EAST WEST UNIVERSITY
Department of Computer Science and Engineering
B.Sc. in Computer Science and Engineering Program
Final Assessment (Online), Spring 2021 Semester

Course: CSE 302 Database Systems
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Full Marks: 100 (30 will be counted for final grading)
Submission Deadline: 27 May 2021, 11:50 AM

Note: There are **6** (**SIX**) questions. Answer ALL of them. The Mark of each question is mentioned at the right margin. Do not write unnecessary things and, as a consequence, waste your valuable time! Answer sequentially.

1. Consider a relation R (A, B, C, D, E, F, G, H) and the following functional dependencies as shown below. Match the rule shown in Column A with the logically implied functional dependencies shown in Column B (one FD for one rule). [Mark: 12]

A → B
C → DE
F → G
B → FG
H → A

Column A	**Column B**
Transitivity Rule	A → G
Psuedotransitivity Rule	H → AB
Reflexivity Rule	H → B
Union Rule	B → A
Decomposition Rule	BC → DEF
Augmentation Rule	CF → DEG
	AC → BDF
	BC → CFG
	CDE → DE

2. Consider the instance of the following relation PATIENTS_INFO. [Mark: 20]

patient_id	patient_name	doctor_id	registration_id	doctor_name	specialization	test_id	test_name	test_report
P-001	Alice	D-001	R-001	John	Eye	T-001	Eye	good
P-002	Bob	D-001	R-001	John	Eye	T-001	Eye	bad
P-001	Alice	D-002	R-002	Smith	Medicine	T-002	Blood	good
P-002	Bob	D-002	R-002	Smith	Medicine	T-003	Urine	good
P-003	Charlie	D-003	R-003	Mike	Gynae	T-004	Ultrasono	good

Answer the following questions.

a) Find the primary key of the relation PATIENTS_INFO.
b) Show an example of a Delete Anomaly in this relation.

c) The relation is already in the First Normal Form (1NF). Decompose the relation to the third normal form (3NF). Explain each decomposition step you applied. Finally, show the decomposed relations.

3. Consider the relation R (A, B, C, D, E) and the functional dependency C → ABCDE. How can you decompose the relation R into two smaller relations? Explain your answer. [Mark: 8]

4. Consider the following schedule S. Read operations are represented by R, and write operations are indicated by W. [Mark: 15]

T1	**T2**	**T3**	**T4**
	R (A)		
		W (A)	
R (A)			
	W (B)		
	R (C)		
			W (A)
			R (B)
R (B)			

Is S conflict-serializable? If yes, also determine the serial schedule with which it is conflict-equivalent. Otherwise, justify why it is not conflict-serializable.

5. Insert 'commit' statements in schedule S, as given in Question 4, so that the schedule can be both recoverable and cascadeless. [Mark: 10]

6. Consider the following instance of the Product table. [Mark: 15]

Product

Product_no	**Product_name**	**Product_type**	**Unit_price**
P-1	Apple	Fruits	250.00
P-2	Biscuit (imported)	Luxury	1000.00
P-3	Chocolate (Ferrero Rocher)	Luxury	750.00
P-4	Daal	Grocery	150.00
P-5	Eggs	Grocery	120.00
P-6	Flour	Grocery	70.00

An index helps queries to execute faster. One of the users wants to perform the following query.

```
SELECT Product_name, Unit_price
FROM Product
WHERE Product_type = 'Grocery';
```

Answer the following questions.

a) On which attribute should you create an index to execute the above query faster? Write the SQL statement to create the index?

b) What type of index do you need to create in this case? Draw the index structure accordingly.

c) Assume that the Product relation has 10000 tuples and 10 tuples can fit into 1 block (1 block = 4 KB). Calculate the size of the data file.

d) Also, calculate the index file size as per the index you have created in Question 6.(b). Please note that 20 index entries can fit into 1 block. Explain your answer.