## Colours Schema

### Customer

<table>
<thead>
<tr>
<th>cust#</th>
<th>PK</th>
</tr>
</thead>
<tbody>
<tr>
<td>cname</td>
<td></td>
</tr>
<tr>
<td>fav_colour</td>
<td></td>
</tr>
<tr>
<td>phone#</td>
<td></td>
</tr>
</tbody>
</table>

### Item

<table>
<thead>
<tr>
<th>item#</th>
<th>PK</th>
</tr>
</thead>
<tbody>
<tr>
<td>prod#</td>
<td>FK to Product</td>
</tr>
<tr>
<td>cust#</td>
<td>FK to Customer</td>
</tr>
<tr>
<td>colour</td>
<td></td>
</tr>
<tr>
<td>date_sold</td>
<td></td>
</tr>
</tbody>
</table>

### Product

<table>
<thead>
<tr>
<th>prod#</th>
<th>PK</th>
</tr>
</thead>
<tbody>
<tr>
<td>pname</td>
<td></td>
</tr>
<tr>
<td>cost</td>
<td></td>
</tr>
<tr>
<td>maker</td>
<td>FK to Company</td>
</tr>
</tbody>
</table>

### Avail_Colours

<table>
<thead>
<tr>
<th>prod#</th>
<th>PK, FK to Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>colour</td>
<td>PK</td>
</tr>
</tbody>
</table>
Query 1.

Show, for each customer (reporting the customer’s name), the products by name that come in the customer’s favourite colour.

```
select C.cname, P.pname
from Customer C, Avail_Colours A, Product P
where C.fav_colour = A.colour
    and A.prod# = P.prod#;
```
Show, for each customer (reporting the customer’s name), the products by name that do not come in the customer’s favourite colour.

```
select C.cname, P.pname
    from Customer C, Product P
    where C.fav_colour not in ( 
        select A.colour
            from Avail_Colours A
            where A.prod# = P.prod#
    );
```
select C.cname, P.pname
from Customer C, Product P,
     ( select distinct Q.prod#, A.colour
         from Product Q,
             Avail_Colours A
         except
         select prod#, colour
             from Avail_Colours
     ) as N
where C.fav_colour = N.colour
    and P.prod# = N.prod#;
with
  NotAvail (prod#, colour) as (  
    select distinct Q.prod#, A.colour  
    from Product Q,  
    Avail_Colours A  
    except  
    select prod#, colour  
    from Avail_Colours  
  )
select C.cname, P.pname  
  from Customer C, Product P, NotAvail N  
where C.fav_colour = N.colour  
  and P.prod# = N.prod#;
Query 3.

List pairs of customers (columns: first_cust#, first_cname, second_cust#, second_cname) such that the two customers own at least two products in common.

```
select distinct C.cust#, C.cname, D.cust#, D.cname
from Customer C, Customer D, Item IC, Item JC, Item ID, Item JD
where C.cust# = IC.cust# and C.cust# = JC.cust# and
  D.cust# = ID.cust# and D.cust# = JD.cust# and
  IC.prod# = ID.prod# and JC.prod# = JD.prod# and
  IC.prod# <> JC.prod# and
  C.cust# < D.cust#;
```
Query 4.

List customers who own items in all the available colours. That is, for every available colour, the customer owns some item in that colour.

```sql
select cust#, cname
    from Customer
except
select C.cust#, C.cname
    from ( select D.cust#, A.colour
            from Customer D,
            Avail_Colours A
        except
        select I.cust#, I.colour
            from Item I
    ) as M,
    Customer C
where C.cust# = M.cust#;
```
List each customer by name, paired with the product(s) by name that he or she has bought that was the most expensive (cost) of all the products he or she has bought.

```
select C.cname, P.pname
    from ( select distinct cust#, prod#
            from Item
        except
        select I.cust#, I.prod#
            from Item I, Item J, Product Q, Product R
            where I.cust# = J.cust# and 
                 I.prod# = Q.prod# and J.prod# = R.prod# and 
                 Q.cost < R.cost
        ) as M,
    customer C, Product P
    where C.cust# = M.cust# and P.prod# = M.prod#;
```
Query 6.

Show, for each customer, the total cost he or she has paid for products in his or her favourite colour.

```
select C.cust#, C.name,
       sum(P.cost) as total
from Customer C, Item I, Product P
where C.cust# = I.cust#
  and I.prod# = P.prod#
  and C.fav_colour = I.colour
group by C.cust#, C.cname;
```
Query 7.

