Dr Pooja Sharma

Roll No..... 16/11/2023

National Institute of Technology, Hamirpur
BTech & Dual Degree (CSE)
CS-312, DATABASE MANAGEMNET SYSTEM
End Semester Examination, Nov-Dec- 2023

Duration:03 Hours Max. Marks: 50

Note: *Attempt all the questions. Be brief and to the points in writing answers. Assume suitable data if necessary. Preferably, write the answers in sequential order.*

1. List two reasons why null values might be introduced into the database. Discuss the relative merits of procedural and nonprocedural languages. (5)
2. Explain the difference between two-tier and three-tier architectures. Which is best for Web applications? Give reason for your answer. Also write its advantages and disadvantages. (5)
3. List the ACID properties. Explain the usefulness of each. During its execution, a transaction passes through several states, until it finally commits or aborts. List all possible sequences of states through which a transaction may pass. Explain why each state transition may occur. (5)
4. Explain the purpose of the checkpoint mechanism. How often should checkpoints be performed? Describe how the frequency of checkpoints affects:
   a) *System performance when no failure occurs*
   b) *The time it takes to recover from a system crash*
   c) *The time it takes to recover from a disk crash* (5)
5. Design a database for an airline. The database must keep track of customers and their reservations, flights and their status, seat assignments on individual flights, and the schedule and routing of future flights. Your design should include an E-R diagram, a set of relational schemas, and a list of constraints, including primary-key and foreign-key constraints. (5)
6. Given a relational Schema R (W, X, Y, Z) and set of Function Dependency FD = {W $\rightarrow$ X, Y $\rightarrow$ X, Z $\rightarrow$ WXY, WY $\rightarrow$ Z}. Find the canonical cover? (5)
7. Suppose we have a database for an investment firm, consisting of the following attributes: B – Broker, O – Office of a broker, I – Investor, S – Stock, Q – Quantity of stock owned by an investor, D – dividend paid by a stock.
   Hence, the overall schema is R = (B, O, I, S, Q, D). Assume that the following functional dependencies are required to hold on this I $\rightarrow$ B, IS $\rightarrow$ Q, B $\rightarrow$ O, S $\rightarrow$ D.
   a) *List all the candidate keys for R.*
   b) *Give a lossless-join decomposition of R into BCNF.*
   c) *Give a lossless-join decomposition of R into 3NF preserving functional dependencies.* (5)
8. Construct a B+-tree for the following set of values (2, 3, 5, 7, 11, 17, 19, 23, 29, 31) Assume that the tree is initially empty and values are inserted in ascending order. Construct B+-trees for the cases where the number **m** of pointers that will fit a node is as follows: a. 4 b. 7 (5)

9. For the following relation schema: Give an expression in SQL for each of the following queries: ***employee*** *(employee-name, street, city),* ***works*** *(employee-name, company-name, salary),* ***company*** *(company-name, city),* ***manages*** *(employee-name, manager-name)*

a) *Find the names, street address, and cities of residence for all employees who work for 'First Bank Corporation' and earn more than $10,000*

b) *Find the names of all employees in the database who live in the same cities as the companies for which they work.*

c) *Find the names of all employees in the database who live in the same cities and on the same streets as do their managers.* (5)

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

employee *(person name, street, city),* ***works*** *(person name, company name, salary),* ***company*** *(company name, city)*

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

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

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.*

d) *Find the names of all employees in this database who live in the same city as the company for which they work.*

e) *Find the names of all employees who live in the same city and on the same street as do their managers.* (5)