

CS 327 Spring 2025

Homework 1

Basic Concepts/ DBMS Architecture

Question 1:

a. List any three advantages of using a database over traditional file storage.

1. Data Redundancy Control: A database system reduces redundancy by ensuring that the same data is not duplicated across multiple files. This minimizes storage usage and enhances consistency [OBJ].
2. Data Sharing and Concurrency: Databases allow multiple users to access and manipulate the data simultaneously without conflicts, thanks to built-in concurrency control mechanisms. This is a significant advantage over traditional file systems, which struggle with such multi-user operations [OBJ] [OBJ].
3. Data Integrity and Security: Databases enforce integrity constraints, ensuring data accuracy and reliability. They also provide robust mechanisms for restricting unauthorized access through user roles and permissions, features that are typically limited in traditional file systems [OBJ] [OBJ].

b. List any three situations where using a database would be disadvantageous.

1. High Initial Investment and Maintenance Costs: Implementing a database system can require a significant initial investment in software and hardware. Additionally, ongoing maintenance and updates may incur substantial costs. This can make databases less ideal for small-scale or simple applications with limited budgets [OBJ].
2. Unnecessary Overhead for Simple Applications: If the database requirements are simple, well-defined, and not expected to change (e.g., a small personal project or a static dataset), the overhead of using a database system may outweigh the benefits. In such cases, traditional file storage might be more efficient and cost-effective [OBJ].
3. Real-Time Requirements Not Met: Databases introduce additional overhead for features like security, integrity, and concurrency control. This can make them unsuitable for applications with stringent real-time performance requirements, where minimal latency and high-speed data access are critical.

Question 2:

a. Describe in your own words, what is meant by data abstraction.

Data abstraction refers to the process of hiding the complexities of how data is stored and maintained in a database system. It provides users with a simplified, high-level view of the data without exposing the intricate details of storage, indexing, or physical implementation.

b. Write in your own words, the difference between database schema and database instance.

1. Database Schema: A database schema is the overall blueprint or structure of the database. It defines how the data is organized, including tables, relationships, constraints, and data types.

2. Database Instance: A database instance, on the other hand, refers to the actual content of the database at a specific point in time. It includes the data stored in the database tables and reflects the current state of the database.

The database schema is like the **class definition** in Java. It defines the structure, attributes, and behavior (methods) of the objects. Similarly, the schema specifies the structure of the database, such as tables, columns, data types, and constraints.

Question 3:

Write brief answers to the following, in your own words:

a. When starting up your servers, which should you start first: the Apache web server or the MariaDB database server? Why?

You should start the MariaDB database server first before the Apache web server. This is because the Apache web server often relies on the database server to retrieve and display dynamic content.

b. What does A_I mean, in the context of a table column? What is it used for?

A_I stands for **Auto Increment**. In the context of a table column, it means that the database automatically assigns a unique incrementing value to the column whenever a new record is inserted.

Question 4: Create a database called "college". In it, create a table called "student." It should have a numeric ID column that is the primary key, a firstname, a lastname (both 30 characters long), a decimal GPA column, an email column and a phone number column. Only the phone number column is allowed to be null, and the email must be unique.

View the SQL code for the table creation and copy-paste it as the answer to this question.

```
CREATE TABLE student (  
  id INT NOT NULL AUTO_INCREMENT,  
  firstname CHAR(30) NOT NULL,  
  lastname CHAR(30) NOT NULL,  
  gpa DECIMAL(3, 2) NOT NULL,  
  email VARCHAR(100) NOT NULL UNIQUE,  
  phone_number CHAR(15) NULL,  
  CONSTRAINT studentPK PRIMARY KEY (id)  
);
```