Indian Institute of Engineering Science and Technology, Shibpur
B.Tech(CST) 5th Semester Mid Semester Examinations, December 2020
(Database Management Systems CS 501)

Full Marks: 30 **Time:** 45 Minutes

1. Given the relations
EMPLOYEE (name, salary, deptno)
DEPARTMENT(deptno, deptname, address)

Which of the following queries cannot be expressed using the basic relational algebra operations?

(a) Department address of every employee
(b) Employees whose name is the same as their department name
(c) The sum of all employees' salaries
(d) All employees of a given department

2. Suppose we have a file with n records organised into a B-tree with parameters d and e (d for index block, e for data block). If the values of all such parameters are n = 1,000,000, d = 50, e = 5, what is the expected number of read/write of blocks in an update operation ?

3. Given the following relation instance

X	Y	Z
1	4	2
1	5	3
1	6	3
3	2	2

Which of the following functional dependencies are satisfied by the instance?
(a) XY -> Z and Z -> Y
(b) YZ -> X and Y -> Z
(c) YZ -> X and X -> Z
(d) XZ -> Y and Y -> X

4. Which one of the following statements about normal forms is FALSE?
(a) BCNF is stricter than 3NF
(b) Lossless, dependency-preserving decomposition into 3NF is always possible
(c) Lossless, dependency-preserving decomposition into BCNF is always possible
(d) Any relation with two attributes is in BCNF

5. Consider a schema R(A, B, C, D) and functional dependencies A -> B and C -> D. Then the decomposition of R into R1 (A, B) and R2(C, D) is
a) dependency preserving and loss less join
b) loss less join but not dependency preserving
c) dependency preserving but not loss less join
d) not dependency preserving and not loss less join

[5x1=5]

6. Consider the following relational schema:

TEACHER (tname,dept,tel_no, sub_title)
STUDENT (sname, course, hall)
STUDY (sub_title, sname, status, marks)

Here status may be 'core' or 'elective'.

Write the query 'List the name and marks of each student in B. S.C. course who takes DBMS as elective subject' in the following form:

a) Relational Algebra
b) Tuple relational calculus
c) SQL

[3x5=15]

7. Draw the ER diagram for the following:

A Zoo has many types of animals. Every type has a unique name. Every animal of the same type has a unique animal ID. Animals in two types may have the same animal ID. Animals also have age and gender. Animals may have diseases. The beginning time and the duration of a disease need to be recorded. A disease has a unique name. A type keeper takes care of only one type of animals. Every type may have many type keepers. A type keeper may or may not be familiar with diseases. But every disease must be handled by at least one type keeper. Type keepers have name, employee ID, Aadhar no., address and phone number.

All animals are in cages. Some cage may be empty. Every cage has a cage ID, space and height. A cage keeper may take care of many cages. Every non-empty cage must have at least one cage keeper. Empty cages don't need any cage keepers. Cage keepers have name, employee ID, Aadhar no., address and phone number.

Also note the following during drawing:

(a)Animal is a weak entity.
(b) Use ISA
(c) Type keepers take care of only one type.
(d) All non-empty cages must have at least one cage keeper.

Finally, write down any assumptions you make. [10]