

Queries: Part 1 of 2

IS240 – DBMS

Lecture # 6 – 2010-02-13

M. E. Kabay, PhD, CISSP-ISSMP

Assoc. Prof. Information Assurance
School of Business & Management, Norwich University

<mailto:mkabay@norwich.edu>

V: 802.479.7937

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Topics

- Why do we Need Queries
- Four Questions to Create a Query
- Query By Example & SQL
- Boolean Algebra
- DeMorgan's Law
- SQL Server Views
- Simple Computations
- SQL Differences
- Groups and Subtotals
- Where (Detail) v Having (Group)
- Student Databases from Website
- HOMEWORK

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Why do we Need Queries

- Natural languages (English) are too vague
 - ❑ With complex questions, it can be hard to verify that the question was interpreted correctly, and that the answer we received is truly correct.
 - ❑ Consider the question: *Who are our best customers?*
- We need a query system with more structure
- We need a standardized system so users and developers can learn one method that works on any (most) systems.
 - ❑ Query By Example (QBE)
 - ❑ SQL

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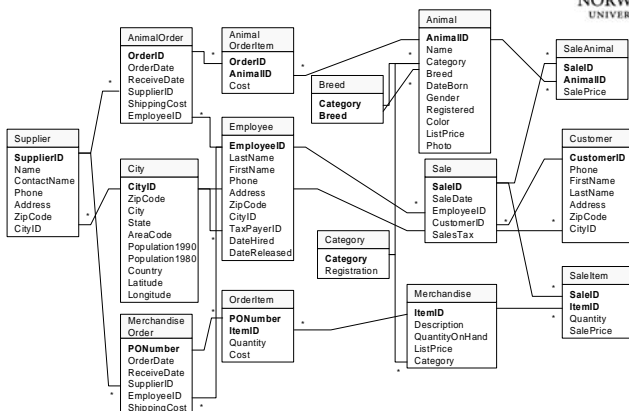
Four Questions to Create a Query

- What output do you want to see?
- What do you already know (or what constraints are given)?
- What tables are involved?
- How are the tables joined together?

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Tables



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Organization

- Single table
- Constraints
- Computations
- Groups/Subtotals
- Multiple Tables

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Sample Questions



- List all animals with yellow in their color.
- List all dogs with yellow in their color born after 6/1/04.
- List all merchandise for cats with a list price greater than \$10.
- List all dogs who are male and registered or who were born before 6/1/04 and have white in their color.
- What is the average sale price of all animals?
- What is the total cost we paid for all animals?
- List the top 10 customers and total amount they spent.
- How many cats are in the animal list?
- Count the number of animals in each category.
- List the CustomerID of everyone who bought something between 4/1/04 and 5/31/04.
- List the first name and phone of every customer who bought something between 4/1/04 and 5/31/04.
- List the last name and phone of anyone who bought a registered white cat between 6/1/04 and 12/31/04.
- Which employee has sold the most items?

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Query04_01

Query By Example & SQL



What tables?

What to see?

What conditions?

```
SELECT AnimalID, Category, Breed, Color
FROM Animal
WHERE (Color LIKE '%Yellow%');
```

Field	AnimalID	Category	Breed	Color
Table	Animal	Animal	Animal	Animal
Sort				
Criteria				Like '%Yellow%'
Or				

List all animals with yellow in their color

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Basic SQL SELECT



- | | |
|------------------------|----------------------------|
| SELECT columns | What do you want to see? |
| FROM tables | What tables are involved? |
| JOIN conditions | How are the tables joined? |
| WHERE criteria | What are the constraints? |

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ORDER BY



- | | |
|-----------------|--------------------|
| SELECT | columns |
| FROM | tables |
| JOIN | join columns |
| WHERE | conditions |
| ORDER BY | columns (ASC DESC) |

Field	Name	Category	Breed
Table	Animal	Animal	Animal
Sort		Ascending	Ascending
Criteria			
Or			

```
SELECT Name, Category, Breed
FROM Animal
ORDER BY Category, Breed;
```

Name	Category	Breed
Cathy	Bird	African Grey
Debbie	Bird	Canary
Terry	Bird	Cockatiel
	Bird	Cockatiel
	Bird	Lovebird
	Bird	Other
Charles	Bird	Parakeet
Curtis	Bird	Parakeet
Ruby	Bird	Parakeet
Sandy	Bird	Parrot
Hoyt	Bird	Parrot
	Bird	Parrot

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DISTINCT



- | | |
|---------------------------------|--|
| SELECT Category
FROM Animal; | SELECT DISTINCT Category
FROM Animal; |
|---------------------------------|--|

Category
Fish
Dog
Fish
Cat
Cat
Dog
Fish
Dog
Dog
Dog
Fish
Cat
Dog
...

