

SECTION-B

2. Emerging Electric wishes to create a database with the following entities and attributes :
- a) Customer, with attributes Customer ID, Name, Address (Street, City, State, Zip Code), and Telephone
 - b) Location, with attributes Location ID, Address (Street, City, State, Zip Code), and Type (values of Business or Residential)
 - c) Rate, with attributes Rate Class and RatePerKWH

After interviews with the owners, you have come up with the following business rules:

- i) Customers can have one or more locations.
- ii) Each location can have one or more rates, depending on the time of day.

Draw an ERD for this situation and place minimum and maximum cardinalities on the diagram. Also, draw a data model for this situation. State any assumptions that you have made.

3. a) What is the relationship between the primary key of a relation and the functional dependencies among all attributes within that relation?
- b) How does a query tree represent a relational algebra expression? Discuss any three rules for query optimization, giving example as to when should each rule be applied.
4. What do you understand by transitive dependencies? Explain with an example **any two** problems that can arise in the database if transitive dependencies are present in the database.
5. In the three-tiered database architecture, is it possible for there to be no database on a particular tier? If not, why? If yes, give an example.
6. Let transactions T_1 , T_2 and T_3 be defined to perform the following operations :

T_1 : Add one to A

T_2 : Double A

T_3 : Display A on the screen and then set A to one.

(Where A is some item in the database) Suppose transactions T_1 , T_2 and T_3 are allowed to execute concurrently. If A has initial value zero, how many possible correct results are there? Enumerate them.

SECTION-C

7.
 - a) What is meant by heuristic optimization? Discuss the main heuristics that are applied during query optimization.
 - b) Consider the relation Student (student, name, course, year) Given that A student may take more than one course but has unique name and the year of joining.
 - i) Identify the functional and multivalued dependencies for Student.
 - ii) Identify a candidate key using the functional and multivalued dependencies arrived at in step (b).
 - iii) Normalize the relation so that every decomposed relation is in 4NF.
8. What are deferred modification and immediate modification technique for recovery? How recovery does take place in case of a failure in these techniques?
9.
 - a) What are wait-for-graphs? Give the algorithm to construct a wait-for-graph from a given schedule of transactions. How can deadlocks be detected from wait-for-graphs?
 - b) What are the costs to be considered when a transaction has to be rolled back when recovering from deadlock?