Automobile Parts Manufacturing Factory

(Team: DNAsequence)

Introduction

The mini-world is an independent private Automotive parts manufacturing plant. This secondary industry is only for wholesale production and sale of these goods. The plant consists of several assembly lines consisting of multiple machines and skilled/semi-skilled workers that work towards the production of parts for automobiles. The workers in the plant can be waged or on the payroll.

Purpose

The purpose of the database is to store, update and retrieve the information related to the employees, products made, suppliers, clients, and other data associated with the plant for its smooth functioning.

Users

- Stakeholders of the industry - Casual / Temporary users
- Management employees - Sophisticated Users / System Analysts
- Other employees - Naive / Parametric users
- Application program
- Database Administrators

Applications

- The data about the salaried and waged employees of the plant and Information on the availability of raw material, machinery stats, and product stock is stored as factory records.
- These records are used to compute the state of the working and fixed capital, correspondingly the expenditure and the investment required in the same.
- The database stores both, the details of the wholesale purchase of raw materials with the suppliers and the sale to clients.
- The information and data stored can be used to realize the gross and net gains of the company and formulate plans to improve/ maximize the same.

Database Requirements

Entities

1. Employee
    a. E_ID
        - PRIMARY KEY
    b. Full Name(Fname, Mname, Lname)
        - NOT NULL
    c. DOB
        - NOT NULL
    d. *Age (derived attribute: Current date - DOB)*
    e. Gender
        - CHECK in (M, F, O)
    f. {Skills}
    g. {Phone Number}
    h. Address (Address_Line1, City, State, Zip)
    i. Date_of_Joining
        - NOT NULL
    j. Role
    k. Employment Type
        - **Defining Attribute for the disjoint subclasses (Salaried Employee, Hourly_paid_employees)**

2. Salaried_employee
    a. Salary
        - NOT NULL

3. Hourly_paid_employee
    a. Pay_scale
        - NOT NULL
    b. Hours_of_work
        - DEFAULT
    c. Day_pay (derived attribute: Pay_scale * Hours_of_work)
    d. Date_of _work

4. Raw_materials
    a. R_Id
        - PRIMARY KEY
    b. Name
        - NOT NULL
    c. Quantity
    d. Price

- NOT NULL

5. Product

PRIMARY KEY: Product Number
ALTERNATE KEY: Name
CANDIDATE KEYS: Product Number, Name
SUPER KEY: {Product Number, Name}, {Product Number, Name, Stock}

a. Product_Number
   - PRIMARY KEY
b. Name(Type, Model)
   - ALTERNATE KEY *with 2 candidate key attributes*
c. Stock
d. Price
   - NOT NULL

6. Assembly line

a. Line_Number
   - PRIMARY KEY
b. Number of parts
   - NOT NULL
c. Max Employees
d. Hours_active
   - DEFAULT
e. Energy_consumption (derived attribute: Hours_active * Sum(Power_Consumption of each machine on the line))

7. Clients

a. C_Id
   - PRIMARY KEY
b. Name
   - NOT NULL
c. Address (Address_Line1, City, State, Zip)
   - NOT NULL
d. Phone
   - NOT NULL
e. email
   - NOT NULL

8. Supplier

a. S_Id
   - PRIMARY KEY
b. Name
   - NOT NULL
c. Location (Address_Line1, City, State, Zip)
   - NOT NULL

d. Phone
    - NOT NULL
e. Email
    - NOT NULL

Weak Entity:

1. Dependents

Foreign key - E_ID

a. Name
    - PARTIAL KEY
b. Relationship
    - CHECK in (Mother, Father, Spouse, Children, Other)
c. Date of Birth
    - NOT NULL
d. Gender
    - CHECK in (M, F, O)

2. Machines

Foreign Key - Line_Number

a. Number_on_line
    - PARTIAL KEY
b. Cost
c. Function
d. Power_Consumption
    - NOT NULL

Relationships

1. Purchase
    a. Degree - 2
    b. Entities related - Clients, Product
        i. Clients
            - Total Participation
            - (Min, max) constraint - (1,N)
        ii. Product
            - (Min, max) constraint - (1,M)
    c. Ratio - (Clients : Product) - (N:M)
    d. Attributes- Date, Quantity

2. Supply
    a. Degree - 2
    b. Entities related - Supplier, Raw material
        i. Supplier
            - Total Participation
            - (Min, max) constraint - (1,N)

ii. Raw material
- (Min, max) constraint - (1,M)

c. Ratio - (Supplier: Raw material) - (N:M)
d. Attributes- Date, Quantity

3. Parts
   a. Degree - 2
   b. Entities related - Assembly Line, Machines
      i. Assembly Line
         - Total Participation
         - (Min, max) constraint - (1,1)
      ii. Machines
         - (Min, max) constraint - (1,N)
   c. Ratio - (Assembly Line: Machines) - (1:N)

4. Manages
   a. Unary relationship
   b. Entities related - employee
      i. employee(supervisor)
         - (Min, max) constraint - (1,1)
      ii. employee(subordinate)
         - (Min, max) constraint - (1,N)
   c. Ratio - (supervisor: subordinate) - (1:N)

5. Depend_on
   a. Degree - 2
   b. Entities related - employee, dependents
      i. employee
         - (Min, max) constraint - (1,1)
      ii. dependents
         - (Min, max) constraint - (1,N)
   c. Ratio - (employee, dependents) - (1:N)

n>3 Relationships:

6. Production
   a. Degree - 4
   b. Entities related - Product, Assembly Line, Raw material, employee
      i. Product
         - (Min, max) constraint - (1,1)
      ii. Assembly Line
         - (Min, max) constraint - (1,1)
      iii. Raw material
         - (Min, max) constraint - (1,N)
      iv. Employee
         - (Min, max) constraint - (1,M)
   c. Ratio - (Product: Assembly Line: Raw material: Employee) - (1:1:N:M)

This 4-degree relationship can be modeled differently through the following binary relationships:

- **The Product uses Raw_materials (weak entity)**
- **Product is produced on the Assembly line**
- **Raw materials are supplied to the Assembly Line**
- **Employees works on the assembly line**

Functional Requirements

Modifications

1. Insert:
    a. Maintaining records for hourly-paid workers
    b. Entering purchase records (date etc. of the deal).
2. Delete:
    a. Delete complete data tuples from the “Participant” entity set.
3. Update:
    a. Update stock of various products made.
    b. Update quantity of raw materials available.
    c. Update the role of an employee in the factory.

Retrievals

1. Selection:
    a. Retrieve complete data tuples of products.
    b. Retrieve complete data tuples of clients.
2. Projection:
    a. An employee with age >= 50.
    b. Raw material with price per entity >= 1,000.
3. Aggregate:
    a. The total salary of permanent employees.
    b. The average power consumed by machines.
4. Search:
    a. Searching for “Jamshedpur” in the supplier location.
5. Analysis:
    a. Corporate profit made by the factory last month.
    b. Most profitable products - derived from the analysis of the total cost of production(including raw material and running capital) and average sale.