Database Systems Constraint Statements

CS 630 Database Systems

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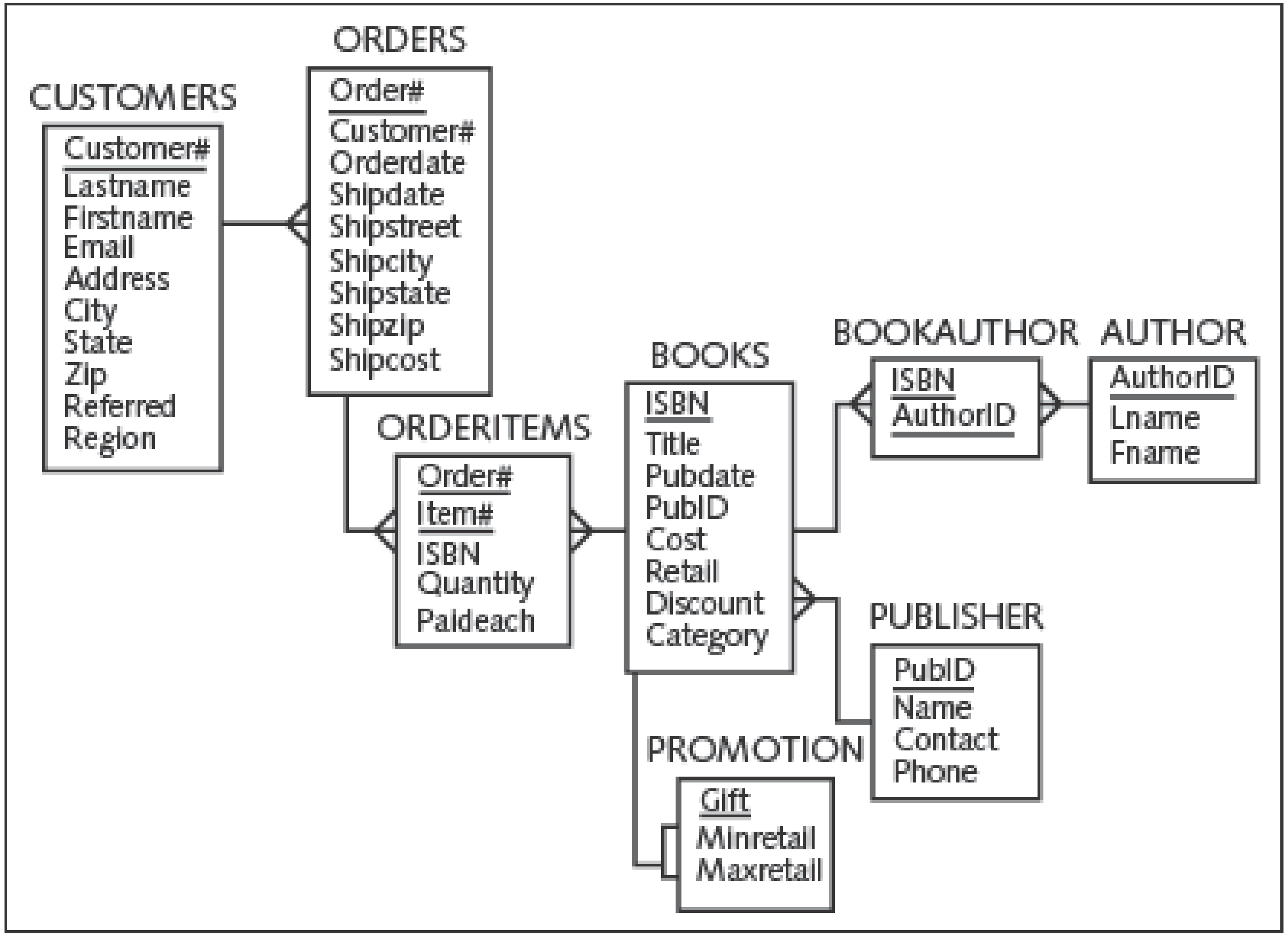
Objectives…

- Explain the Purpose of Constraints in a Table…
- Explain the Differences and Uses of a PRIMARY KEY, (PK), a FOREIGN KEY (FK), a UNIQUE Constraint, a CHECK Constraint, and a NOT NULL Constraint…
- Understand How and When Constraints Can Be Created…
- Distinguish Between Creating Constraints At The Column Level and the Table Level…
- Create a PK, a FK, a UNIQUE Constraints, and a CHECK Constraint…

Normalized JustLee Books Database…



CUSTOMERS
Customer#
Lastname
Firstname
Email
Address
City
State
Zip
Referred
Region

ORDERS
Order#
Customer#
Orderdate
Shipdate
Shipstreet
Shipcity
Shipstate
Shipzip
Shipcost

