



3.6 Some advanced SQL syntax

● Another SQL Query?

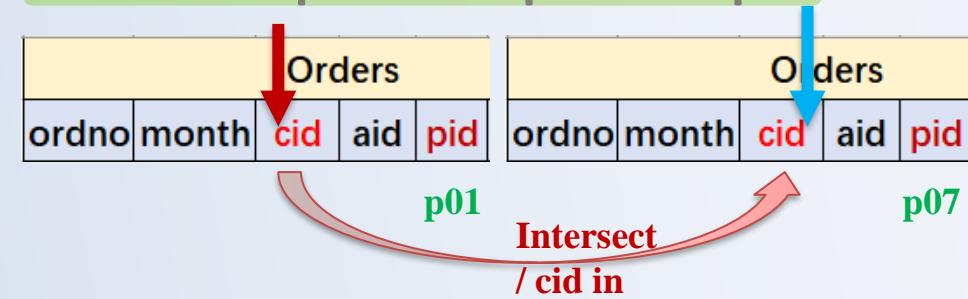


1. UNION, INTERSECT and EXCEPT Operators

[1] form subquery {UNION [ALL] | INTERSECT [ALL]

| EXCEPT [ALL] subquery}

[2] Example 3.6.1 Find cids who order both products p01 and p07.



New) (select distinct cid from orders where pid = 'p01')

intersect (select cid from orders where pid = 'p07');

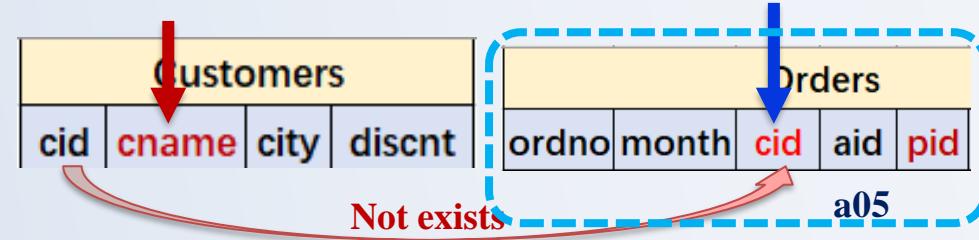
Old) select distinct cid from orders where pid = 'p01' and

cid in (select cid from orders where pid = 'p07');



3.6 Some advanced SQL syntax

[3] Example 3.6.2 (p116) Retrieve all cnames where the customer don't place any order through agent a05.



Old) select c.cname from customers c where

not exists (select * from orders x where x.aid='a05' and x.cid=c.cid);

New) select c.cname from customers c

except (select c.cname from customers c, orders x
where x.aid = 'a05' and x.cid = c.cid);

[4] Operators in DBMS product

- ORACLE 8 : {UNION, UNION ALL, INTERSECT, EXCEPT}
- DB2 Version 5 : {UNION, INTERSECT, EXCEPT} [ALL]
- INFORMIX : UNION [ALL]



3.6 Some advanced SQL syntax

2. Join in advanced SQL

a) Join Predicate

Tableref := tablename [[AS] corr_name[(colname {, colname ...})]]
| (subquery) [AS] corr_name [(colname {, colname ...})]
| tableref1 [INNER | { **LEFT** | **RIGHT** | **FULL** }
[OUTER] **JOIN** tableref2 ON search_condition |
USING (colname {, colname ...}))

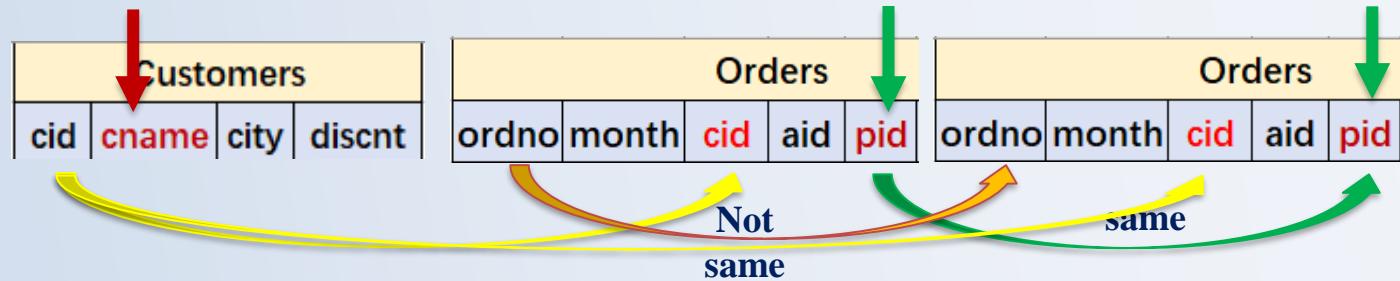
b) FROM 子句中含Subquery

clause := **FROM** tableref {, tableref ...}



3.6 Some advanced SQL syntax

[2] Example 3.6.3_(p118) Retrieve all cnames where the customer places at least two orders for the same product.