Report with columns cust# and colour for each customer which colour he or she has spent more on products of that colour than on products of any other colour.

with

    Colours (cust#, colour, total) as ( 
      select I.cust#, I.colour, sum(P.cost) 
      from Item I, Product P 
      where I.prod# = P.prod# 
      group by I.cust#, I.colour 
    ),

    : 

    :
with

::

Most (cust#, highest) as (  
    select C.cust#, max(C.total)  
    from Colours C  
    group by cust#  
)

::
Query 7. (p.3)

```
select C.cust#, C.cname, R.colour, M.highest 
from Customer C, Colour R, Most M 
where C.cust# = R.cust# 
    and C.cust# = M.cust# and 
    R.total = M.highest;
```
Query 8.

What is the total each customer has spent on items since his or her most expensive purchase? In case of ties for the most expensive purchase, count since the first most expensive purchase.

with

    Expensive (cust#, cost) as (  
        select I.cust#, max(P.cost)  
        from Item I, Product P  
        where I.prod# = P.prod#  
        group by I.cust#  
    ),

    : 
with
  :  
  First (cust#, when) as ( 
    select I.cust#, min(date_sold) 
      from Item I, 
        Expensive E, 
        Product P 
    where I.cust# = E.cust# 
      and I.prod# = P.prod# 
      and P.cost = E.cost 
      group by I.cust# 
  )
select C.cust#, C.cname, sum(P.cost) as total
from Customer C, Item I, Product P, First F
where C.cust# = I.cust#
    and C.cust# = F.cust#
    and I.prod# = P.prod#
    and I.date_sold > F.when
group by C.cust#, C.cname;
Query 9.

Which pairs of customers own at least twelve products in common?

with
    Owned (cust#, prod#) as (  
        select distinct cust#, prod#  
        from Item
    )

::
Query 9. (p.2)

select C.cust#, C.cname, 
    D.cust#, D.cname 
from Customer C, Customer D, 
    Owned P, Owned Q 
where C.cust# = P.cust# 
    and D.cust# = Q.cust# 
    and P.prod# = Q.prod# 
    and C.cust# < D.cust# 
group by C.cust#, C.cname, 
    D.cust#, D.cname 
having count(*) >= 12;
Query 10.

Query 5 again: List each customer by name, paired with the product(s) by name that he or she has bought that was the most expensive (cost) of all the products he or she has bought. Hey, but you have aggregation now!

with

\[
\text{Expensive (cust#, highest)} \text{ as (}
\quad \text{select I.cust#, max(P.cost)}
\quad \text{from Item I, Product P}
\quad \text{where I.prod# = P.prod#}
\quad \text{group by I.cust#}
\quad \text{)}
\quad : \quad :
\]
select C.cname, P.pname
   from Customer C, Item I,
       Product P, Expensive E
where C.cust# = I.cust#
   and C.cust# = E.cust#
   and I.prod# = P.prod#
   and P.cost = E.highest;
Recursion: E.g., Bosses

with
  Boss (emp#, boss#) as (  
    select emp#, boss#  
    from Employee  
    union all  
    select E.emp#, B.boss#  
    from Boss B, Employee E  
    where E.boss# = B.emp#  
  ),
  select E.emp#, E.name as ename,  
    B.boss#, F.name as bname  
  from Boss B, Employee E, Employee F  
  where B.emp# = E.emp#  
    and B.boss# = F.emp#;
with
    First (a, b, r#) as (  
        select a, b, 0  
        from Data  
        except  
        select Y.a, Y.b, 0  
        from Data Y, Data Z  
        where (Y.a > Z.a) or  
            ((Y.a >= Z.a) and (Y.b > Z.b))  
    ),
    ::
with

::

Counter (a, b, r#) as (  
    select a, b, r#  
    from First  
union all  
select D.a, D.b, C.r# + 1  
    from Counter C, Data D  
where (D.a > C.a) or  
    ((D.a >= C.a) and (D.b > C.b))  
)

::
select a, b, r#
    from Counter
except
select M.a, M.b, M.r#
    from Counter M, Counter X
    where M.a = X.a
    and M.b = X.b
    and M.r# < X.r#
order by a, b;