Patel Mittal **19524** **CS547** **HW#1**

1.10 List five responsibilities of a database-management system. For each responsibility, explain the problems that would arise if the responsibility were not discharged

Ans: a. interaction with the file manager. No DBMS can do without this. If there is no file manager interaction, then nothing stored in the files can be retrieved.

b. integrity enforcement. Consistency constraints may not be satisfied, for example an instructor may belong to a non-existent department, two students may have the same ID, account balances could go below the minimum allowed, and so on.

c. security enforcement. Unauthorized users may access the database, or users authorized to access part of the database may be able to access parts of the database for which they lack authority. For example, a low-level user could get access to national defense secret codes, or employees could find out what their supervisors earn (which is presumably a secret).

d. backup and recovery. Data could be lost permanently, rather than at least being available in a consistent state that existed prior to a failure.

e. concurrency control. Consistency constraints may be violated despite proper integrity enforcement in each transaction. For example, incorrect bank balances might be reflected due to simultaneous withdrawals and deposits on the same account, and so on.

1.14 Explain the difference between two-tier and three-tier architectures. Which is better suited for Web applications? Why?

2-tier architecture is Client server application and 3-tier architecture is Web based application.

In 2-tier architecture, the direct communication takes place between client and server. There is no intermediate between client and server.

Whereas In 3-tier architecture, there are three layers as follows: Client layer Business layer Data layer.

3-tier architecture is suitable for Web applications because, it gives you the ability to update the technology stack of one tier, without impacting other areas of the application and it allows for different development teams to each work on their own areas of expertise.

2.10 Consider the advisor relation shown in Figure 2.8, with s_id as the primary key of advisor. Suppose a student can have more than one advisor. Then, would s_id still be a primary key of the advisor relation? If not, what should the primary key of advisor be?

Ans: s_id would not be a primary key, since there may be at least two tuples for a single student, corresponding to two advisors. Then the primary key should be s_id, i_id.

2.12 Consider the relational database of Figure 2.14. Give an expression in the relational algebra to express each of the following queries:

a. Find the names of all employees who work for "First Bank Corporation".

Ans: $\pi_{\text{person\_name}}(\sigma_{\text{company\_name = "First Bank Corporation"}}(\text{works}))$

b. Find the names and cities of residence of all employees who work for "First Bank Corporation".

Ans: $\pi_{\text{person\_name, city}}(\text{employee} \bowtie (\sigma_{\text{company\_name = "First Bank Corporation"}}(\text{works})))$

c. Find the names, street address, and cities of residence of all employees who work for "First Bank Corporation" and earn more than $10,000.

Ans: $\pi_{\text{person\_name, street, city}}(\sigma_{(\text{company\_name = "First Bank Corporation" } \wedge \text{ salary > 10000})}(\text{works} \bowtie \text{employee}))$

2.13 Consider the bank database of Figure 2.15. Give an expression in the relational algebra for each of the following queries:

a. Find all loan numbers with a loan value greater than $10,000.

Ans: $\pi_{\text{loan\_number}}(\sigma_{\text{amount>10000}}(\text{loan}))$

b. Find the names of all depositors who have an account with a value greater than $6,000.

Ans: $\pi_{\text{customer\_name}}(\sigma_{\text{balance>6000}}(\text{depositor} \bowtie \text{account}))$

c. Find the names of all depositors who have an account with a value greater than $6,000 at the "Uptown" branch.

Ans $\pi_{\text{loan\_number}}(\sigma_{\text{balance>6000 } \wedge \text{ branch\_name="Uptown"}}(\text{depositor} \bowtie \text{account}))$