S1) select cname from (select o.cid as spcid from orders o, orders x
where o.cid=x.cid and o.pid=x.pid and o.ordno<>x.ordno) as y,
customers c where y.spcid = c.cid;

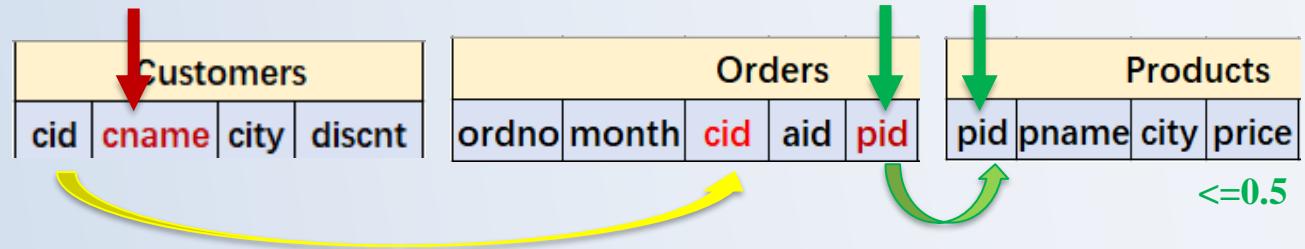
(from子句中出现Subquery : 先求View y, 再作其它处理)

S2) select cname from customers c, orders o, orders x
where c.cid=o.cid and o.pid=x.pid and o.ordno<>x.ordno;



3.6 Some advanced SQL syntax

[3] Example 3.6.4 (p119) Retrieve all customers who has buy at least one product costing less than \$0.50.



a)Alg. $(((P \text{ where } \text{price} < 0.50)[\text{pid}]) \bowtie O \bowtie C) [\text{cname}]$

b)New1 select distinct cname from (O join P on O.pid = P.pid)

join C on O.cid = C.cid where P.price < 0.50;

New2 select distinct cname from (O join P using(pid))

join C using(cid) where price < 0.50;

Old3 select cname from Customers C, Orders O, Products P

where C.cid=O.cid and O.pid=P.pid and P.price<0.50;



3.6 Some advanced SQL syntax



3. Outer Join

[1] Form: [{LEFT | RIGHT | FULL} [OUTER]] JOIN

[2] Example: _(p120) We have two tables S and T

(a) select * from S full outer join T using(A) ;

(b) select * from S left outer join T using(A)

UNION select * from S right outer join T using(A);

(a)

S.C	S.A	T.A	T.B
c1	a1	a1	b1
c3	a3	a3	b3
c4	a4	a4	b4
	?	a2	b2

(b)

S.C	S.A	T.B
c1	a1	b1
c3	a3	b3
c4	a4	b4
null	a2	b2



3.7 Set function in SQL



- *Is there some Functions in the SQL?*



1. Set functions in SQL

[1] Set Functions

- Five types : **count, max, min, sum, avg**
- Operate on sets of values, return a single value

[2] Different terms in Products

- X/OPEN and INGRES refer to *set function*
- ANSI says *aggregate functions*
- ORACLE has *group functions*
- DB2 says *column functions*



3.7 Set function in SQL

[3] Set function syntax of SQL

Select **SET_functionName** ([ALL | DISTINCT] **colname**) from.....

Select **COUNT(*)** from.....

Name	Argument type	Result type	Description
count	any (can be *)	numeric	count of occurrences
sum	numeric	numeric	sum of arguments
max	char or numeric	same as arg.	maximum value
min	char or numeric	same as arg.	minimum value
avg	numeric	numeric	average of arguments



3.7 Set function in SQL

2. Example 3.7.2 Please to determine the total quantity of product p03 that has been ordered.

Orders							求和
ordno	month	cid	aid	pid	qty	dallor	‘p03’

```
select sum(qty) as TOTAL from orders where pid = 'p03';
```

3. Example 3.7.4 Get number of cities where customers are based.

```
select count (distinct city) from customers;
```

Comparing:

```
select count(*) from customers; /* all the numbers of rows */
```

```
select count(cid) from customers; /* null values not counted, cid is PK of customers*/
```

```
select count(city) from customers; /* only if no null city values*/
```

