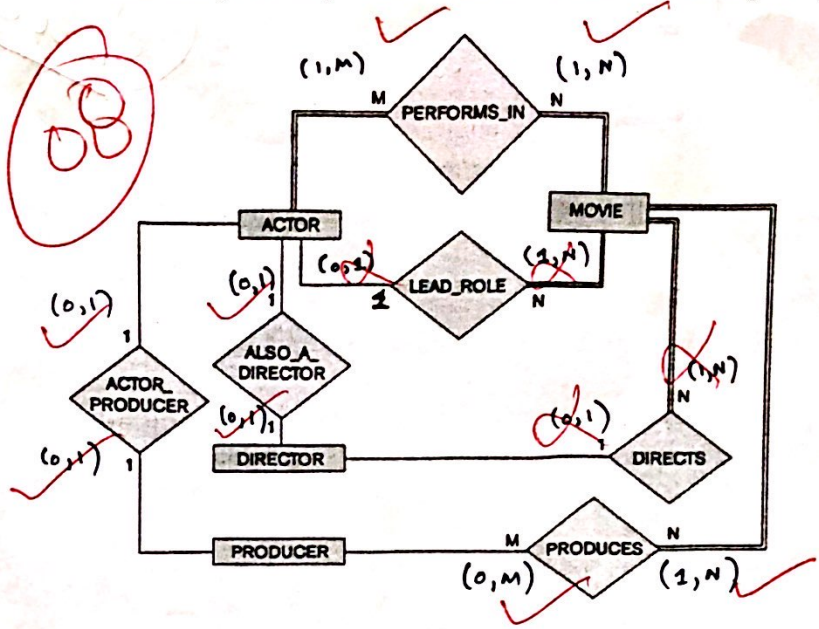
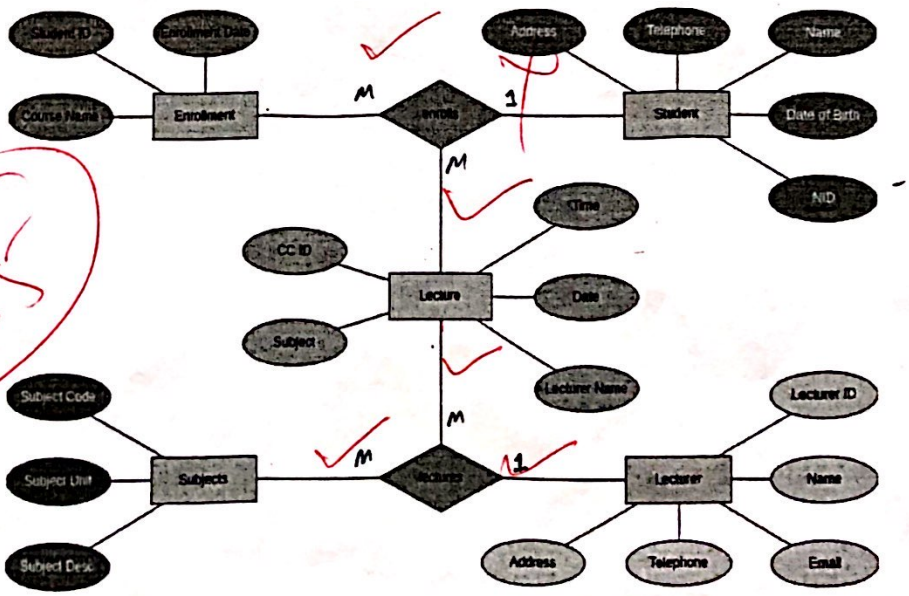
Question 1 [25 Marks]

a. An ER diagram for a movie database schema is given below. You have to write (min,max) constraints (modality) on every relationship. Clearly mention the constraints on the figure. *[12]*



b. The following entity relationship diagram shows a university management system. The students can enroll in the lecture by providing enrollment information. Student details include NID, date of birth, name, telephone numbers and address. When the student is enrolled in a lecture, his/her student id, course name and date of enrollment is saved. All lecturers give lectures regarding a subject. A lecturer can give multiple lectures for multiple subjects. In this database, lecturer's ID, name, email, an address and telephone numbers are saved.



i. Fill in the cardinalities in above ERD. Write assumptions if any. [3 marks]

2

ii. List all strong entities that exist in the above ERD? [2 marks]

Student, Lecturer, Subjects

01

iii. Please specify the type of attributes in above ERD [5 marks]

Attribute name	Attribute type
Subject Code	Key attribute
Address	Composite attribute
Telephone	Multi-valued attribute
Date of Birth	Composite attribute
Course Name	atomic / simple attribute
Name	Composite attribute
Date	Composite attribute
Subject Desc (subject description)	Simple attribute
Student ID	~~Key attribute~~ Derived attribute
Email	Key attribute

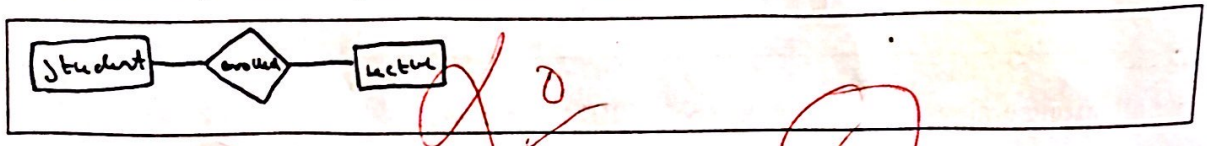
3.5

iv. Which type of relation exists between Lecturer, student and subject? [2]

Ternary Relationship

02

v. List an example of a binary relation in above ERD [1]