Category
Bird
Cat
Dog
Fish
Mammal
Reptile
Spider

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Query04_02

Constraints: And



List all dogs with yellow in their color born after 6/1/04.

Field	AnimalID	Category	DateBorn	Color
Table	Animal	Animal	Animal	Animal
Sort				
Criteria		'Dog'	>'01-Jun-2004'	Like '%Yellow%'
Or				

```
SELECT AnimalID, Category, DateBorn
FROM Animal
WHERE ((Category='Dog')
AND (Color Like '%Yellow%')
AND (DateBorn>'01-Jun-2004'));
```

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Boolean Algebra



And: Both must be true.
Or: Either one is true.
Not: Reverse the value.

a = 3
b = -1
c = 2

(a > 4) And (b < 0)
F F T

(a > 4) Or (b < 0)
F T T

NOT (b < 0)
F T

a	b	a AND b	a OR b
T	T	T	T
T	F	F	T
F	T	F	T
F	F	F	F

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Boolean Algebra



The result is affected by the order of the operations.

Parentheses indicate that an operation should be performed first.
With no parentheses, operations are performed left-to-right.

a = 3
b = -1
c = 2

Always use parentheses so other people can read and understand your query.

It will also help you when you come back to one of your own queries later.

((a > 4) AND (b < 0)) OR (c > 1)
F F T T

(a > 4) AND ((b < 0) OR (c > 1))
F F T T

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DeMorgan's Law Example



Customer: "I want to look at a cat, but I don't want any cats that are registered or that have red in their color."

Animal
AnimalID
Name
Category
Breed
DateBorn
Gender

SELECT AnimalID, Category, Registered, Color
FROM Animal
WHERE (Category='Cat') **AND**
NOT ((Registered is NOT NULL)
OR (Color LIKE '%Red%')).

Field	AnimalID	Category	Registered	Color
Table	Animal	Animal	Animal	Animal
Sort				
Criteria		'Cat'	Is Null	Not Like '%Red%'
Or				

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DeMorgan's Law



➤ Negation of clauses

- Not (A And B) becomes Not A Or Not B
- Not (A Or B) becomes Not A And Not B

Customer: "I want to look at a cat, but I don't want any cats that are registered or that have red in their color."

CAT:
Registered=ASCF
Color=Black

NOT ((Registered is NOT NULL) OR (Color LIKE '%Red%'))

T or F
F not T

(Registered is NULL) AND NOT (Color LIKE '%Red%')

F and T
F not F

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Query04_03 Conditions: AND, OR



SELECT AnimalID, Category, Gender, Registered, DateBorn, Color
FROM Animal
WHERE ((Category='Dog') **AND**
((Gender='Male') **AND** (Registered Is Not Null)) **OR**
(DateBorn<'01-Jun-2004') **AND** (Color Like '%White%')));

Animal
AnimalID
Name
Category
Breed
DateBorn
Gender

List all dogs who are
male and registered
or
who were born before 6/1/2004
and have white in their color.