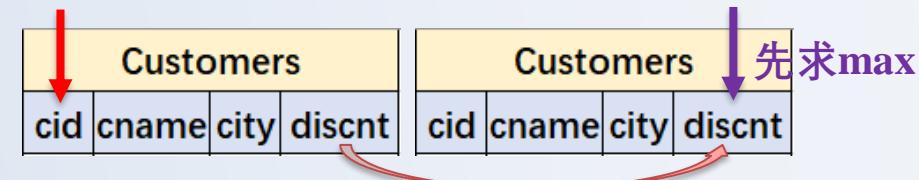


3.7 Set function in SQL

4. Restriction !!! set functions are not allowed to appear in comparison of a WHERE clause

5. Example 3.7.5 List cids who have a discount less than maximum discount.

a) Invalid: select cid from customers where discnt < max(discnt);



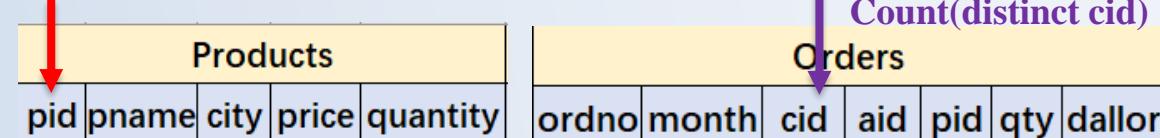
b) Effective: select cid from customers

where discnt < (select max(discnt) from customers);

6. Example 3.7.6 Find products ordered by at least two customers.

select pid from products

where 2 <= (select count(distinct cid) from order o
where o.pid=p.pid)





3.7 Set function in SQL

7.Handing NULL values

- *null* is a special constant(常數)
- meaningful a value that is *UNKNOWN*.

8.Example 3.7.8 After adding a row (c007, Windix, Dallas, **null**) to the customers table, Pose the query to retrieve this row.

- a) SQL **select * from customers where discnt **is null**;**
- b) wrong **select * from customers where **discnt<=10 and discnt>10;****



3.7 Set function in SQL

9.Example 3.7.9 After adding the row (c007,Windix,Dallas,**null**) to customers table. We wish to find the average discount of all customers.

a) the null is discarded (抛弃, 排除)

```
select avg(discnt) from customers;
```

b) A set function acting on a empty set

- **count()**
- **sum(), avg(), max() and min()**

returns zero for a empty set.

return the null value.



3.8 Group of rows in SQL

- How to classify the Data in different groups?



1. GROUP and HAVING clause

```
SELECT [ALL|DISTINCT] {*|expr [[AS] c_alias]{,expr [[AS] c_alias]...}}  
    FROM tableref {, tabletrf...}  
    [WHERE search_condition]  
    [GROUP BY column {, column...} ] [HAVING search_condition]  
    | subquery UNION [ALL] | INTERSECT [ALL] | EXCEPT [ALL]  
    [CORRESPONDING [BY] (colname {, colname . . .}))] subquery
```

2. Example 3.8.1 Let's create a query to calculate the total product quantity ordered of each individual product by each individual customer. (查每个(pid, cid)对之间的销货数).

```
select pid, cid, sum(qty) as TOTAL from orders group by pid, cid;
```

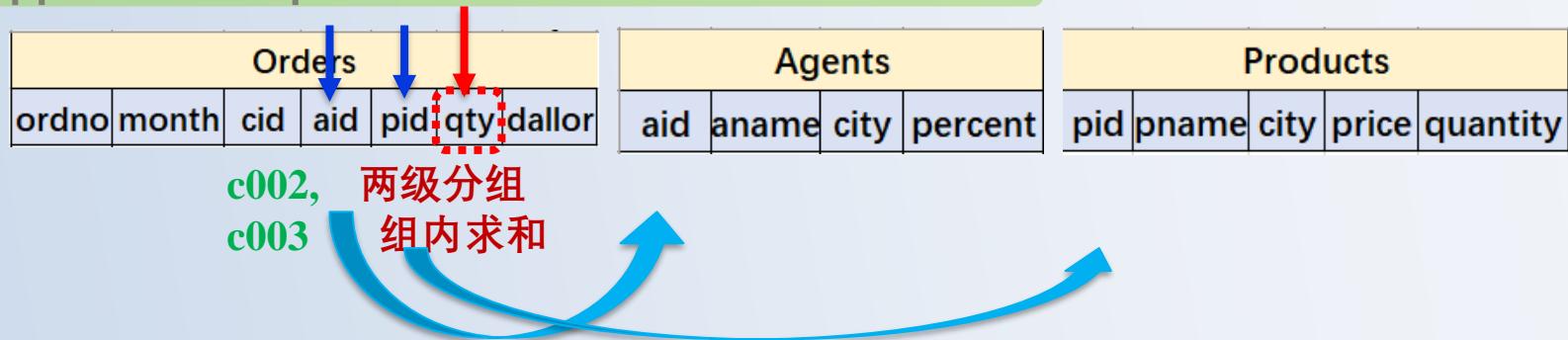
Orders					
ordno	month	cid	aid	pid	qty
					dallor