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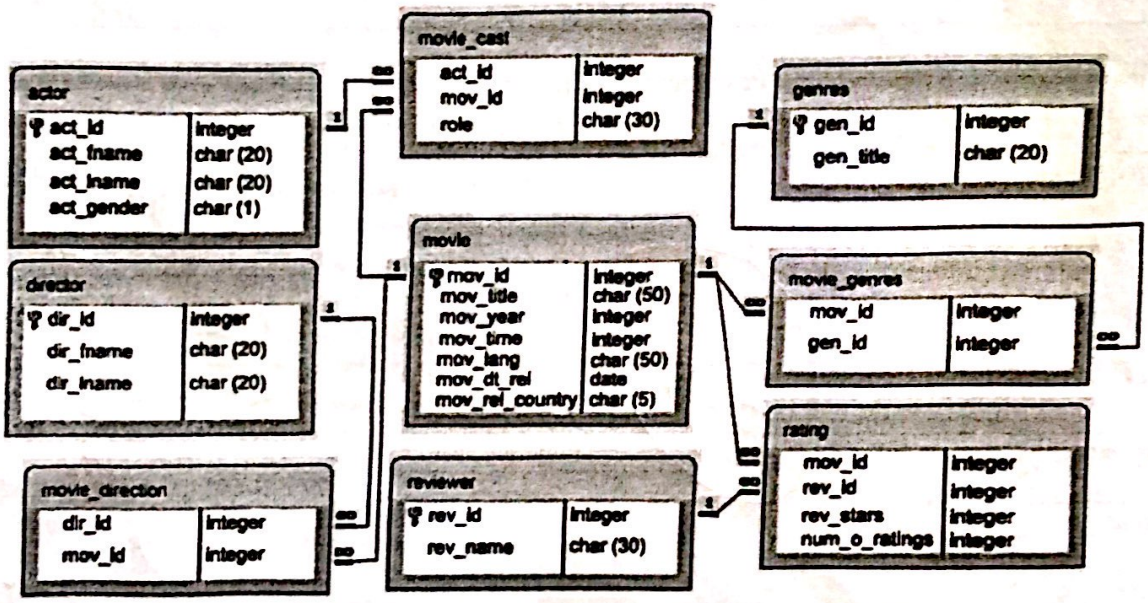
Question 2 [10 Marks] 05

Apply SQL DML statements on the following schema to answer the queries given below [10 Marks]



i. Write a query in SQL to find the movies which were released in between 1988 and 1999.

```
Select mov_title
From movie
where mov_year >=1988 AND mov_year <=1999
```

2

ii. Write a query in SQL to find the total number of all male actors

```
Select sum(act_gender)
From actor
where act_gender = 'M'
```

0

iii. Write a SQL query to display full name of all female actresses in descending order.

```
Select act_fname, act_lname
From actor
where act_gender = 'F' Sort by Desc
```

order 01

iv. Write a SQL query to find the ID of all movies that have no ratings.

```
Select mov_id
From rating
where num_o_ratings = 0
```

02

v. Write a SQL query to list the movie id with maximum stars

```
Select mov_id
From rating
where rev_stars is MAX
```

0

Question 3 [10 Marks]

a. Imagine you are a database architect working on a project for a retail company. The company operates both physical stores and an online e-commerce platform. To streamline operations and enhance data management, you decide to implement the Three Schema Architecture in your database management system (DBMS). In the context of the retail company's database system following the Three Schema Architecture, which schema is responsible for the following:

Managing the physical storage details of the data, including data storage structures and access paths? [1]

(i.) External Schema
ii. Conceptual Schema
iii. Internal Schema

D DS

Providing a high-level, abstract view of the entire database, defining the overall structure and relationships between data elements? [1]

i. External Schema
ii. Conceptual Schema
(iii.) Internal Schema

Defining user-specific views of the database, catering to different user groups such as store managers, online sales teams, and inventory controllers? [1]

i. External Schema

ii. Conceptual Schema

iii. Internal Schema

Enabling efficient querying and retrieval of data for day-to-day operations, such as finding the current stock of a product in a specific store? [1]

i. External Schema

ii. Conceptual Schema

iii. Internal Schema

b. In a DBMS with program data independence, consider a scenario where a university decides to update its student registration system. They want to add a new field called "Student Photo" to the student records, which will store a photograph of each student.

Which statement best describes the significance of program data independence in this scenario? [2]

i. Program data independence allows changes to the database structure without affecting the application programs that use the data.

ii. Program data independence ensures that all data updates are done programmatically, eliminating the need for manual data entry.

iii. Program data independence guarantees that only authorized users can access and modify the student records.

iv. Program data independence automates the process of taking student photographs and linking them to the database.

c. A popular online multiplayer game with thousands of concurrent players is experiencing high demand due to a special in-game event. Players are competing, trading items, and making in-game purchases. The game's DBMS handles these transactions.

In this context, what is a key challenge that the DBMS needs to address to ensure smooth multi-user transaction processing? [2]

i. Ensuring that players can access the game servers at any time.

ii. Managing the game's graphics and visual effects to maintain a high-quality gaming experience.

iii. Handling concurrent access and updates to the game database while maintaining data consistency and integrity.

iv. Preventing players from using third-party cheats and hacks.

d. In a government agency's Database Management System (DBMS), multiple departments have access to a centralized database containing citizen records, tax information, and public service requests. Different departments need to retrieve and update information as part of their daily operations. [2]

Which DBMS characteristic is most essential for ensuring smooth collaboration and data sharing among multiple users across various departments?

i. Data Consistency

ii. Data Security

iii. Data Redundancy

iv. Data Sharing and Concurrency Control