ABES Engineering College, Ghaziabad
B. Tech Odd Semester Make-Up Test

Printed Pages: 03
Session: 2022-23
Roll No.:

Course Code: KCS 501
Course Name: Data Base Management Systems
Maximum Marks: 100

Date of Exam:
Time: 3 Hours

Instructions:
1. **Attempt All sections.**
2. **If require any missing data, then choose suitably.**

Q. No.	Question	Marks	CO	KL	PI
	Attempt All Questions	**Total Marks: 10*10= 100**			
1a)	Explain different Components of an ER Diagram with their Notation. Construct an E-R diagram that uses only a binary relationship between students and course-offerings. Make sure that only one relationship exists between a particular student and course-offering pair, yet you can represent the marks that a student gets in different exams of a course offering.	6+4	CO1	K2	1.4.1
1b)	Define Schema. Explain the terms CANDIDATE KEY, SUPER KEY & PRIMARY KEY in DBMS with an appropriate example.	1+3+ 3+3	CO1	K2	3.1.1
2a)	(i) Consider the following relations P(X, Y, Z), Q(X, Y, T) and R(Y, V).				

P

X	Y	Z
X1	Y1	Z1
X1	Y1	Z2
X2	Y2	Z2
X2	Y4	Z4

Q

X	Y	T
X2	Y1	2
X1	Y2	5
X1	Y1	6
X3	Y3	1

R

Y	V
Y1	V1
Y3	V2
Y2	V3
Y2	V2

How many tuples will be returned by the following relational algebra query? Display the output of the below query.

$$\prod_{X}\left(\sigma_{(P.Y=R.Y \wedge R.V=V2)}(P \times R)\right) - \prod_{X}\left(\sigma_{(Q.Y=R.Y \wedge Q.T>2)}(Q \times R)\right)$$

(ii) Consider the relational schema given below, where **eId** of the relation **dependent** is a foreign key referring to **empId** of the relation **employee**. Assume that every employee has at least one associated dependent in the dependent relation:
employee (empId, empName, empAge)
dependent (depId, eId, depName, depAge)
Write a query that evaluates the set of empIds of employees whose age is greater than that of all his/her dependents.

(iii) Consider the relation **employee(name, sex, supervisorName)** with name as the key, supervisorName gives the name of the supervisor of the employee under consideration.
Write the Tuple Relational Calculus query to produce names of employees with no immediate female subordinates.

3+3+4 | CO2 | K2 | 5.1.1

<table>
<tr><td>2b)</td><td>What is the purpose of using indexing in DBMS? Discuss different types of indexing with the help of an example. Differentiate between sparse and dense indexing.</td><td>2+6+2</td><td>CO2</td><td>K3</td><td>1.3.1</td></tr>
<tr><td>3a)</td><td>Consider a relation R(A,B,C,D,E,F,G,H), where each attribute is atomic, and the following functional dependencies exist:
{CH->G, A->BC, B->CFH, E->A, F->EG}
(i) Identify the all possible candidate keys.
(ii) Identify highest normal form of the relation.
(ii) Decompose the relation R into 3NF.</td><td>1+4+5</td><td>CO3</td><td>K3</td><td>2.4.4</td></tr>
<tr><td>3 b)</td><td>(i) You are given the table below for a relation R(A,B,C,D,E). You do not know the functional dependencies for this relation.
<table>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th></tr>
<tr><td>'a'</td><td>122</td><td>1</td><td>'s1'</td><td>'a'</td></tr>
<tr><td>'c'</td><td>236</td><td>4</td><td>'c2'</td><td>'b'</td></tr>
<tr><td>'a'</td><td>199</td><td>1</td><td>'b5'</td><td>'c'</td></tr>
<tr><td>'b'</td><td>213</td><td>2</td><td>'z8'</td><td>'d'</td></tr>
</table>
Suppose this relation is decomposed into the following two tables: R1(A,B,C,D) and R2(A,C,E). Is this decomposition lossless? Explain your reasoning?
(ii) You are given the below set of functional dependencies for a relation R(A,B,C,D,E,F,G),
F ={AD → BF, CD → EGC, BD → F, E → D, F → C, D → F}
Find the minimal cover for the above set of functional dependencies</td><td>5+5</td><td>CO3</td><td>K3</td><td>2.4.4</td></tr>
<tr><td>4a)</td><td>In order to maintain consistency and correctness in a database, what are the properties or mechanism that should be followed? Also explain all the states including additional operations through which a transaction goes during its lifetime with the help of a diagram and by taking real life example?</td><td>5+5</td><td>CO4</td><td>K3</td><td>1.4.1</td></tr>
<tr><td>4b)</td><td>"When two schedules are said to be conflict equivalent? What are the conflicting operations? With reference to this, explain conflict serializablity and check whether the given schedules are conflict serializable or not?
S1: R1(X), R1(Y), R2(X), R2(Y), W2(Y), W1(X)
S2: R1(X), R2(X), R2(Y), W2(Y), R1(Y), W1(X)</td><td>1+1+2+6</td><td>CO4</td><td>K3</td><td>1.3.1</td></tr>
<tr><td>5a)</td><td>(i) Assume basic timestamp ordering protocol and that time starts from 1, each operation takes unit amount of time and start of transaction T_i is denoted as S_i. The table of timestamp is given below:
<table>
<tr><th>Time</th><th>Output</th></tr>
<tr><td>1</td><td>S1</td></tr>
<tr><td>2</td><td>r1(a)</td></tr>
<tr><td>3</td><td>S2</td></tr>
<tr><td>4</td><td>r2(b)</td></tr>
<tr><td>5</td><td>w2(b)</td></tr>
<tr><td>6</td><td>w1(a)</td></tr>
<tr><td>7</td><td>S3</td></tr>
<tr><td>8</td><td>w3(a)</td></tr>
<tr><td>9</td><td>w3(b)</td></tr>
</table>
Find rts(a), wts(a), rts(b) and wts(b) at the end with proper justification. (rts: read-timestamp, wts: write-timestamp)
(ii) "Timestamp-ordering concurrency control protocol with Thomas' Write Rule can generate view serializable schedules that are not conflict Serializable". Justify your answer with the help of an example.</td><td>5+5</td><td>CO5</td><td>K3</td><td>5.1.2</td></tr>
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