Database Design Templates

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1 Bill of Materials

We need to keep and process the following information:
"a particular quantity ("Qnt") of the product "P" is needed for manufacturing a new product "CP".

For example, suppose we need 5 pieces of product "D_B" to produce a product "D_A".
In a similar way, we need 3 pieces of product "D_D" and 8 pieces of product "D_C" to produce a product "D_B".

A typical database schema can be defined as follows:

```
CREATE TABLE Product(
P# INTEGER, PName CHARACTER(20), Price INTEGER,
PRIMARY KEY (P#),
)
CREATE TABLE Bill_Materials(
P#_need INTEGER, P#_needed INTEGER, Qnt INTEGER,
PRIMARY KEY (P#_need, P#_needed),
FOREIGN KEY(P#_need) REFERENCES Product.P#,
FOREIGN KEY(P#_needed) REFERENCES Product.P#
)
```

Note that referential integrity of relational databases protects the database from referencing to non-existing products in the bill of materials.
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Basically, working with such databases require a virtual splitting of the relation "Product" into two identical relations which can be processed independently.

Get list of products where product "D_C" is needed.

```sql
SELECT Product WHERE Pname="D_C" GIVING Needed;
SELECT Product GIVING Need;
JOIN Need and BillMaterial Over Need.P# = BillMaterial.P#_need GIVING A;
JOIN Needed and A Over Needed.P# = BillMaterial.P#_needed GIVING B;
PROJECT B OVER Need.Pname GIVING Results;
```
Get list of products where product "D_C" is needed.

\[
\text{need} \rightarrow \text{Product}; \\
\text{needed} \rightarrow \text{Product}; \\
\text{bill} \rightarrow \text{BillMaterial}; \\
(\text{need.Pname}) \exists \text{bill} \exists \text{needed} \\
(\text{need.P#} = \text{bill.P#}_\text{need} \text{ And } \text{bill.P#}_\text{needed} = \text{needed.P#} \text{ And } \text{needed.PName} = 'D_C')
\]

Get list of products where product "D_C" is needed.

Select PName from Product where P# In 
(Select P#_need from BillMaterial where P#_needed In 
(Select P# from Product where PName = 'D_C'))
Get list of products where product "D_C" is needed.

\[
\text{Select Need.Pname from Product as Need, BillMaterial, Product as Needed}
\]
where
Need.P# = BillMaterial.P#_need And
BillMaterial.P#_needed=Needed.P# And
And Needed.Pname = 'D_C';
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