Selected Topics - Part I - Database Index

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Outline

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Reminder: Project Demo and Presentation

Are you ready for project demo and presentation?

Outline

Selected Topics

To discuss

- Database index
- ACID and transactions
- Introduction to database in programming environment

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Database Index: Concept

A database index is a data structure created on one or more attributes that make search efficient

- i.e., it is to make it efficient to find those tuples that have a fixed value for those attributes.

Database Index: Motivation

An analogy: binary search vs. sequential search

Observe this query

```
SELECT *
FROM Students
WHERE birthdate >= '1980-01-01';
```

Without any additional data structure, we must sequentially search all the tuples for name and phone.

Database Index: Index Type

What are the data structures and index types?

- MariaDB index data structure
- PostgreSQL index data structure

Declaring Index

To declare an index, use

```
CREATE INDEX <index_name> ON <relation(list of attributes)>
```

Declaring Index: Examples

Example 1. Create an index on `birthdate` of `Students`

```
CREATE INDEX BirthDateIndex ON Students(birthdate);
```

Example 2. Create an index on `phone` of `Students`

```
CREATE INDEX PhoneIndex ON Students(phone);
```

Example 3. Create an index on `name, phone` of `Students`

```
CREATE INDEX NamePhoneIndex ON Students(name, phone);
```

Discussion Questions

- What kind of queries can be made more efficient by having an appropriate index?
- What kind of queries can become slower by having an index?

Selection of Index

Choosing which indexes to create requires the database designer to analyze a trade-off

- Benefit. The existence of an index on an attribute
  - may speed up greatly the execution of those queries in which a value, or range of values, is specified for that attribute
  - may speed up greatly joins involving that attribute as well.
- Cost.
  - Every index built for one or more attributes of some relation makes insertions, deletions, and updates to that relation more complex and time-consuming.

Continue to explore this on your own or in a future database class.

Outline

Questions and Summary

- A brief introduction to database index