两级分组
组内求和



3.8 Group of rows in SQL

3.Example 3.8.2 Print out the **aname**, **aid**, **pname**, **pid** together with the **total quantity** each agent supplies of that product to customers **c002** and **c003**.



```
select x.aid, x.pid, sum(qty) from orders x  
where x.cid in ('c002','c003') group by aid, pid;
```

```
select aname, x.aid, pname, x.pid, sum(qty) as total_qty  
from agent a, products p, orders x  
where x.cid in ('c002','c003') and x.aid=a.aid and x.pid=p.pid  
group by aid, pid;
```



3.8 Group of rows in SQL

4. Example 3.8.4 Provided pids purchased by (sell to) at least two customers.

Orders					
ordno	month	cid	aid	pid	qty dollar

pid分组
组内cid计数 ≥ 2

select pid from orders

group by pid having count(distinct cid) ≥ 2 ;

5. Example 3.8.5 Pose a query to find the average, over all agents, of the maximum dollar sales made by each agent.

Orders					
ordno	month	cid	aid	pid	qty dollar

aid分组;
找组内dollar最大

select aid, max(dollar) as x
from orders group by aid;

select avg(t.x) from (select aid, max(dollar) as x
from orders group by aid) t;



3.9 A complete description of Select

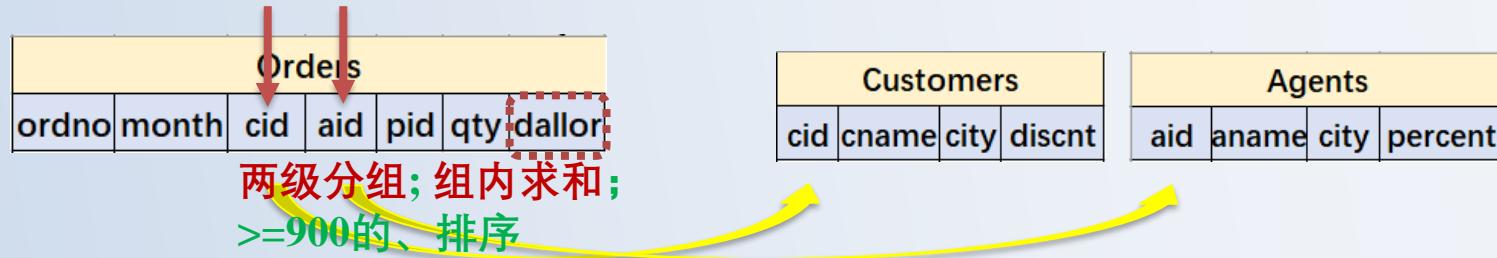
1. Experiments of making a Select statement

- a) The **Cartesian Product** of all tables in **FROM** clause is formed.
- b) Rows not satisfying in **WHERE** condition are eliminated (消去/限制).
- c) Rearranging rows are grouped in accordance with the **GROUP BY**.
- d) Groups not satisfying the **HAVING** clause are then eliminated.
- e) The expressions of the **Select Clause target list** are calculated.
- f) If the keyword **DISTINCT** is present, *duplicate rows are eliminated*. The **UNION**, **INTERSECT**, **EXCEPT** is taken after each subquery.
- g) If an **ORDER BY** is present that set of *all selected rows is sorted*.



3.9 A complete description of Select

2.Example 3.9.1 List all customers, agents and the dollar sales for pairs of customers and agents, and order the result from largest to smallest sales totals. Retain only those pairs for which the dollar amount is at least 900.



```
select c.cname, o.cid, a.fname, a.lname, sum(o.dollars) as casales  
from customers c, orders o, agents a  
where c.cid = o.cid and o.aid = a.aid  
group by (c.cname,) o.cid, (a.fname, a.lname)  
having sum(o.dollars) >= 900.00  
order by 5 desc;
```

Note: 5 is means to the fifth column “casales” is on descending.



3.9 A complete description of Select

3. Expressions, Predicates, Search_condition

[1] Expressions Form

expr = num-expr | strv-expr | date-xpr | intv-expr | con-dexpr

[2] Data Types

- *Numeric* value expressions
- *String* value expression
- *Datetime* expression
- *Interval value* expression
- *Conditional* expression

Note:

- Difference *DBMS product* provides difference function;
- Data types for columns defined in Appendix A.3



3.9 A complete description of Select

[3] Mathematical functions

abs(n), mod(n,b), sqrt(n). NOT standardized in SQL-99.

