Database Design Document for Automobile Manufacturing Operations
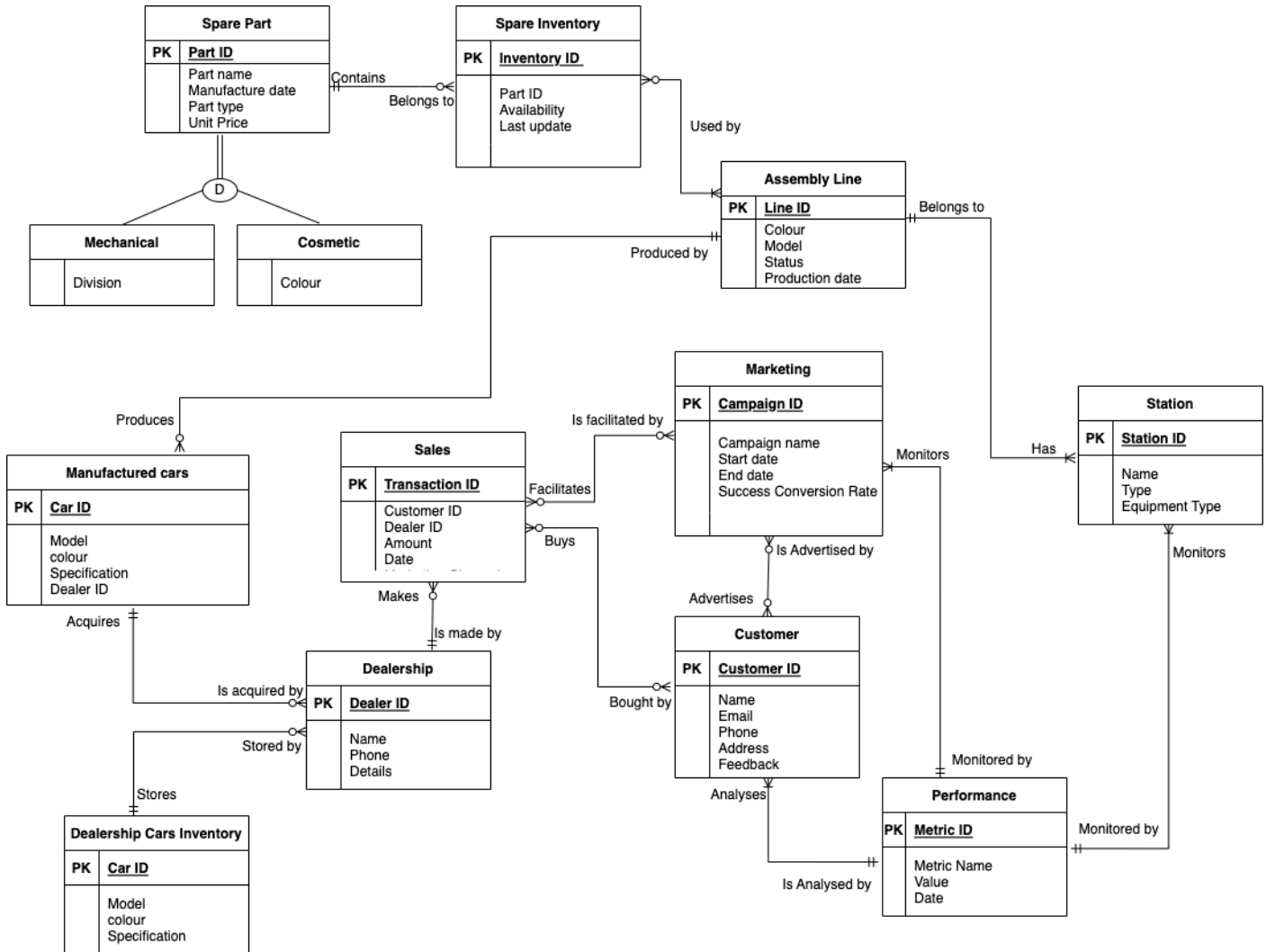
Group – 5

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Entity Relationship Diagram:

Business Problems Addressed:

- Our database aims to address the following business challenges faced by a car dealership:
- Inventory Management: Efficiently track car inventory, spare parts, and their availability.
- Sales Transactions: Record sales, manage customer information.
- Operational Optimization: Streamline assembly line processes and marketing efforts.
- Performance Metrics: Extract info from the sales conducted, equipment and the marketing activities for targeted strategies enabling the business for overall betterment and improved customer satisfaction and retention.

