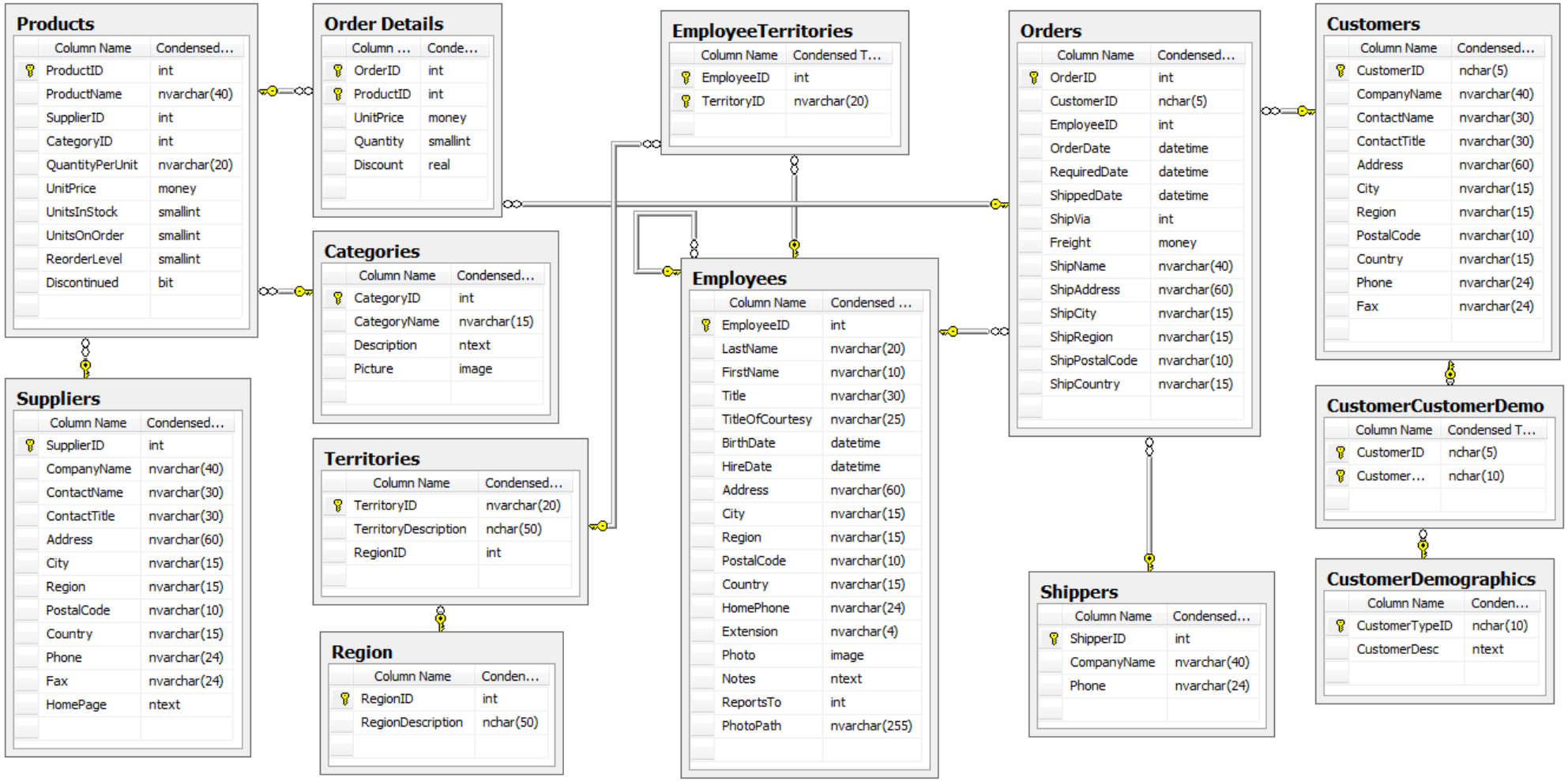
Introduction to Operating Systems and SQL for Data Science

Practice 9 - SQL

Northwind DB

- We will work with Nordwind DB for this recitation.



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SQL – self learning

You are more than welcome to visit w3school
for further explanations and detailed documentation.

