



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

1. a) Consider a relation with schema $R(A,B,C,D)$ with following functional dependencies (FD's): 2+2+3+5

$BC \rightarrow A, AD \rightarrow B, CD \rightarrow B, AC \rightarrow D.$

Find all the candidate keys of R.

- b) Consider a relation R (A, B, C, D) with the following instance

A	B	C	D
1	1	2	3
1	2	2	3
1	3	2	3
2	4	5	6
5	6	7	8

Which of the following functional dependencies are satisfied by this relation? How?

- (i) $A \rightarrow B$
- (ii) $A \rightarrow CD$
- (iii) $BD \rightarrow AC$
- (iv) $AD \rightarrow BC$

- c) What is decomposition? Briefly explain lossless decomposition with an example.
- d) Consider a relation with schema $R(A,B,C,D)$ with following functional dependencies (FD's):

$AB \rightarrow C, B \rightarrow D, C \rightarrow A$

Can we decompose the relation into BCNF form by preserving dependency? If not, then what will be the maximum normalized form

that can be achieved by preserving dependency.

2. a) "A secondary index is always a dense index" - explain this statement with examples. 3+5

[Answer any one of the following 2(b) questions]

- b) Consider an extensible hashing scheme where the bucket capacity is 2 and the initial local and global depth are both 1. Insert the following five records in the hash table **showing the state of the table for each record insertion**. Assume that the LSB (least-significant bit) is being checked to find the directory for a record.

Record	Key	hash(Key)	hash(Key) in binary
Record-1	1620	20	10100
Record-2	1821	29	11101
Record-3	1075	18	10010
Record-4	2115	11	01011
Record-5	5659	27	11011

- or, b) Write short notes on the following five topics in context of indexing.
Sector, Track, Search Key, Record, Multilevel indexing

3. a) If the order of a B+ tree is 6, then determine the minimum number of keys and minimum number of pointers for root node and internal nodes. 3+7
- b) Construct a B+ tree for the following set of key values, where each internal node can contain at most 5 children. Assume that the tree is initially empty and values are added sequentially one by one.

~~1, 10, 1, 23, 5, 15, 17, 9, 11, 39, 35, 8, 40, 25~~

4. a) How can we ensure atomicity and durability of transactions? Write 3+7

down what you understand by view serializability.

[See rest of the Q4 on the next page]

- b) Find out whether the following schedule is conflict serializable or not. If it is conflict serializable, show the serial schedule.

T1	T2	T3	T4
read(A)			
read(B)			
	read(B)		
write(A)			
			read(C)
		read(A)	
		write(A)	
	write(B)		
	Write(C)		
			write(C)
		write(B)	
read(C)			