows, Performances

Contestants stores all the contestants of type PersonType.

Judges stores all the judges of type PersonType.

Pieces store all the pieces of type PieceType.

Performances store all the performances of type PerformanceType.

Shows store all the shows of type ShowType

Since the documentation indicates that “Typed table implement a subset of the SQL standard”. So the all typed tables do not contain the self-referencing column. We decide to use the OID feature to support the column explicitly. Therefore, all 5 typed tables are enabled with OID and the OID is the primary key for the objects (entries) in the tables.

Create a table called Show_Performances that relates entries in Shows and Performances. The reason for that is explained in the integrity constraints section.

Integrity Constraints

According to the SQL standard, we should define the PerformanceType like :

```
CREATE TYPE PerformanceType AS (
    contestant REF(PersonType) SCOPE Contestants
    ...
}
```

Since there is a difference between the SQL standard and the implementation in postgresql, we implement the referential integrity by using the foreign keys to reference the objects (entries) in the typed table. So in the creation of Performances table:

```
CREATE TABLE Performances OF PerformanceType (
    Contestant WITH OPTIONS REFERENCES Contestants(oid),
    Piece WITH OPTIONS REFERENCES Pieces(oid),
    PRIMARY KEY (oid)
) WITH (OIDS);
```

The attribute Contestant and Piece for an object in Performances should reference the respective objects in the Contestants and Pieces

Another issue is that the current version of postgresql does not support the foreign key constraint on array member. So in order to relate a Show with multiple Performances. We use a relational approach to create a table Show_Performances that relate and reference objects in Shows and Performances:

```
CREATE TABLE Show_Performances (
    show oid REFERENCES Shows(oid),
    performance oid REFERENCES Performances(oid)
);
```

As the name of contestants, judges and pieces should be unique (it can be duplicate when we have more identifier for the objects like SSN), we have the UNIQUE constraints on them:

```
    UNIQUE(name)
```

CHECK constraints are used on the names such that it cannot accept a contestant/judge/piece with empty string as the name:

```
    name WITH OPTIONS CHECK (char_length(name) > 0)
```

SQL Commands: CREATE TYPE

```
CREATE TYPE PersonType AS (
    name text
);

CREATE TYPE PieceType AS (
    name text
);

CREATE TYPE ResultType AS (
    judge text,
    score integer
);

CREATE TYPE PerformanceType AS (
    Contestant oid,
    Piece oid,
    results ResultType[]
);

CREATE TYPE ShowType AS (
    showdate date
);
```

SQL Commands: CREATE TABLE

```
CREATE TABLE Contestants OF PersonType (
    UNIQUE(name),
    PRIMARY KEY (oid),
    name WITH OPTIONS CHECK (char_length(name) > 0)
) WITH (OIDS);

CREATE TABLE Judges OF PersonType (
    UNIQUE(name),
    PRIMARY KEY (oid),
    name WITH OPTIONS CHECK (char_length(name) > 0)
) WITH (OIDS);

CREATE TABLE Pieces OF PieceType(
    UNIQUE(name),
    PRIMARY KEY (oid),
    name WITH OPTIONS CHECK (char_length(name) > 0)
) WITH (OIDS);
```

```
CREATE TABLE Performances OF PerformanceType (
    Contestant WITH OPTIONS REFERENCES Contestants(oid),
    Piece WITH OPTIONS REFERENCES Pieces(oid),
    PRIMARY KEY (oid)
) WITH (OIDS);

CREATE TABLE Shows OF ShowType(
    UNIQUE(showdate),
    PRIMARY KEY (oid)
) WITH (OIDS);

CREATE TABLE Show_Performances (
    show oid REFERENCES Shows(oid),
    performance oid REFERENCES Performances(oid)
);
```

SQL Commands: CREATE VIEW

The view `Direct_Coaudition` is used in query 1 and 5.

```
CREATE VIEW Direct_Coaudition AS (
    SELECT C1.name AS name1, C2.name AS name2
    FROM Contestants C1, Contestants C2,
      Show_Performances SP1, Show_Performances SP2,
      Performances P1, Performances P2
    WHERE SP1.show = SP2.show AND // select same show of different performances
      SP1.performance = P1.oid AND
      SP2.performance = P2.oid AND
      P1.piece = P2.piece AND    //with same piece
      P1.contestant = C1.oid AND
      P2.contestant = C2.oid AND
      C1.name != C2.name AND  // but different contestants
      P1.results && P2.results  // with at least one same result from same judge
);
```

The recursive view Coaudition is used in query 5.

```
CREATE RECURSIVE VIEW Coaudition (name1, name2) AS (
    SELECT *
    FROM Direct_Coaudition //select all from Direct_Coaudition first as base case
  UNION
    SELECT C1.name1,C2.name2
    FROM Coaudition C1, Direct_Coaudition C2 //build it recursively
    WHERE C1.name2 = C2.name1 AND
            C1.name1 != C2.name2
);
```

The view Shows3Judges is used in query 3.

```
CREATE VIEW Shows3Judges AS  //find shows with 3 judges
  SELECT oid, showdate // Select the show's oid that
  FROM Shows S
  WHERE EXISTS(    // exists some of the contestants
    SELECT P.contestant
    FROM Show_Performances SP, Performances P
    WHERE S.oid = SP.show AND
      SP.performance = P.oid AND
      array_length(P.results, 1) > 2   // that have more than 2 results (means there
are at least 3 judges)
  );
```

SQL Query: Query 1

Find all pairs of contestants who happened to audition the same piece during the same show and got the same score from at least one judge

```
SELECT * FROM Direct_Coaudition WHERE name1 < name2; //show the tuples in
Direct_Coaudition without duplicated data
```