Field	AnimalID	Category	Gender	Registered	DateBorn	Color
Table	Animal	Animal	Animal	Animal	Animal	Animal
Sort						
Criteria		'Dog'	'Male'	Is Not Null		
Or		'Dog'			< '01-Jun-2004'	Like '%White%'

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Useful Where Conditions

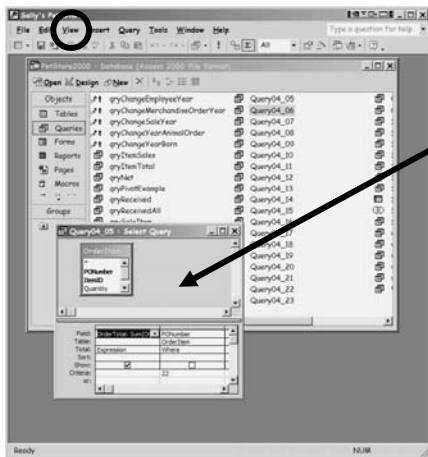


Comparisons	Examples
Operators	<, =, >, <=, BETWEEN, LIKE, IN
Numbers	AccountBalance > 200
Text	
Simple	Name > 'Jones'
Pattern match one	License LIKE 'A__82_'
Pattern match any	Name LIKE 'J%'
Dates	SaleDate BETWEEN '15-Aug-2004' AND '31-Aug-2004'
Missing Data	City IS NULL
Negation	Name IS NOT NULL
Sets	Category IN ('Cat', 'Dog', 'Hamster')

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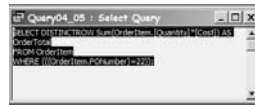
SQL in MS-ACCESS



View | Design View



View | SQL View



Simple Computations



Basic computations (+ - * /) can be performed on numeric data.

The new display column should be given a meaningful name.

SaleItem(OrdID, ItemID, SalePrice, Quantity)

Select OrdID, ItemID, SalePrice, Quantity,
SalePrice*Quantity As Extended
From SaleItem;

OrderID	ItemID	Price	Quantity	Extended
151	9764	19.50	2	39.00
151	7653	8.35	3	25.05
151	8673	6.89	2	13.78

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Computations: Aggregation- -Avg



What is the average sale price of all animals?

```
SELECT Avg(SalePrice) AS AvgOfSalePrice
FROM SaleAnimal;
```

SaleAnimal
SaleID
AnimalID
SalePrice

Sum
Avg
Min
Max
Count
StdDev or StdDev
Var

Field	SalePrice
Table	SaleAnimal
Total	Avg
Sort	
Criteria	
Or	

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Computations (Math Operators)



➤ What is the total value of the order for PONumber 22?

- Use any common math operators on numeric data.
- Operate on data in one row at a time.

OrderItem
PONumber
ItemID
Quantity
Cost

```
SELECT Sum(Quantity*Cost) AS OrderTotal
FROM OrderItem
WHERE (PONumber=22);
```

Field	PONumber	OrderTotal: Quantity*Cost
Table	OrderItem	OrderItem
Total		
Sort		
Criteria	=22	
Or		

OrderTotal
1798.28

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SQL Differences



Task	Access	SQL Server	Oracle
Strings			
Concatenation	FName & " " & LName	FName + ' ' + LName	FName ' ' LName
Length	Len(LName)	Length(LName)	LENGTH(LName)
Upper case	UCase(LName)	Upper(LName)	UPPER(LName)
Lower case	LCase(LName)	Lower(LName)	LOWER(LName)
Partial string	MID(LName,2,3)	Substring(LName,2,3)	SUBSTR(LName,2,3)
Dates			
Today	Date(), Time(), Now()	GetDate()	SYSDATE
Month	Month(myDate)	DateName(month, myDate)	TRUNC(myDate, 'mm')
Day	Day(myDate)	DatePart(day, myDate)	TRUNC(myDate, 'dd')
Year	Year(myDate)	DatePart(year, myDate)	TRUNC(myDate, 'yyyy')
Date arithmetic	DateAdd	DateAdd	ADD_MONTHS
	DateDiff	DateDiff	MONTHS_BETWEEN
			LAST_DAY
Formatting	Format(item, format)	Str(item, length, decimal)	TO_CHAR(item, format)
		Cast, Convert	TO_DATE(item, format)
Numbers			
Math functions	Cos, Sin, Tan, Sqrt	Cos, Sin, Tan, Sqrt	COS, SIN, TAN, SQRT
Exponentiation	2 ^ 3	Power(2, 3)	POWER(2,3)
Aggregation	Min, Max, Sum, Count, Avg	Min, Max, Sum, Count, Avg, StdDev, Var, LinRegSlope, Correlation	MIN, MAX, SUM, COUNT, AVG, STDDEV, VARIANCE, REGR, CORR
Statistics			

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Subtotals (Where)



How many cats are in the Animal list?

