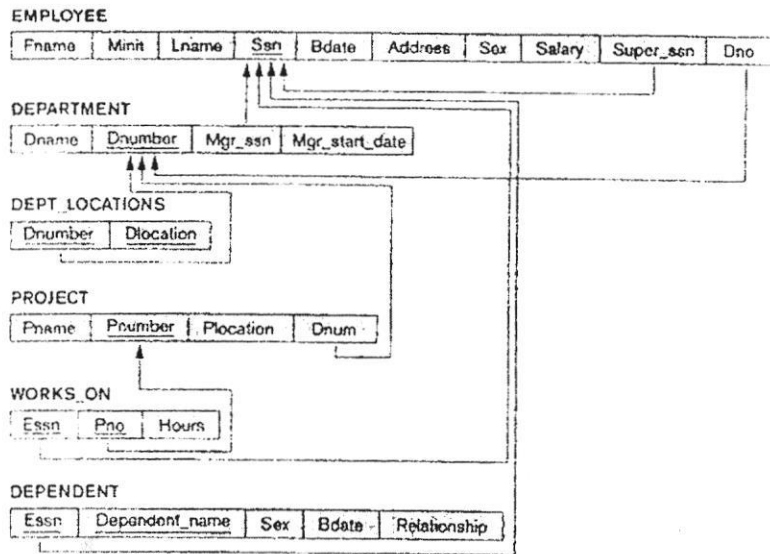


each disk block contains R records. Identify the number of records to be maintained for the primary index constructed for this data file. (3)

(b) Consider the COMPANY database schema as given below :



(i) Give SQL query to retrieve the names and SSN of employees who have exactly two dependents. (3)

(ii) Give SQL query to create table *WORKS_ON* including all integrity constraints. (3)

(c) Write a query in **Relational Algebra** to display Name and Salary for all employees who work for a project named 'CovidVaccine'. (3)

5. (a) What are the responsibilities of the DBA and database designers? (3)

(b) Explain the three schemas in three-tier DBMS architecture? Define Data independence. What is the difference between logical data independence and physical data independence? (7)

6. (a) Given the following functional dependencies set G on $R(A, B, C, D, E, F)$.

$$G = \{A \rightarrow BDE, AB \rightarrow C, D \rightarrow ACE, B \rightarrow F\}$$

Find the closure of AC. What will be the minimal primary key for this relation? (4)

(b) Generate a B+-tree of order $p=3$ and $p_{leaf}=2$ for the given sequence of values 10, 15, 12, 14, 16, 17, 8. (6)

7. (a) What are the constraints on specialization and generalization in DBMS? Explain them with example. (4)

T1	T2
Read item(X);	
X = X-N;	
	Read item(X);
	X = X+M;
Write item(X);	
Read item(Y);	
	Write item(X);
Y=Y+N;	
Write item(Y);	

4. Consider the COMPANY database schema given in Q 1b.

(a) Give SQL query to retrieve Department No, Department Name, Manager Name and the number of locations for all the departments. (3)

(b) Give SQL query to retrieve the project number, project name, controlling department name, the number of employees working on the project and the total salary paid to these employees. (4)

(c) Given below are two relational tables *T1* and *T2*. The key in each table is underlined.

T1(CarId, Carname, Carmodel, Cost)

T2(Carmodel, Insurance-cost)

While implementing the database, the programmer did not define foreign key constraint on the common attribute *Carmodel*. Identify all anomalies which may arise due to this mistake. Explain any one of the anomaly with an example. (4)

(d) Differentiate between the relational model, the object model, and the XML model? (3)

(e) Given a relation *PROJECT*(Ssn, Pnumber, Hours, Ename, Pname, Plocation) with the following FDs as

$F = \{ Ssn, Pnumber \rightarrow Hours,$

$Ssn \rightarrow Ename,$

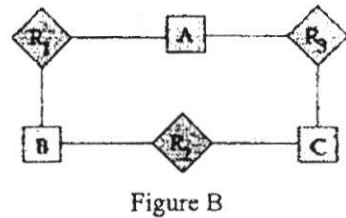
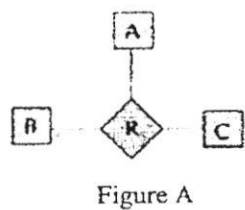
$Pnumber \rightarrow Pname,$

$Plocation, Ssn, Pnumber \rightarrow Pname,$

$Pname \rightarrow Plocation \}$.

Identify the redundant functional dependencies and give justification for the same. (3)

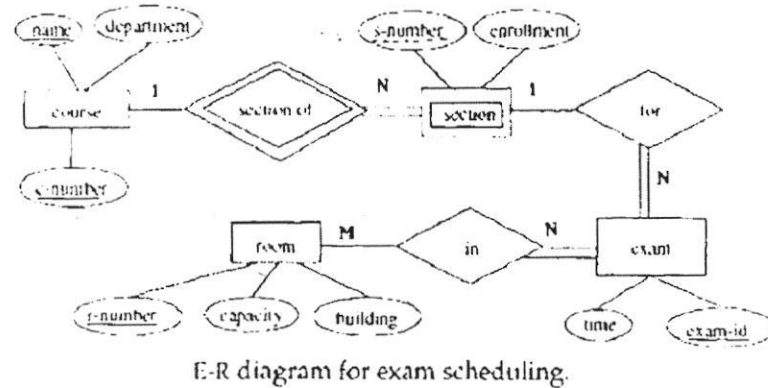
- (f) Give example of a relation, which is in 3NF, but not in BCNF. State all the functional dependencies used in the example. (2)
- (g) Given a relation $PROJ(Pnumber, Pname, Plocation)$, where $Plocation$ is a multi-valued attribute. Is this table in INF? Give justification for your answer. (2)
- (h) Can the ternary relationship R as given in Figure A be replaced with three binary relationships R1, R2 and R3 as given in Figure B? Give reason. (3)



- (i) Consider an *Online Store* selling three different types of items: books, music cassettes and video compact disks. The data requirements are summarized as follows. (4)
- Each shopping basket is identified by a unique order id, order_date and customer_name. It may consist of books, music cassettes and compact disks.

- (b) Given the following relationships, give the cardinality ratio and justify your answer. (2)
- Actors perform in movies
 - An instructor teaches at most one course

3. (a) Map the following ER diagram to relations.



- (b) Identify and explain the problem occurring in the concurrent execution of transactions (T1 & T2). (4)

- Each book is represented by `book_isbn`, title and author.
- Each music cassette is represented by the album name and the singer.
- Title and the director are stored for each compact disk.

Represent the shopping basket with an EER diagram, depicting the appropriate constraints.

- (j) Consider an entity type *COUNTRY* represented by *country_id*, *country_name*, *continent*, *area* and *population*.

Identify the following for the above entity and justify :

- One primary key
- Two candidate keys
- One super key (3)

- (k) Give any two commands used in Data Definition Language (DDL). (2)

P.T.O.

SECTION – B

2. (a) Consider an **Employment Agency** database that keeps track of candidates interviewing for jobs at various companies. The data requirements are summarized as follows :
- The Employment Agency manages *companies*, each identified by a *unique id, name, address and phone number*. Each *company* can conduct several interviews.
 - Each candidate is identified by a *unique id, first name, last name, phone number, academic qualification and pin code*. A candidate can give interviews in several companies.
 - A candidate can have several interviews with the same company on separate dates.
 - An *interview* may result in a *job offer*. The *job offer* is identified by *unique offer id, offer date, salary and post*.

Design an Entity-Relationship diagram for the Employment Agency database and specify structural constraints. (8)