

CSI3130 / CSI3530

Databases II

Programming Assignment (Lab No 3 and Lab No 4)

Due: December 2nd, 11:59 PM

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1. The term impedance mismatch in the context of embedding SQL commands in a host language such as C is the problem that occurs because SQL operates on sets of records whereas language, such as C, do not cleanly support a set-of-records abstraction. The solution to the impedance mismatch problem is to provide a mechanism for retrieving rows one at a time from a relation.
2. The value of a host language variable can be passed to an embedded SQL command by ensuring the host language variable is declared in SQL before it is used in the embedded SQL statement. A declaration section is used to declare the host language variable. A declaration section has the following syntax:

```
exec sql begin declare section;  
host language variable declaration  
exec sql end declare section;
```

3. The WHENEVER command is used to simplify the task of checking the SQLSTATE variable for errors and exceptions after each embedded SQL statement.
4. Cursors are the mechanism needed to solve impedance mismatch (explained in question 1).
5. Situations that calls for the use of embedded SQL include statistical analysis of data sets such as variance and standard deviation, as they involve more complex calculations that may include using several aggregate functions in multi-step calculations, or are simply outside the capabilities of existing functions altogether. Embedded SQL is also necessary to integrate a database application with a nice graphical user interface.
6. See attached file.
7. See attached file.
8. See attached file.
9. To calculate transitive closure of a graph, the most practical approach is to use an algorithm, which is crucial as graphs become massive. For this problem, we can use any algorithm that finds a path between all pairs of vertices, such as the Floyd-Warshall algorithm. For our purposes, we create an adjacency matrix with the tuples in the "Edges" relation. It might look like:

"For each distinct vertex 'a' in edges.from, insert path (if we don't care about distance/length, it can be simplified to insert '1' for adjacency, and '0' otherwise) for each vertex 'b' that exists in edges.to".

Once we have the adjacency matrix, we implement the algorithm to compute transitive closure. In this case, the algorithm returns the shortest path, but we can simplify it to: "If distance from 'a' to 'b' \neq infinite, then 'a' to 'b' is reachable. Finally, we can show the results of the algorithm in a more meaningful way by inserting them into its own relation, representing the matrix of the transitive closure.

10. Updatability: if a cursor is updatable (can be read-only or updatable) simple variants of the DELETE and UPDATE commands allow us to delete and update the row on which the cursor is positioned.

Sensitivity: if a cursor is INSENSITIVE, the cursor acts as if it is ranging over a private copy of the collection of answer rows. In contrast, and by default (if the INSENSITIVE keyword is not specified), unpredictable behaviour could occur if other actions of some transaction can modify these rows.

Scrollability: If the SCROLL keyword is specified a cursor is scrollable meaning that the cursor can be positioned in very flexible ways using the FETCH command. Otherwise, if SCROLL is not specified, only the basic FETCH command is allowed which retrieves the next row.

11. DECLARE c SCROLL CURSOR FOR
SELECT * FROM Sailors s
ORDER BY s.age
FOR UPDATE;

This particular cursor cannot update the 'age' field, as the dataset is being sorted on that field by the ORDER BY operation.

12. Examples of situations that call for dynamic SQL are a spreadsheet or a graphical front-end. These situations call for dynamic SQL as the application must accept commands from users and generate appropriate SQL statement to retrieve necessary data based on the user's need. In these such situations, we may not be able to predict in advance what SQL statements need to be executed.