[4] Char & String functions

CHAR_LENGTH (str)

SUBSTRING (str FROM start [FOR length])

TRIM ([[LEADING|TRAILING|BOTH][set] FROM] str)

POSITION (str1 IN str2)

UPPER(strval), LOWER(strval)

[5] Logical Values

- TRUE/ FALSE/ UNKNOWN ('U' is not equivalent to 'F')

AND	T	F	U	OR	T	F	U		NOT
T	T	F	U	T	T	T	T	T	F
F	F	F	F	F	T	F	U	F	T
U	U	F	U	U	T	U	U	U	U



3.9 A complete description of Select

[6] Predicates

- a) Comparison predicate: **expr1 { expr2 | expr1 (Subquery)}**
- b) **Between** predicate: **c.discnt between 10 and 12**
- c) In predicate: **expr [not] in (subquery)**
- d) Quantified predicate: **expr [all |any |some] (subquery)**
- e) Exists predicate: **[not] exists (subquery)**
- f) Is null predicate: **columnname is [not] null**
- g) **Like** predicate: **columnname [not] like 'pattern'**



3.9 A complete description of Select

4. Summary of Predicates

[1] Comparison predicate expr1 | expr1 (Subquery){=, <>, >, <,>=, <=}

➤ Example 3.9.2 Listed cids with a discount less than the maximum discount.

select **max(discnt)** from customers

S1 select **cid** from customers

where **discnt** < (select **max(discnt)** from customers);

S2 select **cid** from customers

where **discnt** < **any**(select **discnt** from customers);

➤ Example: Find orders made by customers whose city come after 'M' in the alphabetic. (选 'M' 以后字母开头的city)

select * from orders o where

'M'<(select city from customers c where c.cid=o.cid);



3.9 A complete description of Select

[2] Between predicate: expr [NOT] BETWEEN expr2 and expr3

select * from products where **price between 1 and 10**

[3] Quantified predicate: expr [ALL | ANY | SOME] (subquery)

➤ Example 3.9.3 Get maximum discount of all customer.

S1 select max(discnt) as maxdis from customers;

S2 select distinct discnt from customers c where discnt
 >=all (select discnt from customers d where d.cid<>c.cid);

[4] Exists predicate [NOT] EXIST (subquery)

[5] In predicate expr [NOT] IN (subquery)

[6] Is null is [NOT] NULL



3.9 A complete description of Select

[7] Like predicate: columnname [NOT] LIKE 'pattern'

- Wildcards (通配符。Like windows file wildcards)

Underscore (_) Any single character

Percent (%) Zero or more characters of any form

Escape character (\) Precedes quoted literal character

All other characters Represent themselves

➤ Example 3.9.4 Retrieve all data of customers whose name begins with the letter 'A'.

```
select * from customers where cname like 'A%' ;
```



3.9 A complete description of Select

- Example 3.9.6 Retrieve cids of customers whose cname begins 'Tip_' and arbitrary(any) number of character .

```
select cid from customers  
      where cname like 'Tip[_%]' escape '\';
```

- Example 3.9.7 Retrieve cids of customers whose cname starts with the sequence 'ab\' .

```
select cid from customers  
      where cname like 'ab\\%\' escape '\';
```



3.10 Insert, Update and Delete statements

● How to Updates the Data in DB?



- Update statements : Insert , Update , Delete
- Need update **privilege** on a table

1. Insert Statement

[1] Form

➤ 标准式: **INSERT INTO tablename [(column {, column...})]**
{VALUES (expr | null {, expr | null...}) | subquery}

[2] Example 3.10.1 (p148) Add a row specified values to the orders table. (no qty or dollars, so on this new row they are null).

```
insert into orders (ordno, month, cid, aid, pid)  
    values('1107', 'aug', 'c006', 'a04', 'p01');  
  
select * from order where dollars is null;
```



3.10 Insert, Update and Delete statements

● How to Updates the Data in DB?



- Update statements : Insert , Update , Delete
- Need update **privilege** on a table

1. Insert Statement

[1] Form

➤ 标准式: **INSERT INTO tablename [(column {, column...})]**
{VALUES (expr | null {, expr | null...}) | subquery}

➤ 插入子查询结果集

INSERT INTO tablename [colname[, colname...]]
Subquery;

[2] Example 3.10.2 Create a new table **Swcuds** of customers, and insert into all customers from Dallas and Austin.

```
select * from customers where city in ('Dallas', 'Austin')  
insert into swcuds (select * from customers where city in ('Dallas', 'Austin'));
```



3.10 Insert, Update and Delete statements

2. Update Statement

[1] Form: **UPDATE tablename SET** colname = {expr | null | (subquery)}
 {, {column = expr |null | (subquery)...}}
 [WHERE search_condition];

[2] Example 3.10.3 (p150) Give All agents in New York a 10% raise in the percent commission they earn on an order.

```
UPDATE agents SET percent = 1.1*percent  
WHERE city = 'New York';
```



3.10 Insert, Update and Delete statements

[3] Example 3.10.5 Update the *discnt* values in rows of the *Swcuds* table created in Example 3.10.2 with more up-to-date *discnt* values from the *customers* table.

