Schema Design

dependent (d_ID, employee_ID, name, age)

employee (employee_ID, warehouse_ID, name salary)

employee_phone (employee_ID, phone)

machines (machine_ID, name)

warehouse (warehouse_ID, street_number, street_name, city, state, country)

security (company_ID, name)

product (prod_ID, manufacturer_ID, type, price)

customer (customer_ID, name, street_number, street_name, city, state, country)

manufacturer (manufacturer_ID, name, street_number, street_name, city, state, country)

operates (employee_ID, machine_ID)

contains (warehouse_ID, prod_ID)

protected_by (warehouse_ID, company_ID)

ordered_by (prod_ID, customer_ID, date_ordered)

Requirements

(a) **dependent** is a weak entity set of **employee**
(b) **address** was a composite attribute – it has been decomposed
(c) **phone** was a multivalued attribute in employee – it has been converted to two relations
(d) **date_ordered** is a descriptive attribute of the **ordered_by** relation

BCNF Satisfaction

(a) Consider my entity sets that were converted to relations – **dependent**, **employee**, **machines**, **warehouse**, **security**, **product**, **manufacturer** and **customer**. These are all in BCNF because they consist of one functional dependency each i.e. from their primary key to the rest of the attributes. The primary key of each of these relations is also a superkey of it. No other functional dependencies exist on these entity sets. Therefore, we conclude that these relations are in BCNF.

(b) Now consider my many-to-many relationship sets that were converted to relations – **operates**, **contains**, **protected_by** and **ordered_by**. The first three relations are trivially in BCNF because all the attributes they contain make up their primary key (and also are their respective superkeys). Since no other functional dependencies hold on these attributes, they are in BCNF (This same reasoning is true for the relation, **employee_phone**). The relation **ordered_by** is also in BCNF because it's primary key determines the descriptive attribute, **date_ordered**. Since this primary key is also a superkey and no other functional dependency holds on the attributes in **ordered_by**, we conclude that it is also in BCNF.

(c) My many-to-one relationship sets - **is_dep**, **works_in** and **shipped_by** do not end up affecting the final relational schema.