

- b) Given a relation $R(A,B,C)$. Find the minimal cover of the set of functional dependencies given; (3)
- $F = \{A \rightarrow BC, B \rightarrow C, A \rightarrow B, AB \rightarrow C\}$
- c) What is the lossless (or nonadditive) join property of decomposition? Why is it important? (3)
- 14 Consider the relation $R = \{A, B, C, D, E, F, G, H\}$ and the set of functional dependencies $F = \{A \rightarrow DE, B \rightarrow F, AB \rightarrow C, C \rightarrow GH, G \rightarrow H\}$. What is the key for R? Decompose R into 2NF and then 3NF relations. (9)

PART E

Answer any four full questions, each carries 10 marks.

- 15 a) Suppose that we have an ordered file with 400,000 records stored on a disk with block size 4,096 bytes. File records are of fixed size and are unspanned, with record length 200 bytes. How many blocks are needed for the file? Approximately, how many block accesses are required for a binary search in this file? On an average, how many block accesses are required for a linear search, if the file is nonordered? (6)
- b) Based on question 15.a, give an example to illustrate that indexing can improve the search time. (4)
- 16 a) Explain the structure of an internal node and a leaf node in a B+-tree. (5)
- b) Illustrate with an example how searching for a record with search key field value is done using a B+-Tree. (5)
- 17 Why Concurrency Control Is Needed? What are the different types of problems we may encounter when two transactions run concurrently? Illustrate each problem with suitable examples. (10)
- 18 a) What are the desirable properties of transactions? Explain. (4)
- b) "If every transaction in a schedule follows the two-phase locking protocol, the schedule is guaranteed to be serializable", justify the statement. (3)
- c) What are the different types of lock that are commonly used in concurrency control? (3)
- 19 a) Consider the following tables representing courses taken by instructors in an institute: (10)
- INSTRUCTOR(ID, NAME, DEPT, SALARY)
- TEACHES(ID, COURSE-ID, SEMESTER, YEAR)
- COURSE(COURSE-ID, TITLE, DEPT, CREDITS)
- where, ID and COURSE-ID are foreign keys referring to the primary keys with the

same names. Show an initial query tree for the following query and optimize it using the rules of heuristics. Assume that TITLE is a candidate key of COURSE.

```
SELECT NAME, TITLE, SEMESTERYEAR
```

```
FROM INSTRUCTOR, COURSE, TEACHES
```

```
WHERE COURSE.COURSE-ID=TEACHES.COURSE-ID AND
```

```
TEACHES.ID = INSTRUCTOR.ID AND INSTRUCTOR.DEPT = 'MATHS'
```

```
AND TEACHES.DEPT = INSTRUCTOR.DEPT
```

- 20 a) Write a short note on Big Data. (4)
- b) What is a semantic web technology? How is it relevance? (3)
- c) How does RDF support semantic web technology? (3)