- http://www.w3schools.com/sql/default.asp

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SQL Query Structure

SELECT <list_of_fields> ⇔ π<list of fields>
FROM <table_name>
WHERE <search_condition> ⇔ σ<search condition>

ORDER BY <list_of_fields>

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SQL Query Structure – bit complex

SELECT <list_of_fields> ⇔ π<list of fields>
FROM <table_name>
WHERE <search_condition> ⇔ σ<search condition>

GROUP BY <list_of_fields>

HAVING <group_by_condition>

ORDER BY <list_of_fields>

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SQL – Select .. From .. Where Example

```
SELECT *

FROM [Products]

WHERE ([UnitPrice] > 20 AND [UnitsOnOrder] <> 0) OR    ([ReorderLevel] = 10 AND
NOT [ProductID] = 3) OR ([UnitPrice] BETWEEN 8 AND 30)
```

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SQL – Select .. From .. Where

Which products the following query selects?

```
SELECT *
FROM [Products]
WHERE [UnitPrice] IN (10,15,20)
```

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SQL – Select .. From .. Where

Which products the following query selects?

SELECT *

FROM [Products]

WHERE [ProductName] **IS NOT Null**

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SQL – “Like” conditions

Select ProductId and ProductName where product name contains “Alice”:

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SQL – “Like” conditions

Select ProductId and ProductName where product name contains “Alice”:

SELECT [ProductID],[ProductName]

FROM [Products]

WHERE [ProductName] **LIKE** '%Alice%'

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SQL – “Like” conditions

Select ProductId and ProductName where product name starts with “CH”:

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SQL – “Like” conditions

Select ProductId and ProductName where product name starts with “CH”:

SELECT [ProductID],[ProductName]

FROM [Products]

WHERE [ProductName] **LIKE** 'CH%‘

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SQL – “Like” conditions

Select ProductId and ProductName where product name starts with “CH” and contains 4 chars:

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SQL – “Like” conditions

Select ProductId and ProductName where product name starts with “CH” and contains 4 chars:

SELECT [ProductID],[ProductName]

FROM [Products]

WHERE [ProductName] **LIKE** ‘CH__‘

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SQL – Sorting result

Select CustomerID (sorted) from Orders table:

SELECT DISTINCT [CustomerID]

FROM [Orders]

ORDER BY [CustomerID], [field2], [field3] **DESC**

- **Distinct will avoid duplications**
- **Distinct should appear only once**
- **ASC – ascending DESC – descending**
- **We can sort by several fields (sort order is by fields order)**

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SQL – Join

SELECT [field1],[fileld2],[field3],…

FROM [table1] A **JOIN** [table2] B

ON [table1].[field1] = [table2].[field2]

JOIN [table3] C

ON [table2].[field3] = [table3].[field4]

WHERE condition

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SQL – Join

Another option:

SELECT [field1],[fileld2],[field3],…

FROM [table1] A,[table2] B, [table3] C

WHERE [table1].[field1] = [table2].[field2] **AND**

[table2].[field3] = [table3].[field4]

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SQL – Join example with same table

Select product names of products that sells in at least 3 different colors :

```
SELECT DISTINCT p1.pname
FROM product AS p1, product AS p2, product AS p3
WHERE p1.pname=p2.pname AND p2.pname=p3.pname AND
  p1.color<>p2.color AND p1.color<>p3.color AND
  P2.color<>p3.color;
```

After renaming a table, we should approach it in its new name.

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SQL – Join example with multiple tables

Select product ids names and suppliers of products from category 3 :

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SQL – Join example with multiple tables

Select product ids names and suppliers of products from category 3 :

```
SELECT [ProductID],[ProductName],[CompanyName]
FROM [Products] JOIN [Suppliers]
ON [Products].[SupplierID] = [Suppliers].[SupplierID]
WHERE [CategoryID] = 3
```

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SQL – Join example with multiple tables

Select product ids names and suppliers of products from category 3 :

```
SELECT [ProductID],[ProductName],[CompanyName]
FROM [Products],[Suppliers]
WHERE [Products].[SupplierID] = [Suppliers].[SupplierID]
        AND [CategoryID] = 3
```