Entities and Relationships:

Spare Part:

- Represents individual spare parts (e.g., engine components, tires).
- Attributes: Part ID (Primary Key), Part Name, Manufacturing Date, Unit Price.
- Related to Spare Inventory through Inventory ID.
- Relationship: it is the super type of the spare part types cosmetic and mechanical, here its connected via a one mandatory to optional many relationship to spare parts inventory.

Mechanical & Cosmetic:

- Subtype of Spare Parts (e.g., mechanical or cosmetic).

- Attributes: Division (Mechanical), Colour (Cosmetic).
- Both related to Spare Part supertype entity.
- Relationship: they are the sub-type of spare parts and a spare part follow the total specialisation rule under the entity Spare Parts

Spare Inventory:

- Manages stock levels of spare parts.
- Attributes: Inventory ID (Primary Key), Part ID, Quantity Available.
- Related to Spare Part via Part ID.
- Relationship: Spare Inventory is an entity for managing the segregated inventory as per the ID and its availability, it is connected via a one mandatory to optional many, i.e. many spare parts must belong to a spare part inventory and one spare part inventory can contain many spare parts.

Manufactured Cars:

- Records specifications of manufactured cars.
- Attributes: Model (Primary Key), Specification, Dealer ID.
- Related to Dealership via Dealer ID.
- Relationship: Manufactured cars entity is managing the records for all the cars manufactured by the plant it is connected via an optional many to one mandatory relationship with assembly line. I.e. many cars from the assembly line can be manufactured cars and each manufactured car will be associated to a single assembly line.

Dealership:

- Manages dealership information
- Dealership Attributes: Dealer ID (Primary Key), Name, Phone, Address.
- Linked to Sale via Dealer ID
- Relationship: The relationship between Dealership entity and Manufactured Cars is Optional Many - Optional Many as manufactured cars can have many dealers or none and each dealer may or might not have a manufactured car to sell.

Dealership Cars Inventory:

- Manages car inventory
- Attributes: Car ID (Primary Key), Model, Colour, Specification
- Relationship: Dealership Car Inventory is connected to the Dealer entity via mandatory one - mandatory one relationship where an inventory must be associated with one dealer.

Sales:

- Sale records each transaction (car purchase).
- Attributes: Transaction Log ID (Primary Key), Customer ID, Dealer ID, Amount, Sale Date, Marketing Channel
- Related to Customer via Customer ID.
- Relationship: The relationship between Sales entity and Customer entity is Optional one - Optional Many. This means that for each sale (transaction), there can be 0 / 1 corresponding customer involved (Optional one). However, a single customer can be associated with multiple sales transactions (Optional Many).

Customer:

- Stores customer information (personal details, preferences).
- Attributes: Customer ID (Primary Key), Customer Name, Email, Phone, Address, Feedback
- Linked to Sale via Customer ID.
- Relationship: Each of the customer's behaviour is analysed by performance entity making it a many to mandatory one relationship; 0 or many customers can be advertised by marketing – making it an optional many to optional many relationship; 0 or many customer may or might not buy a vehicle – making it an optional many to optional many relationship with Sales.

Assembly Line:

- Assembly Line manages car assembly processes.
- Attributes: Line ID (Primary Key), Colour, Model, Production Date, Status
- Relationship: An assembly line has one or many stations, and a station must belong to an assembly line – making it to be mandatory one to mandatory many relationship; An assembly line from might use 0 or many parts from the spare inventory – making it mandatory many to optional many relationship; An assembly line may produce 0 or many manufactured cars,

although a manufactured car must belong to an assembly line – making it to be mandatory one to optional many relationship.

Marketing:

- Marketing tracks marketing efforts (e.g., test drives, promotions).
- Attributes: Camp ID (Primary Key), Campaign name, Start & end date, gross value.
- Relationship: Many Marketing channels is monitored by performance – making it a mandatory many to mandatory one relationship; Many marketing channels may or might not affect 0 / more sales – making it an optional many to optional many relationship; Many marketing channels may or might not affect 0 / more customers – making it an optional many to optional many relationship.

Stations:

- Present in assembly line – such as paint station, welding station, etc.
- Attributes: equipment ID (Primary Key), Name, Type, manufacture.
- Relationship: A station must be monitored by Performance entity – making it mandatory many to mandatory one

Performance:

- Used to track and monitor several metrics in the overall system
- Attributes: equipment ID (Primary Key), Name, Type, manufacture.

Key Design Decisions:

- Inclusion of Spare Part Entities: Necessary for inventory management.
- Relationships: Modelled based on real-world interactions (e.g., enrolment, sales).
- Customer Entity: Essential for tracking customer interactions.
- Assembly Line & Marketing: Internal management and marketing optimization.