United International University (UIU)
Dept. of Computer Science & Engineering (CSE)

Final Exam, Trimester: Summer 2024

Course Code: CSE-3521   Course Title: Database Management Systems

Total Marks: 50   Duration: 2 hours

Any examinee found adopting unfair means will be expelled from the trimester / program as per UIU disciplinary rules.

1.   a) Suppose we have a relation named R, having attributes as A, B, C, D, E and F.   **4**
The relation R is having the following functional dependencies,
$A \rightarrow C$
$B \rightarrow DF$
$AB \rightarrow E$
$D \rightarrow F$

Considering the relation with functional dependencies, find if **CD→E** and **AB → CE** is valid or not using Armstrong's axioms. [mention the axim's rule applied in each state]

b) Consider the functional dependencies of the relation,
R(P, Q, R, S, T, U)   **3+**
FD: {   **4+**
$P \rightarrow SQR$ **3**
$Q \rightarrow T$
$R \rightarrow U$
$PR \rightarrow U$
$S \rightarrow Q$
}

i) Find out all the candidate keys.
ii) Find out the minimal cover.
iii) Explain in which normal form the relation is with proper justification.

c) Consider a relation **R(L, M, N, O, P, R)** with the following functional   **6**
dependencies,

$L \rightarrow NR$
$M \rightarrow OP$
$LM \rightarrow P$

If we decompose the relation in **R1(L, N, R, M)** and **R2(M, O, P, L)**, state the validity of this decomposition in terms of lossless and dependency preserving concepts.

2. a) Differentiate the pros and cons of using hashing over indexing with proper justification. **2+8**

b) Draw a B+ tree of order 4 for the given key values below,

23, 9, 3, 10, 7, 15, 30, 2, 19, 8, 25, 21, 6, 22, 4

3. Consider the following hash function: **10**

$$h(x) \; = \; (x * 31) \% 8$$

and the given search keys:

1, 7, 13, 27, 15, 35, 50, 8, 18, 25

Considering the **MSB mapping of the hash values**, insert the search keys one by one into the extensible hash structure using the given hash function where each bucket can contain at most 2 keys.

4. Irfan, an experienced data engineer, has been assigned the critical task of analyzing a series of transactions in a complex database system. He's been handed a schedule of transactions and needs to determine whether this schedule is conflict serializable. This analysis is crucial for ensuring that the transactions in the system maintain consistency and avoid conflicts that could lead to errors. Given his expertise, Irfan approaches the task carefully, knowing that proper scheduling can make or break the integrity of the database operations. **10**

T_1	T_2	T_3	T_4
		WRITE(B)	
READ(C)			
			WRITE(B)
			WRITE(A)
READ(A)			
		WRITE(C)	
	WRITE(A)		
	READ(D)		
	WRITE(B)		
		READ(D)	

If the above schedule is conflict serializable, his task is to demonstrate all the equivalent serial schedules that preserve the integrity of the database operations. However, if the schedule is not conflict serializable, he must carefully identify the specific conflicts within the transactions that prevent serializability. Show the steps how he can solve this problem.