ASSIGNMENT-1

DATABASE AND MANAGEMENT SYSTEM-CSA0556

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Task 1: Entity Identification and Attributes

Entities and Attributes

1. Roads

- - RoadID (PK)
- - RoadName
- - Length (in meters)
- - SpeedLimit (in km/h)

- **2. Intersections**
- - IntersectionID (PK)
- - IntersectionName
- - Latitude
- - Longitude

- **3. Traffic Signals**
- - SignalID (PK)

- - IntersectionID (FK)
- - SignalStatus (Green, Yellow, Red)
- - Timer (countdown to next change)

- **4. Traffic Data**
- - TrafficDataID (PK)
- - RoadID (FK)
- - Timestamp
- - Speed (average speed on the road)
- - CongestionLevel (degree of traffic congestion)

Task 2: Relationship Modeling

Relationships

1. Roads and Intersections

- - One-to-Many: A road can have multiple intersections (at either end).
- - An intersection can be connected to multiple roads.

2. Intersections and Traffic Signals

- - One-to-One: Each intersection hosts one traffic signal.
- - Optionality: An intersection might not have a traffic signal (optional).

3. Roads and Traffic Data

- - One-to-Many: A road can have multiple traffic data entries over time.

Cardinality and Optionality Constraints

1. Roads to Intersections

- - One Road to Many Intersections (1:N)
- - One Intersection to Many Roads (1:N)

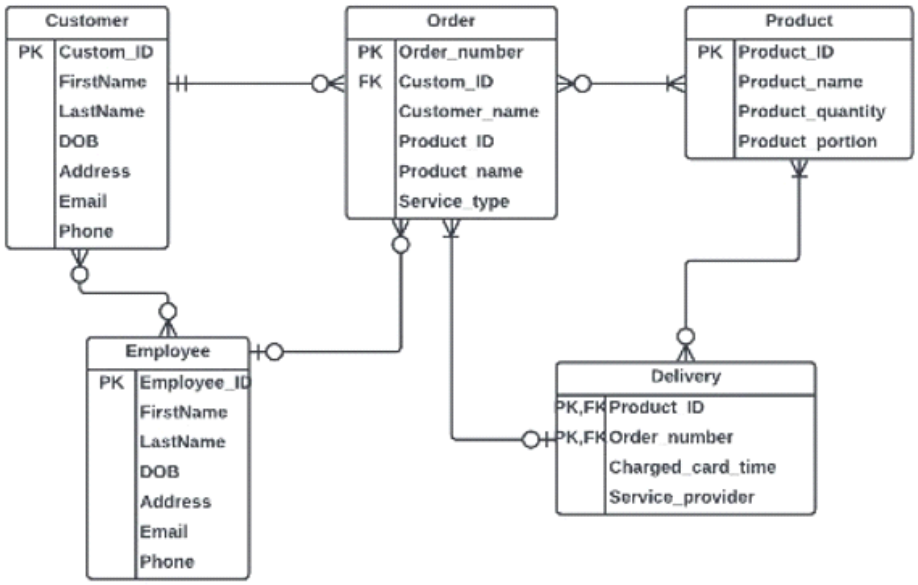
- **2. Intersections to Traffic Signals**
- - One Intersection to One Traffic Signal (1:1)
- - Traffic Signal is optional at an intersection.

3. Roads to Traffic Data

- - One Road to Many Traffic Data entries (1:N)

Task 3: ER Diagram Design

Entity Relationship Diagram:



Task 4: Justification and Normalization

Justification:

1. Scalability:

- - The design allows for easy addition of new roads, intersections, and traffic signals without affecting existing data.
- - Real-time data integration is facilitated through a separate Traffic Data entity, ensuring high performance for read/write operations.

2. Real-time Data Processing:

- - Separate entity for Traffic Data ensures that real-time data can be processed and stored efficiently.
- - Relationships are designed to minimize redundancy and optimize querying capabilities.
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3. Efficient Traffic Management:

- - Clear relationships between roads, intersections, and traffic signals enable effective traffic signal control and route optimization.
- - Historical traffic data storage allows for analysis and future planning.

Normalization:

1. First Normal Form (1NF):

- - Each attribute contains only atomic (indivisible) values.
- - Each record is unique, identified by a primary key.

2. Second Normal Form (2NF):

- - The ER diagram meets 2NF as all non-key attributes are fully dependent on the primary key.

3. Third Normal Form (3NF):

- - The diagram adheres to 3NF by ensuring that all attributes are directly dependent on the primary key and not on other non-key attributes.

Deliverables:

ER Diagram:

The ER diagram is illustrated above, accurately reflecting the structure and relationships of the TFMS database.

Entity Definitions

- - Roads: Contains attributes such as RoadID, RoadName, Length, and SpeedLimit.
- - Intersections: Contains attributes such as IntersectionID, IntersectionName, Latitude, and Longitude.
- - Traffic Signals: Contains attributes such as SignalID, IntersectionID, SignalStatus, and Timer.
- - Traffic Data: Contains attributes such as TrafficDataID, RoadID, Timestamp, Speed, and CongestionLevel.

Relationship Descriptions

- - Roads to Intersections: One road can connect to multiple intersections, and an intersection can connect multiple roads.
- - Intersections to Traffic Signals: Each intersection can host one traffic signal, which is optional.
- - Roads to Traffic Data: One road can have multiple traffic data entries over time.

Justification Document

- - Scalability: The design allows for adding new entities without affecting existing data.
- - Real-time Data Processing: Separate entity for real-time traffic data ensures efficient data handling.
- - Efficient Traffic Management: Clear relationships enable effective control and optimization of traffic flow.
- - Normalization: The diagram adheres to 1NF, 2NF, and 3NF, ensuring data integrity and minimizing redundancy.