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SQL – computing new fields

Select for each product its total price in the order
(there might be Quantity >1)

```
SELECT [OrderID], [ProductID], [UnitPrice], [Quantity]
        ,[UnitPrice]*[Quantity] AS [Price]

FROM [Order Details]
```

- We defined new field (Price) for the total price in the order

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SQL – computing new fields

```
SELECT [OrderID], [ProductID], [UnitPrice], [Quantity]
,[UnitPrice]*[Quantity] AS [Price]

FROM [Order Details]

Where [Price] > 100
```

We cannot use Price in the Where condition since Where is evaluated before the Select Action therefore not aware of the new field Price

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The right way to do so…

Select for each product in Orders the total price of the product if total price is larger than 100, sort result by ProductId asc and by total price desc

SELECT [OrderID],[ProductID],[UnitPrice],[Quantity],[UnitPrice]*[Quantity] **AS** [Price]

FROM [Order Details]

WHERE [UnitPrice]*[Quantity] > 100

ORDER BY [ProductID], [UnitPrice]*[Quantity] **DESC**

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SQL – Aggregation: max

Select maximum product price:

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SQL – Aggregation: max

Select maximum product price:

SELECT MAX(UnitPrice) **AS** 'MaxPrice'

FROM [Products]

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SQL – Aggregation: average

Select average price of product supplied by supplier 2:

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SQL – Aggregation: average

Select average price of product supplied by supplier 2:

SELECT AVG([UnitPrice])

FROM [Products]

WHERE [SupplierID] = 2

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SQL – Aggregation: sum

Select sum of prices of product supplied by supplier 2:

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SQL – Aggregation: sum

Select sum of prices of product supplied by supplier 2:

SELECT SUM([UnitPrice])

FROM [Products]

WHERE [SupplierID] = 2

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SQL – Aggregation: count

Select number of product supplied by supplier 2:

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SQL – Aggregation: count

Select number of product supplied by supplier 2:

SELECT COUNT([ProductID]) **AS** 'Supplier2Products'

FROM [Products]

WHERE [SupplierID] = 2

Count(*) will return how many lines are in the result

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SQL – Aggregation: count

Select number of suppliers that supply any product:

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SQL – Aggregation: count

Select number of suppliers that supply any product:

SELECT COUNT(**DISTINCT** [SupplierID]) AS 'Suppliers'

FROM [Products]

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SQL – Aggregation: Group by

Select for each supplier its ID and number of products it supplies:

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SQL – Aggregation: Group by

Select for each supplier its ID and number of products it supplies:

SELECT [SupplierID],**COUNT**([ProductID]) AS 'Supplier2Products'

FROM [Products]

GROUP BY [SupplierID]

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SQL – Aggregation: Group by

Select for each supplier its ID and number of products it supplies for suppliers with supplier id less than 15:

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SQL – Aggregation: Group by

Select for each supplier its ID and number of products it supplies for suppliers with supplier id less than 15:

```
SELECT [SupplierID],COUNT([ProductID]) AS 'SuppliersProducts'

FROM [Products]

WHERE [SupplierID] < 15

GROUP BY [SupplierID]
```

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SQL – Aggregation: Group by

Select for each supplier its ID and max product price is provides for suppliers with supplier id less than 15:

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SQL – Aggregation: Group by

Select for each supplier its ID and max product price is provides for suppliers with supplier id less than 15:

SELECT [SupplierID], **MAX**([UnitPrice]) **AS** 'SupplierCostlyProductPrice'

FROM [Products]

WHERE [SupplierID] < 15

GROUP BY [SupplierID]

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SQL – Aggregation: Group by + Having

Select for each supplier its ID and number of products it supplies for suppliers who provides more than 3 products:

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SQL – Aggregation: Group by + Having

Select for each supplier its ID and number of products it supplies for suppliers who provides more than 3 products:

SELECT [SupplierID],**COUNT**([ProductID]) **AS** 'SuppliersProducts'

FROM [Products]

GROUP BY [SupplierID]

HAVING COUNT([ProductID]) > 3

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SQL – Aggregation

What does the following query returns?

SELECT *

FROM [Products]

WHERE MAX([UnitPrice]) < 20

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SQL – Aggregation

What does the following query returns?