[2] Example 3.10.2 Create a new table *Swcuds* of customers, and insert into all customers from Dallas and Austin.

```
insert into swcuds (select * from customers  
where city in ('Dallas', 'Austin') );
```

```
update swcuds s set discnt=(select discnt from customers c  
where c.cid = s.cid );
```



3.10 Insert, Update and Delete statements

3. Delete Statement

[1] Form: **DELETE FROM tablename [WHERE search_condition];**

[2] Example 3.10.6 (p151) Delete all agents in New York.

delete from agents where city = 'New York';

[3] Example 3.10.7 Delete agents who have total orders of less than \$600.

Orders							Agents			
ordno	month	cid	aid	pid	qty	dollar	aid	aname	city	percent

aid分组; 组内求和;
<600的、aid

删除aid的行

select aid from orders

group by aid having sum(dollars) < 600

delete from agents where aid in

(select aid from orders

group by aid having sum(dollars) < 600);



3.10 Insert, Update and Delete statements

[4] Notice: Table Drop

drop table agents;

~~(表结构+数据)~~

Suggestions for doing exercises:

(1) reading through Appendix B, and Appendix C

C.2, C.3, C.4, C.14, C.17, C.25, C.28, and C.31

(2) Exercises: all exercises of charter 3 .

specialized for [3.1], [3.2], [3.5], [3.7], [3.8], [3.10], [3.11], [3.12], [3.14],
[3.15], [3.16], [3.18], [3.19], [3.20]



Additional: DBMS Example

1. DBMS Example ORACLE

- ✓ Setup ORACLE 11g (for Windows 7 64bit)
- ✓ There are 7 Serves in Windows:

The screenshot shows the Windows Task Manager with the 'Services' tab selected. The left pane displays a tree view of system management tools, and the right pane lists services. The service 'OracleServiceORCL' is highlighted.

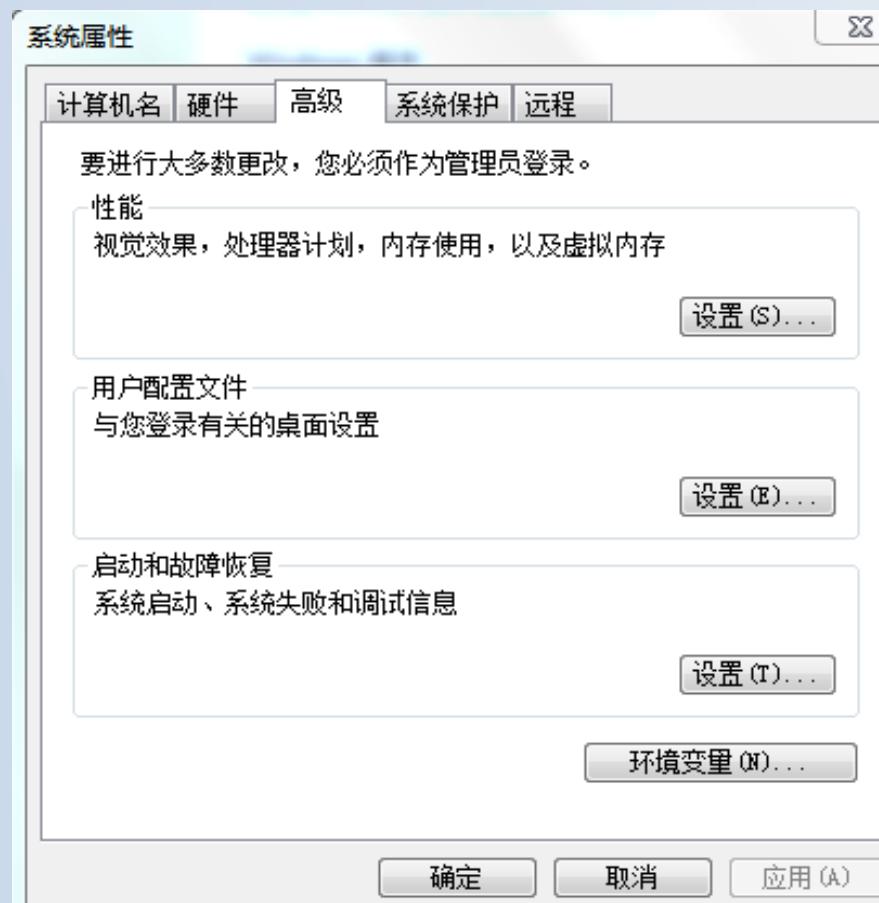
名称	描述	状态	启动类型
Network Store Interface Service	此服...	已启动	自动
NI Application Web Server (64-bit)	The ...		禁用
NVIDIA Display Driver Service	Prov...	已启动	自动
Office Source Engine	保存...		手动
Office Software Protection Platform	Offic...		手动
Offline Files	脱机...		手动
Oracle ORCL VSS Writer Service			手动
OracleDBConsoleorcl			手动
OracleJobSchedulerORCL			禁用
OracleMTSRecoveryService			手动
OracleOraDb11g_home1ClrAgent			手动
OracleOraDb11g_home1TNSListener			手动
OracleServiceORCL			手动
Parental Controls	此服...		手动



