# CS550 Project Part 1
MITHILAESH JAYAKUMAR
G01206238

PART1: DATABASE DESIGN

Consider the following Supply Chain information system description. The system should support a collaborative supply chain composed of suppliers, manufacturers, shippers and end customers. Items of different kinds are being moved in the supply chain. Manufacturers use Items of materials to manufacture Items of products for customers. Suppliers supply Items of materials to manufacturers; they also supply Items directly to Customers. Shippers (e.g., UPS, FedEx etc.) move items from one business entity (supplier, manufacturer, customer etc.) to another. Items have a unique id and weight. Every business entity (suppliers, manufacturers, customers etc.) is identified by its id, and has a shipping location (to be used by Shippers for shipping orders), address, phone, web location, and contact information. Every product item (e.g., a table) has several associated material/part items in certain quantities necessary to produce 1 unit of the product item. For example, a table product item, requires 1 tabletop item, 4 leg items and 8 screw items. Suppliers supply Items, using price per unit, which may vary among different Suppliers for the same Item. Suppliers have volume discount applied on the dollar amount computed based on price per unit. Volume discount is described by a percentage of deduction for amount above a predetermined bound. Manufacturers produce product Items; this production has an associated setup Cost and product cost per unit. Manufacturers may offer volume discounts to customers applied the same way suppliers apply volume discounts. Shippers price shipping services per pairs of (source, destination) pairs, where sources and destinations are shipping locations of business entities. The pricing of each shipper is based on the total weight of shipment from source to destination, using price per lb., and a volume discount applied on the total dollar amount. Customers have demand quantity for certain Items. The orders are recorded separately for shipping, manufacturing and supply. Shipping orders capture information about a shipper, sender, and recipient (who are business entities) and the Item being shipped and record the quantity of the Item shipped. Manufacturing orders capture information about a manufacturer, a manufactured Item and the ordered quantity; and Supply orders capture information about a supplier, Item and the quantity supplied.

1. Create an ER diagram and specify all integrity constraints. If some information is missing, suggest additional assumptions and briefly explain their rationale.
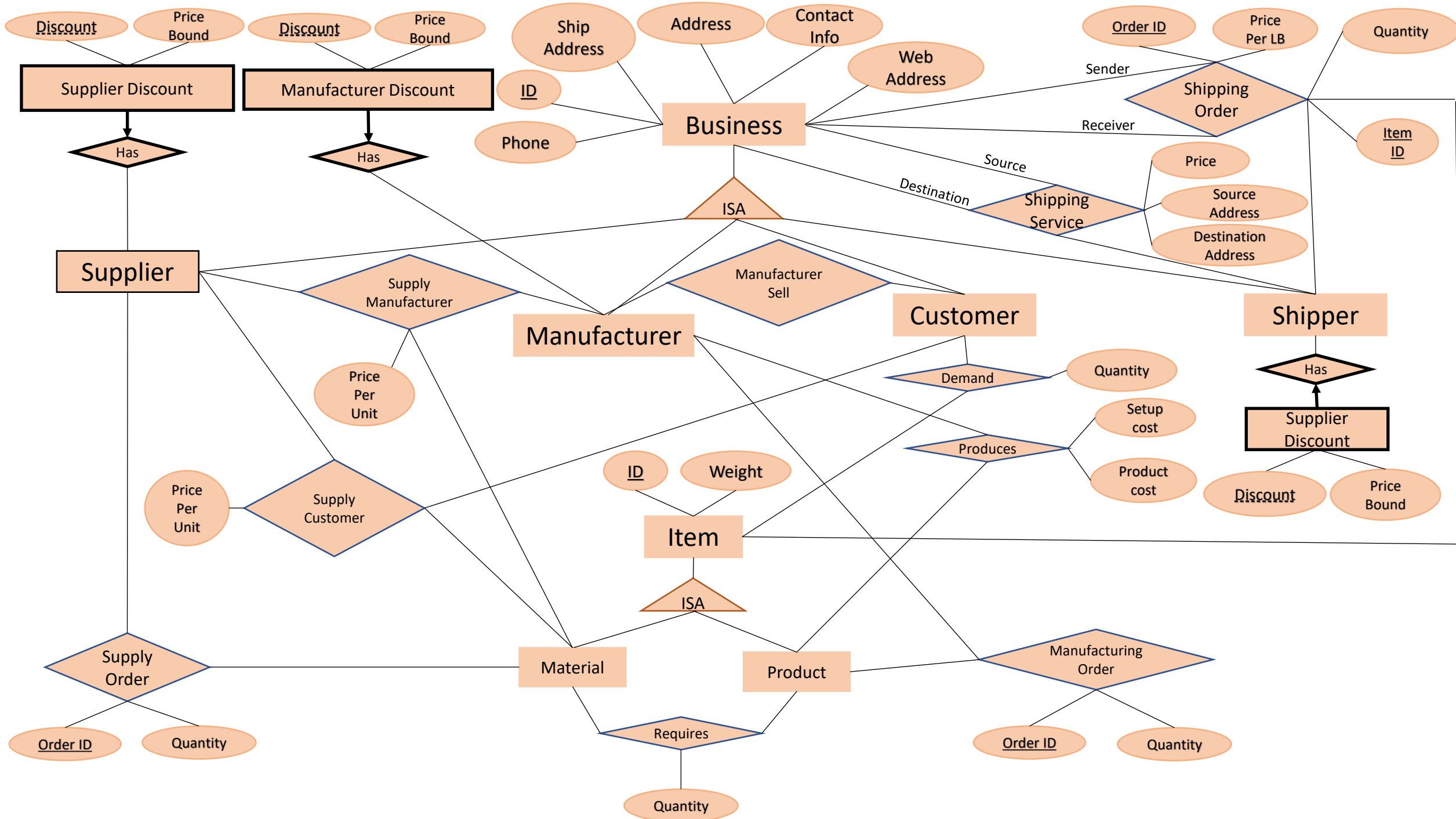
Integrity Constraints:
- Supplier supplies to Customers(Many-to-Many)
- Supplier supplies to Manufacturers(Many-to-Many)
- Manufacturer supplies to Customers (Many-to-Many)
- Manufacturer produces Products (Many-to-Many)
- Customers demand Items (Many-to-Many)
- Products require Material (Many-to-Many)
- Shippers charge for Shipping Services (Many-to-Many)
- Suppliers offer Discounts (One-to-Many: One Supplier may give many discounts based on Price bounds)
- Manufacturer offer Discounts (One-to-Many: One Manufacturer may give many discounts based on Price bounds)
- Shipper offer Discounts (One-to-Many: One Shipper may give many discounts based on Price bounds)
- Supply Orders (Many-to-Many)
- Manufacturing Orders (Many-to-Many)
- Shipping Orders (Many-to-Many)

The Properties not reflected in the ER Diagram:
Volume Discount is not reflected in the ER diagram. Volume discount is described by a percentage of deduction for amount above a predetermined bound

Information Missing and Assumptions made:
- Order ID: The question does not mention anything about Order ID in Orders. We assume that there must be an Order ID for each order. In the SQL table for Orders there must be a primary key. If we use Shipper ID as the primary key, then only one value can be stored for a respective shipper. This does not support the case where there are multiple orders for the same shipper. So, we go with this assumption in order to resolve the issue.
- "Item has unique id and weight": This is ambiguous as it could be interpreted as Unique ID and Unique Weight (or) Unique ID and Weight. Here in the ER, we assume it as Unique ID and Weight.