Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/MCA/SEM-2/MCA-204/2013

2013
DATABASE MANAGEMENT SYSTEM – I

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

   $10 \times 1 = 10$

   i) If two attributes both can be treated as primary key, the either of the keys is called

   a) foreign key   b) alternate key

   c) candidate key   d) super key.

   ii) COUNT (*) returns

   a) Number of rows regardless of NULLS

   b) Number of rows regarding of NULLS

   c) Number of all the rows

   d) None of these.

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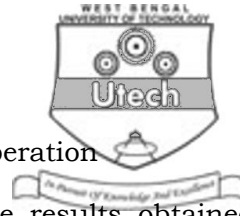
iii) Which statement is correct : Union operation

a) combines the columns from the results obtained from the participating queries

b) combines the rows from the results obtained from the participating queries.

c) both (a) and (b)

d) none of these

iv) Functional dependencies will be required

a) in schema making

b) on Transaction

c) on Cartesian product calculation

d) in Normalization.

v) Given a relation R : {A,B,C} & the set of FDs :

$$A \to B$$

$$B \to C$$

Decomposed into

R1 : {A,B}

R2 : {B,C}

The decomposition is

a) lossless join decomposition

b) dependency preserving

c) both a & b

d) none of these.

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vi) For a given relation R : {J,K,L} having a set of FDs {JK → L, L → K}, the candidate keys are

    a) J & K   b) JK

    c) Only J   d) JK & JL.

vii) The operation on a certain relation X, produces Y such that Y contains only selected attributes of X. The operation is

    a) Projection   b) Selection

    c) Union   d) Difference.

viii) The number sub-schema of a schema with n attributes is

    a) n b) $2^n - 1$

    c) $n^2 - 1$ d) $log\ n$.

ix) Let a DBMS has q external views. Then the number of possible interfaces that may exists are

    a) equal to q b) less than q

    c) greater than q d) none of these.

x) If R and S are two relations, which of the following algebraic expressions is true ?

    a) $R \cap S = (R \cup S) - ((R - S) \cup (S - R))$

    b) $R \times S = (R \cup S) - ((R - S) \cup (S - R))$

    c) $R \cap S = (R \times S) - ((R - S) \cup (S - R))$

    d) None of these.

xi) Armstrong's inference rules are

    a) Weak and sound   b) Strong and sound

    c) Sound and Complete   d) None of these.

xii) Which of the following properties guarantees that spurious tuples does not occur with respect to the relational schema created after decomposition ?

a) Dependency preservation property

b) Non-additive join property

c) Accociatiove join property

d) None of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2. How does tuple relational calculus differ from domain relational calculus ? Discuss the meaning of the existential quantifier ($\exists$) and the universal quantifier ($\forall$).   2 + 3

3. "Every BCNF is also in 3NF and more restrictive constraints than 3NF" explain.

4. Find the minimum cover of $F = \{A \to BC, AC \to D, D \to B, AB \to D\}$

5. Consider the relation $R = \{A,B,C,D,E,F,G,H,I,J)$ and the set of Functional Dependencies F :

$$\{A,B\} \to C$$
$$A \to \{D,E\}$$
$$B \to F$$
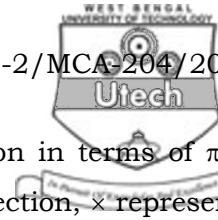$$F \to \{G,H\}$$
$$D \to \{I,J\}$$

a) Deduce the key for R

b) Normalize R up to 3NF.

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6. Express the algebraic operation of Division in terms of π, ×
and – operations, where π represents Projection, × represents
Cartesian Product and – represents Set Difference.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

7. Define functional dependency. What do you mean by Partial
functional dependency and Full functional dependency ?
What are Armstrong's inference rules ? What is
Normalization ? Explain with an example 1NF, 2NF and 3NF.

2 + 4 + 2 + 1 + 6

8. What do you mean by Lossless join decomposition ? Write
down the algorithm for testing lossless join property of
relations. Test the lossless join property of the following
relations.

R = {A, B, C, D, E}

R1 = {AD},

R2 = {AB},

R3 = {BE},

R4 = {CDE} and R5 = {AE}

Functional dependencies are :

$F = (A \rightarrow C, B \rightarrow C, C \rightarrow D, DE \rightarrow C, CE \rightarrow A)$ 2 + 5 + 8

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9. Consider the following tables :

   Loan : {cust_id, name, amount}

   Deposit : {cust_id, name, branch, balance}

   a) Represent the following using relational algebra :

      i) Names of customers having both loan & deposit accounts.

      ii) Names of customers having loan account, but no deposit account.

      iii) Find the branch name where customers having loan account and deposit accounts. Do not use standard natural join operator.

   b) Using tuple calculus, find the names of customers having deposit account in 'xyz' branch having balance > 7500.   (3 + 3 + 5) + 4

10. Outline an algorithm for insertion of a record in a B$^+$ tree. Construct a B$^+$ tree for the following set of key values under the assumption that the number of key values that fit in a node is 3 :

   Key values : 3,10,12,14,29,38,45,55,60,68

   Show the steps involved in the following insertions : Insert 11 & 30.   5 + 5 + 5

11. Write short notes on any *two* of the following : $2 \times 7\frac{1}{2}$

    a)   Query and its optimization

    b)   Network Data Model

    c)   Enhanced ER Diagram

    d)   Applications of Normalization

    e)   Armstrong's Axioms.