

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, May, 2019

B. Tech. in Computer Science Engineering, Semester: IV

Roll No.....

CSESP401: Information Management Basics

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Note: Every question is mapped with expected Learning Outcomes (LO) of this course. Specific LO number is mentioned along with the question in square bracket.

Q.1 Consider the following relational database, where the primary keys are : 10
underlined.

employee (person-name, street, city)
works (person-name, company-name, salary)
company (company-name, city)
manages (person-name, manager-name)

[LO5,
LO6]

Give an expression in the relational algebra to express each of the following queries:

- a. Find the names and cities of residence of all employees who work for First Bank Corporation.
- b. Find the names, street address, and cities of residence of all employees who work for First Bank Corporation and earn more than Rs. 4,00,000 per annum.
- c. Find the names of all employees in this database who live in the same city as the company for which they work.
- d. Find the names of all employees who live in the same city and on the same street as do their managers.
- e. Find the names of all employees in this database who do not work for First Bank Corporation.
- f. Find the names of all employees who earn more than every employee of Small Bank Corporation.
- g. Assume the companies may be located in several cities. Find all companies located in every city in which Small Bank Corporation is located.
- h. Modify the database so that Surabhi now lives in Mahapura.
- i. Give all employees of First Bank Corporation a 10 percent salary raise.
- j. Give all managers in this database a 10 percent salary raise.

Consider the following information about a university database for Q.2 and Q.3:

- Professors have an Aadhar#, a name, an age, a rank, and a research specialty.
- Projects have a project number, a sponsor name (e.g., DST), a starting date, an ending date, and a budget.
- Graduate students have an Aadhar#, a name, an age, and a degree program (e.g., B.Tech., M.Sc. or Ph.D.).
- Each project is managed by one professor (known as the project's principal investigator).
- Each project is worked on by one or more professors (known as the project's co-investigators).
- Professors can manage and/or work on multiple projects.
- Each project is worked on by one or more graduate students (known as the project's research assistants).
- When graduate students work on a project, a professor must supervise their work on the project.
- Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one.
- Departments have a department number, a department name, and a main office.
- Departments have a professor (known as the HoD) who runs the department.
- Professors work in one or more departments, and for each department that they work in, a time percentage is associated with their job.
- Graduate students have one major department in which they are working on their degree.
- Each graduate student has another, more senior graduate student (known as a student advisor) who advises him or her on what courses to take.

Q.2 Design and draw an ER diagram that captures the information about the university. Be sure to indicate any key and participation constraints. 15 [LO2]

Q.3 Consider the above university database and the ER diagram you designed in Q.2. Write SQL statements to create the corresponding relations and capture as many of the constraints as possible. If you cannot capture some constraints, explain why. 15 [LO7, LO8]

Q.4 Consider the relation REFRIG(MODEL#, YEAR, PRICE, MANUF_PLANT, COLOR), which is abbreviated as REFRIG(M, Y, P, MP, C), and the following set of F of functional dependencies: $F = \{M \rightarrow MP, \{M, Y\} \rightarrow P, MP \rightarrow C\}$ 15 [LO4]

a. Evaluate each of the following as a candidate key for REFRIG, giving reasons why it can or cannot be a key: $\{M\}$, $\{M, Y\}$, $\{M, C\}$

- b. Based on the above key determination, state whether the relation REFRIG is in 3NF and in BCNF, giving proper reasons.
- c. Consider the decomposition of REFRIG into $D=\{R1(M,Y,P), R2(M,MP,C)\}$. Is this decomposition lossless? Show why.

Q.5

record 0	A-102	Pune	400
record 1	A-305	Roper	350
record 8	A-218	Pune	700
record 3	A-101	Delhi	500
record 4	A-222	Reva	700
record 5	A-201	Pune	900
record 6	A-217	Bengaluru	750
record 7	A-110	Delhi	600

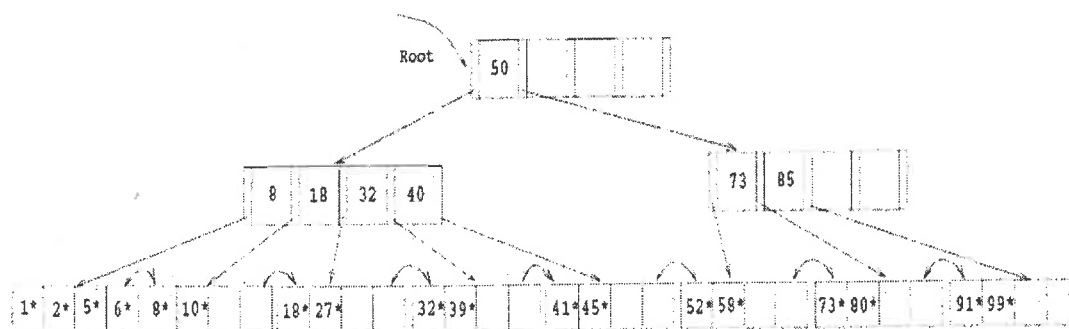
10

[LO9]

Consider the deletion of record 5 from the file of above figure. Compare the relative merits of the following techniques for implementing the deletion:

- Move record 6 to the space occupied by record 5, and move record 7 to the space occupied by record 6.
- Move record 7 to the space occupied by record 5.
- Mark record 5 as deleted, and move no records.

Q.6



15

[LO9]

Consider the B+ tree index shown in above figure.

- Show the tree that would result from inserting a data entry with key 9 into this tree.
- Show the B+ tree that would result from inserting a data entry with key 3 into the original tree. How many page reads and page writes does the insertion require?
- Show the B+ tree that would result from deleting the data entry with key 8 from the original tree, assuming that the left sibling is checked for possible redistribution.

- d. Show the B+ tree that would result from deleting the data entry with key 8 from the original tree, assuming that the right sibling is checked for possible redistribution.
- e. Show the B+ tree that would result from starting with the original tree, inserting a data entry with key 46 and then deleting the data entry with key 52.

Q.7 Consider a database with objects X and Y and assume that there are two transactions T1 and T2. Transaction T1 reads objects X and Y and then writes object X. Transaction T2 reads objects X and Y and then writes objects X and Y. [LO10, LO11] 10

- a. Give an example schedule with actions of transactions T1 and T2 on objects X and Y that results in a write-read conflict.
- b. Give an example schedule with actions of transactions T1 and T2 on objects X and Y that results in a read-write conflict.
- c. Give an example schedule with actions of transactions T1 and T2 on objects X and Y that results in a write-write conflict.
- d. For each of the three schedules, show that Strict 2-Phase Lock protocol disallows the schedule.

Q.8 Consider the following two transactions:

T31: read(A);
 read(B);
 if A = 0 then B := B + 1;
 write(B).
 T32: read(B);
 read(A);
 if B = 0 then A := A + 1;
 write(A).

10
 [LO12]

- a. Add lock and unlock instructions to transactions T31 and T32, so that they observe the two-phase locking protocol.
- b. Can the execution of these transactions result in a deadlock? Support your answer with an example.