SQL Query: Query 2

Find all pairs of contestants who happened to audition the same piece (in possibly different shows) and got the same average score for that piece.

```
SELECT C1.name AS name1, C2.name AS name2
FROM Contestants C1, Contestants C2,
  Performances P1, Performances P2
WHERE P1.piece = P2.piece AND // contestants perform same piece
  P1.contestant = C1.oid AND
  P2.contestant = C2.oid AND
  C1.name < C2.name AND // they have different names
  ( SELECT avg(r.score) FROM unnest(P1.results) r) =
   ( SELECT avg(r.score) FROM unnest(P2.results) r) // have same average scores.
;
```

SQL Query: Query 3

Find all pairs of contestants who auditioned the same piece in (possibly different) shows that had at least 3 judges and the two contestants got the same highest score.

```
SELECT C1.name AS name1, C2.name AS name2
FROM Contestants C1, Contestants C2,  //select 2 contestants
  Shows3Judges S1, Shows3Judges S2,
  Show_Performances SP1, Show_Performances SP2,
  Performances P1, Performances P2
WHERE S1.oid = SP1.show AND  // that perform in the show of show3judge
  S2.oid = SP2.show AND
  SP1.performance = P1.oid AND
  SP2.performance = P2.oid AND
  P1.piece = P2.piece AND  //with same piece
  P1.contestant = C1.oid AND
  P2.contestant = C2.oid AND
  C1.name < C2.name AND
  ( SELECT max(r.score) FROM unnest(P1.results) r) = ( SELECT max(r.score) FROM
unnest(P2.results) r)
; // and same max score
```

SQL Query: Query 4

Find all pairs of contestants such that the first contestants has performed all the pieces of the second contestant (possibly in different shows)

```
  SELECT C1.name AS name1, C2.name AS name2
  FROM Contestants C1, Contestants C2
  WHERE
    AND NOT EXISTS(  // and not exist
      (
        SELECT piece // a piece performed by C2
        FROM Performances P
        WHERE P.contestant = C2.oid
      )
      EXCEPT   //but not performed by C1
      (
        SELECT piece
        FROM Performances P
        WHERE P.contestant = C1.oid
      )
    ) AND
    C1.name != C2.name
;
```

SQL Query: Query 5

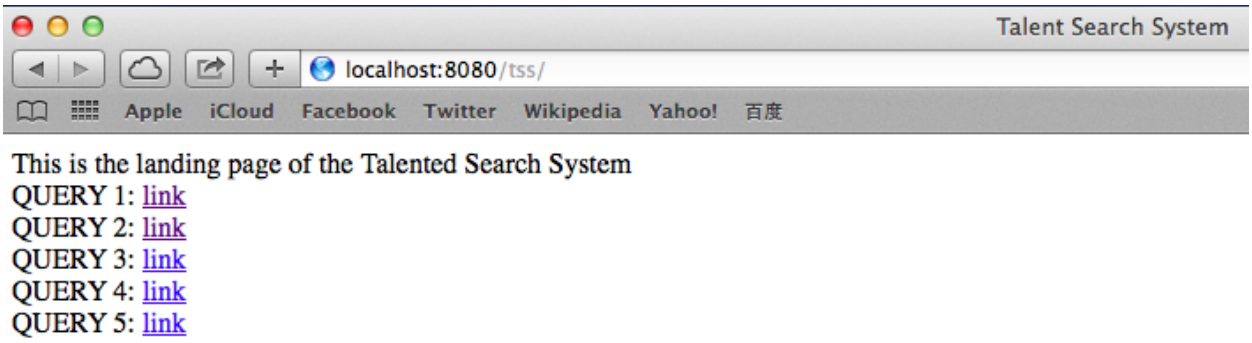
Find all chained co-auditions. A chained co-auditions is the transitive closure of the following binary relation: X and Y (directly) co-auditioned iff they both performed the same piece in the same show and got the same score from at least one (same) judge. Thus, a chained co-audition can be either a direct or an indirect co-audition

```
SELECT * FROM Coaudition C WHERE C.name1<C.name2;
```

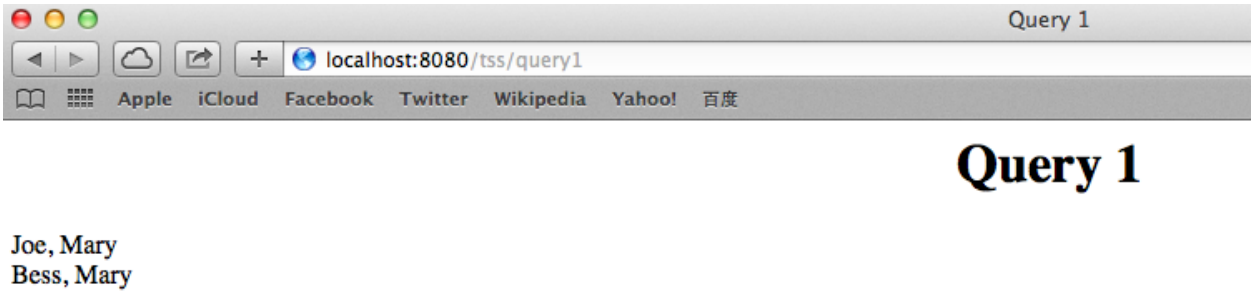
Installation guide & Web Interface

To have everything ready, you need to have postgresql ready. Create a database under the name `tss`, on port 5432. The user name and password should be `kinsumliu` and `pw`. Otherwise, my java code wont be able to connect to the database.

For web interface, we need Apache Tomcat, the postgresql JDBC driver, Eclipse EE and my source code which is an eclipse dynamic web project. The landing page looks like this with 5 links that execute the 5 SQL queries:



If you click one of these links, it directs to a page that displays the result:



Teaming

Division of labor