

CSE 370– Database Systems

Assignment 3

Summer 2024

Marks

Full Name (in Block Letter): _____

ID: _____ **Section:** ____ **Signature:** _____

Date: _____ **Total Marks: 20**

Question 1:

[1+4+5 = 10 marks]

Course_Offering (Course_code, Section_no, Semester, Course_title, Department, Credits, Coordinator_initial, Coordinator_name, Coordinator_email, Slot, Room_no, Building_no, Capacity, Total_students)

The primary key of the relation is underlined. The relation has the following additional functional dependencies (FDs):

FD1: Course_code → Department, Credits, Course_title

FD2: Course_code, Semester → Coordinator_initial, Coordinator_name, Coordinator_email

FD3: Coordinator_initial → Coordinator_Name, Coordinator_email

FD4: Building_no, Room_no → Capacity

- Explain** if the above relation is in the first normal form (1NF) or not? If not, **apply** 1NF normalization.
- Explain** if the relation(s) of no (a) is/are in the second normal form (2NF) or not? If not, **apply** 2NF normalization.
- Explain** if the relation(s) of no (b) is/are in the third normal form (3NF) or not? If not, **apply** 3NF normalization.

Question 2:**[10 marks]**

Construct a B+ tree of order $n = 3$ for the following search key values inserted in the given order: **9, 5, 11, 15, 39, 29, 22, 30, 4, 27, 8, 52**. Each time there is a split, **a new B+ tree must** be drawn.

Question 3:**[10 marks]**

Construct a B+ tree of order $n = 4$ for the following search key values inserted in the given order: **9, 5, 11, 15, 39, 29, 22, 30, 4, 27, 8, 52**. Each time there is a split, **a new B+ tree must** be drawn.

Question 4:**Scenario:**

Imagine a hotel booking system where two employees, John and Sarah, are updating room prices for the same hotel room.

- John begins updating the room price from \$150 to \$200. The transaction starts but is not yet committed.
- During John's update, Sarah checks the room price. Sarah sees the intermediate uncommitted value of \$200.
- Sarah already pays \$200 through her credit card based on the uncommitted value she saw.
- Later, John's transaction is rolled back due to an error, and the room price reverts to \$150.
- This results in Sarah overpaying, leading to inconsistencies in the system.

Question:

Identify the concurrency problem demonstrated in this scenario and explain its implications. Additionally, suggest how the database management system can prevent such temporary update issues.

Question 5:

Scenario:

Imagine an online shopping platform where two users, Alex and Jordan, are both attempting to purchase the last item of a limited-edition product. The current stock for the product is 1.

- Alex checks the inventory and sees that the stock is 1.
- Alex decides to purchase the product and places an order.
- Jordan also checks the inventory and sees the same stock of 1.
- Simultaneously, Jordan also places an order for the same product.
- Alex's transaction is processed first and deducts 1 from the inventory.
- Before Alex's transaction is fully committed and stock value is written in the DB (i.e. the inventory is updated), Jordan's transaction is processed based on the stale stock value of 1, deducting another 1 from the inventory.
- Alex writes 0 as the updated stock value.
- Jordan also writes 0 as the updated stock value.

Question:

Identify the concurrency problem demonstrated in this scenario and explain your answer. Additionally, describe how the inventory management system can be improved to prevent this issue.