Additional: DBMS Example

1. DBMS Example ORACLE

➤ Setup the Environment variables

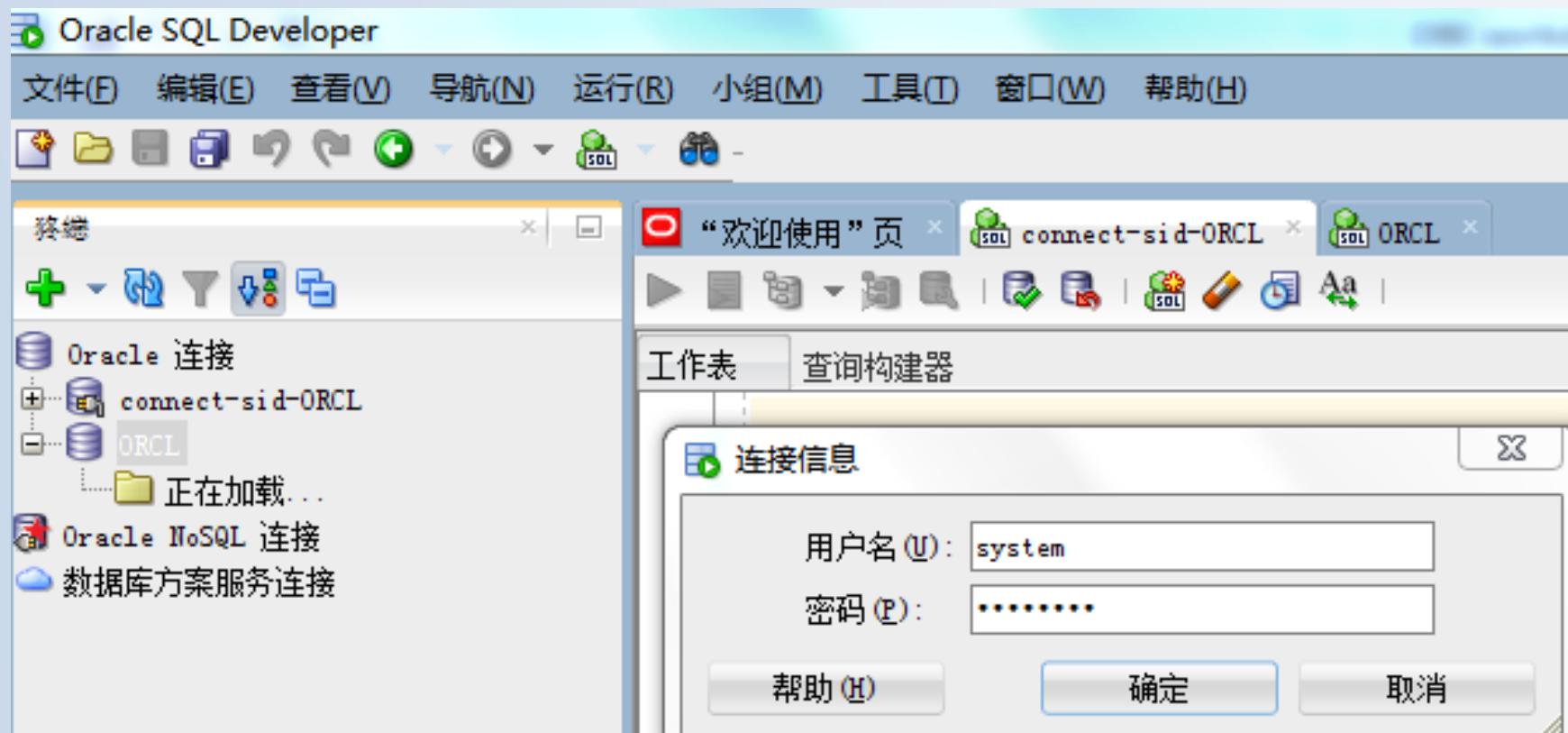




Additional: DBMS Example

1. DBMS Example ORACLE

- Start up ORACLE servies
- Start up SQL Plus or SQLdeveloper
- Login/Connect the ORACLE with Account & Password





