PES UNIVERSITY

Department of CSE

UE22CS343BB3 - DATABASE TECHNOLOGIES

Jan – May 2025

DBT ASSIGNMENT #1

Mode: INDIVIDUAL

Submission Due Date:

(a) Database Preparation:

- Develop a mini-world database by selecting one domain from the provided list or a relevant domain of your choice.
  - Database should be named like “DBT25 A1 SRN Name”
- Create a Relational Schema consisting of at least 5 tables. Draw the Relational Schema diagram.
- Utilize SQL CRUD operations (Create, Read, Insert) to load data into all tables.
- Ensure the tables have only default index on say the Primary Key. Do not create additional indexes.
- Load 10,000+ rows of data into at least 2 of these (transaction?) tables, optionally using distributed storage across multiple drives of your PC.
  - If a program is utilized to create this data, submit the program code along with the assignment.
- Include **your SRN and Name** as part of the data in at least one of the tables while populating the database.

(b) Queries Creation and Performance Measurement:

- Execute "SELECT *" queries on all tables to display data and count the rows.
- Craft a variety of queries to exercise both index scans and table scans.
- Also include queries with multi-table joins involving 3 tables; including both "SELECT *" and conditional "SELECT" queries with a subset of columns.
- Run Explain/Analyze Plans for above queries and document each of them.

(c) Indexing for Query Performance Improvement:

- Create an optimal number of indexes on different tables within the selected mini-world database, focusing on larger tables for significant performance gains.

- After index creation, run Explain/Analyze Plans on select queries and compare the results with the previous Explain Plans, particularly emphasizing the impact on multi-table joins involving 3 tables to demonstrate the effect of indexing on query performance.

(d) Query Optimization with Varied Join Orders and Types

- Explore various optimization strategies by altering the join order of tables in multi-table join queries at least 2 times.
- Incorporate a variety of join types such as outer joins, subqueries, etc., to diversify optimization approaches.
- Analyze performance differences by comparing execution plans and actual execution performance.
- Measure query execution time before and after optimization to quantify improvements accurately.

(e) Query Analysis and Optimization:

Analyze and optimize a complex query within the mini-world database created in part (a).

Part 1: Query Analysis

- Write a parse tree for a complex query, such as a 3-table join, by hand.
- Formulate a relational algebra expression for the same query.
- Create an initial query tree based on the relational algebra expression.

Part 2: Query Optimization

- Optimize the initial query tree to enhance query performance.
- Document the optimization steps taken to refine the query tree.

Ensure that the parse tree, relational algebra expression, initial query tree and optimized query tree are drawn by hand, and an image of each is pasted in the submission document for thorough evaluation.

Submission Instructions:

1. Ensure SQL queries are well-documented and clearly presented. Each clause should start on a separate line.
2. Ensure that the Relational Schema comprises a **minimum of 5 tables**.
3. **Load 10,000 rows of data into a minimum of 2 tables** within the mini-world database.
4. Provide thorough documentation on query optimization techniques, indexing methods, and performance improvements.
5. Include images of the Relational Schema, parse tree, relational algebra expression, and initial & improved query trees, **drawn by hand**.

6. Snapshot Background: When capturing snapshots or images, **set the background color to white**. Avoid using black or dark backgrounds as it can impact readability/printing. Adjust this setting in your preferred SQL environment or tool.
7. Include any additional analysis or commentary relevant to the tasks performed.
8. Name the PDF file including your Student Registration Number (SRN), course code, and Assignment number. Use file name format specified below:
    a. **DBT22CS A1 <SRN>.pdf**
    b. Example: **DBT22CS A1 PES1UG21CS001.pdf**

Domain/Mini-World Options:

1. Airline Reservation or Crew Management
2. Airport Management
3. Alumni Database
4. Apartment Management
5. Bank
6. Car Dealership
7. E-commerce
8. Election
9. Electives Management
10. Expense Management [personal, dept/office, house, etc.]
11. Games of cricket, football, tennis, etc.
12. Hostel Management
13. Hotel Management
14. Insurance Company
15. Library or LMS
16. Movies
17. Music
18. Rental Management [Apt, Car, Bike, Video, etc.]
19. Shipping (Logistics)
20. Stadium/Theater Ticket Sales Management
21. Store Management
22. Ticketing Sales Management (for a specific Seating Plan – like theater, stadium)
23. Travel Agency
24. University – Student, Course/Subject, Faculty, etc.

Good luck with your assignment, and feel free to reach out if you have any questions.