SELECT *

FROM [Products]

WHERE MAX([UnitPrice]) < 20

- **This query is not valid since we can't use aggregation functions inside Where clause.**

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SQL – Aggregation

Find for each order its total cost:

SQL – Aggregation

Find for each order its total cost:

SELECT [OrderID], **SUM** ([UnitPrice]*[Quantity]) **AS** [Price]

FROM [Order Details]

GROUP BY [OrderID]

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SQL – Nested queries

Find product id and name of the best seller product:

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SQL – Nested queries

Find product id and name of the best seller product:

```
SELECT [Products].[ProductID], [ProductName]
FROM [Order Details], [Products]
WHERE [Order Details].[ProductID] = [Products].[ProductID]
GROUP BY [Products].[ProductID],[ProductName]
HAVING COUNT(*) >= ALL (SELECT COUNT([OrderID])
                        FROM [Order Details]
                        GROUP BY [ProductID])
```

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SQL – Nested queries: EXCEPT

Find product ids and names of the products with product id less or equal than 30:

SQL – Nested queries: EXCEPT

Find product ids and names of the products with product id less or equal than 30:

```
SELECT [ProductID],[ProductName]
FROM [Products]
EXCEPT (SELECT [ProductID],[ProductName]
        FROM [Products]
        WHERE [ProductID] > 30)
```

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SQL – Nested queries: EXIST

Find product ids and names of the products that was ordered:

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SQL – Nested queries: EXIST

Find product ids and names of the products that was ordered:

```
SELECT [ProductID], [ProductName]
FROM [Products] P
WHERE EXISTS (SELECT *
              FROM [Order Details]
              WHERE [ProductID] = P.[ProductID])
```

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SQL – Nested queries: IN

Find product ids and names of the products that was ordered:

```
SELECT [ProductID], [ProductName]
FROM [Products]
WHERE [ProductID] IN (SELECT DISTINCT [ProductID]
                      FROM [Order Details])
```

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SQL – INSERT

```
INSERT INTO [Table name]
        ([Field1],
        [Field2],
         …)
   VALUES
        (Value1,Value2,…)
```

```
INSERT INTO [Products]
        ([ProductName]
        ,[SupplierID]
        ,[CategoryID]
        ,[QuantityPerUnit]
        ,[UnitPrice]
        ,[UnitsInStock]
        ,[UnitsOnOrder]
        ,[ReorderLevel]
        ,[Discontinued])
   VALUES
        ('Banana','3','1','20','100','3','2','10','0')
```

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SQL – UPDATE

Update UnitPrice to 12 for products with id 3:

UPDATE [Products]

SET [UnitPrice] = 12

WHERE [ProductID] = 3

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SQL – DELETE

Delete products with product id greater than 50:

DELETE FROM [Products]

WHERE [ProductID] > 50

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Question:

- We are given with the following tables schemas (Primary keys are underlined)

Products (**p_id**, p_name, p_description, category_id, cat_name, manuf_id, manuf_name)

Product_attributes (**p_id, attribute_name**, attribute_value)

Sites (**site_id**, site_name, site_url)

ProductPrice (**p_id, site_id, from_date**, to_date, price, product_site_url)

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Question:

- We are given with the following tables schemas (Primary keys are underlined)
- **Find for product with p_id 18 the difference between its most expensive price in site to its lowest price in site (current prices. Current prices are the ones with to_date=NULL)**

Products (**p_id**, p_name, p_description, category_id, cat_name, manuf_id, manuf_name)

Product_attributes (**p_id, attribute_name**, attribute_value)

Sites (**site_id**, site_name, site_url)

ProductPrice (**p_id, site_id, from_date**, to_date, price, product_site_url)

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Solution:

Products (**p_id**, p_name, p_description, category_id, cat_name, manuf_id, manuf_name)

Product_attributes (**p_id, attribute_name**, attribute_value)

Sites (**site_id**, site_name, site_url)

ProductPrice (**p_id, site_id, from_date**, to_date, price, product_site_url)

SELECT MAX(p1.price - p2.price)

FROM ProdcutPrice p1 **JOIN** ProdcutPrice p2

ON p1.p_id=p2.p_id **AND** p1.site_id<>p2.site_id

WHERE p1.pid=18 **AND** to_date is NULL

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