Animal
AnimalID
Name
Category
Breed
DateBorn
Gender

```
SELECT Count(AnimalID) AS CountOfAnimalID
FROM Animal
WHERE (Category = 'Cat');
```

Field	AnimalID	Category
Table	Animal	Animal
Total	Count	Where
Sort		
Criteria		'Cat'
Or		

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Groups and Subtotals



- Count the number of animals in each category.
 - ❑ You could type in each WHERE clause, but that is slow.
 - ❑ And you would have to know all of the Category values.

Animal
AnimalID
Name
Category
Breed
DateBorn
Gender

```
SELECT Category, Count(AnimalID) AS CountOfAnimalID
FROM Animal
GROUP BY Category
ORDER BY Count(AnimalID) DESC;
```

Field	Category	AnimalID
Table	Animal	Animal
Total	Group By	Count
Sort		Descending
Criteria		
Or		

Category	CountOfAnimalID
Dog	100
Cat	47
Bird	15
Fish	14
Reptile	6
Mammal	6
Spider	3

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Conditions on Totals (Having)



Count number of Animals in each Category, but list Category only if more than 10 in that Category.

Animal
AnimalID
Name
Category
Breed
DateBorn
Gender

```
SELECT Category, Count(AnimalID) AS CountOfAnimalID
FROM Animal
GROUP BY Category
HAVING Count(AnimalID) > 10
ORDER BY Count(AnimalID) DESC;
```

Field	Category	AnimalID
Table	Animal	Animal
Total	Group By	Count
Sort		Descending
Criteria		>10
Or		

Category	CountOfAnimalID
Dog	100
Cat	47
Bird	15
Fish	14

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Where (Detail) v Having (Group)



Count Animals born after 6/1/2004 in each Category, but list Category only if more than 10 in that Category.

Animal
AnimalID
Name
Category
Breed
DateBorn
Gender

```
SELECT Category, Count(AnimalID) AS CountOfAnimalID
FROM Animal
WHERE DateBorn > '01-Jun-2004'
GROUP BY Category
HAVING Count(AnimalID) > 10
ORDER BY Count(AnimalID) DESC;
```

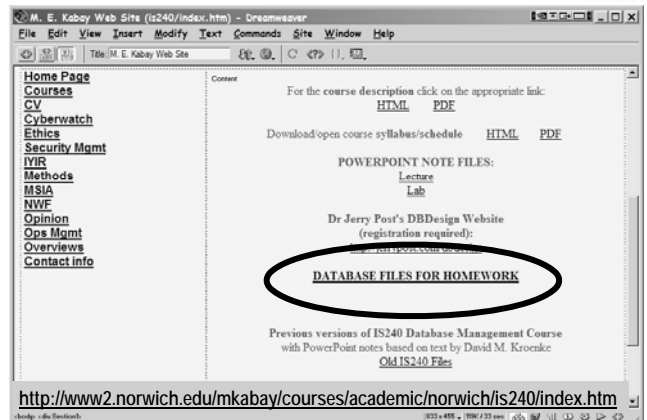
Field	Category	AnimalID	DateBorn
Table	Animal	Animal	Animal
Total	Group By	Count	Where
Sort		Descending	
Criteria		>10	>'01-Jun-2004'
Or			

Category	CountOfAnimalID
Dog	30
Cat	18

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Student Databases from Website



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HOMEWORK REQUIRED



- By Sun 28 Feb 2010 at 23:59
- Study Chapter 4 pp 173-201 thoroughly using SQ3R
- Answer Review Questions 1-12 for yourself to be sure they all make sense to you and you can easily answer them later in quizzes
- Download the PetStore2000.mdb or PetStore2002.mdb file (as appropriate for your system) from Jerry Post's site
- Create SQL code and the records you find to Ch 4 Sally's Pet Store exercises 1-7 (there's no way to learn SQL without actually using it).

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HOMEWORK OPTIONAL



- By Sun 28 Feb 2010 at 23:59
- For extra credit, answer any of the questions in
 - ❑ Rolling Thunder Bicycles #26-35
 - ❑ Corner Med #51-70

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