**ASSIGNMENT – 1**

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**DATABASE MANAGEMENT SYSTEM(DBMS)**

**Task 1: Entity Identification and Attributes**

**Entities and Attributes**

* **Roads**
* RoadID (PK)
* RoadName
* Length (in meters)
* SpeedLimit (in km/h)
* **Intersections**
* IntersectionID (PK)
* IntersectionName
* Latitude
* Longitude
* **Traffic Signals**
* SignalID (PK)
* IntersectionID (FK)
* SignalStatus (Green, Yellow, Red)
* Timer (countdown to next change)
* **Traffic Data**
* TrafficDataID (PK)
* RoadID (FK)
* Timestamp
* Speed (average speed on the road)
* CongestionLevel

**Task 2: Relationship Modeling**

**Relationships and Cardinality**

* **Roads to Intersections**
* One-to-Many: Each road can connect to multiple intersections, but each intersection is on a single road.
* Relationship: RoadID (PK in Roads, FK in Intersections)
* **Intersections to Traffic Signals**
* One-to-One: Each intersection has one traffic signal, and each traffic signal controls one intersection.
* Relationship: IntersectionID (PK in Intersections, FK in Traffic Signals)
* **Roads to Traffic Data**
* One-to-Many: Each road can have multiple traffic data records collected over time.
* Relationship: RoadID (PK in Roads, FK in Traffic Data)

**Task 3: ER Diagram Design**



**Task 4: Relationship entity diagram**



**Task 5: Justification and Normalization**

**Justification for Design Choices**

* **Scalability**: The design allows for easy addition of new roads, intersections, and traffic signals as the city expands.
* **Real-Time Data Processing**: Real-time traffic data is associated with specific roads, making it easier to analyze current conditions and make quick decisions.
* **Efficient Traffic Management**: The relationships ensure that traffic signals are linked to intersections, enabling dynamic control based on real-time data.

**Normalization Considerations**

* **First Normal Form (1NF)**: All attributes in each entity contain atomic values, ensuring no repeating groups.
* **Second Normal Form (2NF)**: All non-key attributes are fully functionally dependent on the primary key. For instance, in the Traffic Data entity, Speed and CongestionLevel depend on TrafficDataID.
* **Third Normal Form (3NF)**: All attributes are not only fully functionally dependent on the primary key but are also non-transitively dependent. This ensures no redundancy. For example, in the Traffic Signals entity, SignalStatus and Timer are only dependent on SignalID.

**Deliverables**

* **ER Diagram**: As illustrated above.
* **Entity Definitions**: Clear definitions provided in Task 1.
* **Relationship Descriptions**: Detailed descriptions with cardinality and optionality constraints in Task 2.
* **Justification Document**: Justification for design choices and normalization considerations explained in Task 4.

**Conclusion**

The ER diagram for the Traffic Flow Management System (TFMS) reflects a structured approach to managing city traffic by integrating real-time and historical data. The design choices ensure clarity in entity relationships and attributes, supporting functionalities such as route optimization and adaptive traffic signal control. Normalization principles further enhance data integrity and efficiency, making the system robust and scalable for future urban planning and traffic management needs.