Course Code : CST 321 **KOLP/RW – 19 / 9545**

Sixth Semester B. E. (Computer Science and Engineering) Examination

DATABASE MANAGEMENT SYSTEM

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) Assume suitable data wherever necessary.
(2) Each question carries marks as indicated against them.

1. (a) Think of different users for the database. What types of applications would each user need ? To which user category would each belong, and what type of interface would each need ? 3(CO1)

(b) Consider the employee database, where the primary keys are underlined. Give an expression in SQL for each of the following queries.

employee (employee–name, street, city)

Works (employee–name, company–name, salary)

company (company–name, city)

manages (employee–name, manager–name)

(1) Find all employees in the database who earn more than each employee of Small Bank Corporation. 1

(2) Find all employees who earn more than the average salary of all employees of their company. 2

(3) Find the company that has the most employees. 2

(4) Find those companies whose employees earn a higher salary, on average, than the average salary at First Bank Corporation. 2

2. (a) Compute the closure of the following set F of functional dependencies for relation schema R = (A, B, C, D, E).

$$F = \{ A \rightarrow BC$$
$$CD \rightarrow E$$
$$B \rightarrow D$$
$$E \rightarrow A \ \}$$

Find the candidate keys for R. Support your answer with appropriate proof. 5(CO2)

(b) For relation R(L, M, N, O, P) the following dependencies hold:{M→O, NO→P, P→L and L→MN}
R is decomposed into R1 = (L, M, N, P) and R2 = (M, O). Use Lossless Join Decomposition algorithm to determine whether this decomposition is lossless or lossy. Does it preserve the dependencies ? 5(CO2)

OR

(c) Define Boyce–Codd normal form. How does it differ from 3NF ? Why is it considered a stronger form of 3NF ? 5(CO2)

3. (a) What do you mean by bitmap index ? List its advantages and disadvantages. Consider a bitmap indexing scheme on the following data :

Roll No	Year	Department	Programme
12111	2012	CS	PhD
13115	2013	CS	MTech
13121	2013	EE	MTech
13125	2013	EE	PhD
14111	2014	CS	MTech
14119	2014	CS	PhD

where the possible values of year, department and program are as follows: year = {2011, 2012, 2013, 2014}; department = {CS, EE}; program ={MS, MTech, PhD, BTech}. What will be the btmaps used and the result for the query: "Find out students from year 2013 that are enrolled in MTech programme?" 5(CO4)

(b) Construct a B+ tree for following search keys:
1, 3, 5, 7, 9, 2, 4, 6, 8, 10. Suppose each B+ tree node can hold up to 4 pointers and 3 keys. 5(CO4)

4. (a) What is meant by the term heuristic optimization ? Discuss the main heuristics that are applied during query optimization. 5(CO4)

(b) Clustering indices may allow faster access to data than a non–clustering index affords. When must we create a non–clustering index ? Explain your anwer. List the advantages of a clustering index. 5(CO4)

5. (a) Prove that the wait–die and wound–wait protocols avoid deadlock and starvation. 5(CO5)

(b) Consider the three transactions T1, T2, and T3, and the schedules S1 and S2 given below. Draw the serializability (Precedence) graphs for S1 and S2, and state whether each schedule is serializable or not. If a schedule is serializable, write down the equalent serial schedule(s).

T1 : r1(X) ; r1(Z) ; w1(X);

T2 : x2(Z) ; r2(Y) ; w2(Z) ; w2(Y);

T3 : r3(X) ; r3(Y) ; w3(Y);

S1 : r1(X) ; r2(Z) ; r1(Z) ; r3(X) ; r3(Y) ; w1(X) ; w3(Y);
r2(Y) ; w2(Z) ; w2(Y);

S2 : r1(X) ; r2(Z) ; r3(X) ; r1(Z) ; r2(Y) ; r3(Y) ; w1(X);
w2(Z) ; w3(Y) ; w2(Y); 5(CO5)

OR

(c) Discuss the ACID properties of a database transaction. 5(CO5)

6. (a) What is the two–phase locking protocol ? How does it gurantee serializability? 5(CO5)

(b) How are buffering and caching techniques used by the recovery subsystem? 5(CO5)