Additional: DBMS Example

1. DBMS Example ORACLE

➤ Input SQL statement

The screenshot shows the Oracle SQL Developer interface. On the left is the Object Navigator pane, which lists connections and various database objects like tables, views, and indexes. The connection 'connect-sid-ORCL' is selected. The main workspace contains a query editor window titled '查询构建器' (Query Builder) with the SQL statement:

```
select * from A_agnet;
```

Below the query editor is a results window titled '查询结果' (Query Results) showing the error message:

ORA-00942: 表或视图不存在
00942. 00000 - "table or view does not exist"
*Cause:
*Action:
行 1 列 15 出错

The status bar at the bottom indicates the query was executed in 0 seconds.



Additional: DBMS Example

1. DBMS Example: ORACLE

- Create table A_agent

文件(F) 编辑(E) 查看(V) 导航(N) 运行(R) 小组(M) 工具(I) 窗口(W) 帮助(H)

表 (已过滤) A_AGENT AQ\$_INTERNET_AGENT_PRIVS AQ\$_INTERNET_AGENTS AQ\$_QUEUE_TABLES AQ\$_QUEUES AQ\$_SCHEDULES DEF\$_AQCALL DEF\$_AQERROR DEF\$_CALLDEST DEF\$_DEFAULTDEST DEF\$_DESTINATION

“欢迎使用” 编辑表

方案(A): SYSTEM
名称(B): A_AGENT
表类型(C): 正常

列(A): 名称

PK	名称	数据类型	大小	非空	默认值	注释
是	AID	CHAR	3	<input checked="" type="checkbox"/>		商家编号
	ANAME	CHAR	10	<input type="checkbox"/>		商家姓名
	CITY	CHAR	10	<input type="checkbox"/>		所在城市
	PERCENT	INTEGER		<input type="checkbox"/>		销货提成比



Additional: DBMS Example

1. DBMS Example ORACLE

- Insert the Data to the table by Visual box

A_agent

The screenshot shows the Oracle SQL Developer interface. On the left, the object browser displays the schema structure, including the A_AGENT table with columns AID, ANAME, CITY, and PERCENT. The AID column uses a sequence generator (+1). The A_AGENT table currently contains three rows:

AID	ANAME	CITY	PERCENT
+1	a01	Newyork	8
+2	susan	Dallas	10
+3	tom	Boston	6

In the center, the A_AGENT table is displayed in a visual edit mode. A confirmation dialog box titled "SYSTEM"."A_AGENT" is overlaid on the interface, asking "SYSTEM". "A_AGENT" 已修改。是否保存更改? (SYSTEM. "A_AGENT" has been modified. Do you want to save changes?). The dialog includes three buttons: 是 (I) (Yes), 否 (II) (No), and 取消 (Cancel).



Additional: DBMS Example

1. DBMS Example ORACLE

- Insert the Data to the table using SQL A_agent

The screenshot shows two windows of Oracle SQL Developer. The top window displays the 'A_AGENT' table with four columns: AID, ANAME, CITY, and PERCENT. A new row is being inserted with values: AID +1, ANAME a01, CITY Newyork, and PERCENT 8. The bottom window shows the same table with three existing rows and the newly inserted row.

AID	ANAME	CITY	PERCENT
+1	a01	john	Newyork
1	a01	john	Newyork
2	a02	susan	Dallas
3	a03	tom	Boston

SQL Statement:

```
INSERT INTO "SYSTEM"."A_AGENT" (AID, ANAME, CITY, PERCENT) VALUES ('a01', 'john', 'Newyork', '8')
INSERT INTO "SYSTEM"."A_AGENT" (AID, ANAME, CITY, PERCENT) VALUES ('a02', 'susan', 'Dallas', '10')
INSERT INTO "SYSTEM"."A_AGENT" (AID, ANAME, CITY, PERCENT) VALUES ('a03', 'tom', 'Boston', '6')
```

提交成功



Additional: DBMS Example

1. DBMS Example ORACLE

The screenshot shows the Oracle SQL Developer interface. The left sidebar displays a tree view of database objects, including tables like A_AGENT, AID, ANAME, CITY, PERCENT, and various system tables starting with AQ\$. The main area contains a query editor with the following SQL code:

```
select * from a_agent;
update a_agent set percent=1.1*percent where city='Newyork';
select * from a_agent;
```

Below the query editor is a results viewer showing the output of the last query:

AID	ANAME	CITY	PERCENT	
1	a01	john	Newyork	9
2	a02	susan	Dallas	10
3	a03	tom	Boston	6