ORDERITEMS
Order#
Item#
ISBN
Quantity
Paideach

BOOKS
ISBN
Title
Pubdate
PubID
Cost
Retail
Discount
Category

BOOKAUTHOR
ISBN
AuthorID

AUTHOR
AuthorID
Lname
Fname

PUBLISHER
PubID
Name
Contact
Phone

PROMOTION
Gift
Minretail
Maxretail

NULL Values…

- Represents an Unknown or a Missing Value…
- **A NULL VALUE DOES NOT MEAN A ZERO OR AN EMPTY TEXT STRING…**
- Zero (0) Can Have Meaning…i.e., the Balance of a Bank Account, Amount of a Product in Stock…
- A Blank Space is a Valid Character…i.e., City Is Not Part of a Country, Someone Has No Middle Initial…

Why Use NULLS?...

- **AGAIN…NULL VALUE DOES NOT MEAN A ZERO OR AN EMPTY TEXT STRING…**
- Can Be Useful in Determining Whether or Not Data Has Been Entered for a Value…i.e., If Someone Does Not Have a Middle Name, the Field Can Be Null…If You Are Uncertain What Category Something Belongs to You Can Leave it NULL Until You Find Out…
- Numbers Can Be NULL…But Using NULLS in a Calculation Results in a NULL Value…
- Functions Can Be Used to Replace NULL Values With a 0 (Much More on That Later)…

Constraints…

- By Definition, a Constraint is Anything That Limits or Restricts…
- In Database, a Constraint is a Rule Used to Ensure the Accuracy and Integrity of Data…
- Constraints Are Used to Enforce Business Rules, Business Practices, and Business Policies…

Types of Constraints…

- **Primary Key (PK) :** Determines Which Column(s) UNIQUELY Identifies Each Record…PK CANNOT Be Null…Data Values Must Be Unique…
- **Foreign Key (FK) :** A Field In One Table That is a PK in Another Table…Ensures That FK Values Already Exist as a PK Somewhere Else…
- **UNIQUE :** Ensures All Data Values Stored in a Specific Column Are Unique…Allows NULL Values…Works in Conjunction With a PK…
- **CHECK :** Ensures a Specific Condition is True Before the Data Value is Added…For Example, an SHIP DATE Must Be Later Than or Equal to ORDER DATE…
- **NOT NULL :** Ensures That a Specific Column Cannot Contain a NULL…

Creating Constraints – Part 1…

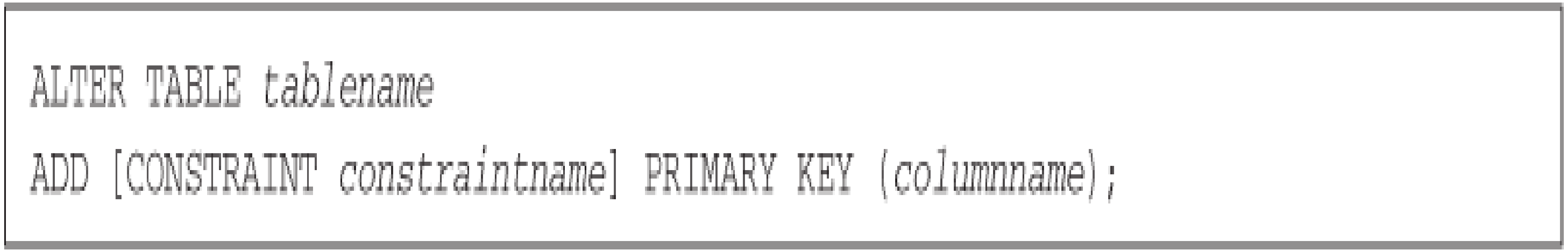
- Use the Optional CONSTRAINT Keyword During Creation to Assign a Name…
- Let the Server Name the Constraint Using The Default Format Sys_c*n*…NOT RECOMMENDED…
- Informative Names Can Assist in Debugging…
- Can Be Created During Table Creation or By Modifying an Existing Table…
- Can Be Created at the Column Level or the Table Level…

Creating Constraints – Part 2…

- All Constraints Are Enforced at the Table Level…
- If a Data Value in a Record Violates a Constraints, the ENTIRE RECORD is Rejected…
- Use the ALTER TABLE Command to Add a Constraint to an Existing Table…
- Add a NOT NULL Constraint Using the MODIFY Clause…
- All Other Constraints are Added Using the ADD Clause…

Primary Key Constraint…

- Ensures That Columns Do Not Contain Duplicate Or NULL Values…
- Only One Per Table Is Allowed…



```
ALTER TABLE tablename
ADD [CONSTRAINT constraintname] PRIMARY KEY (columnname);
```

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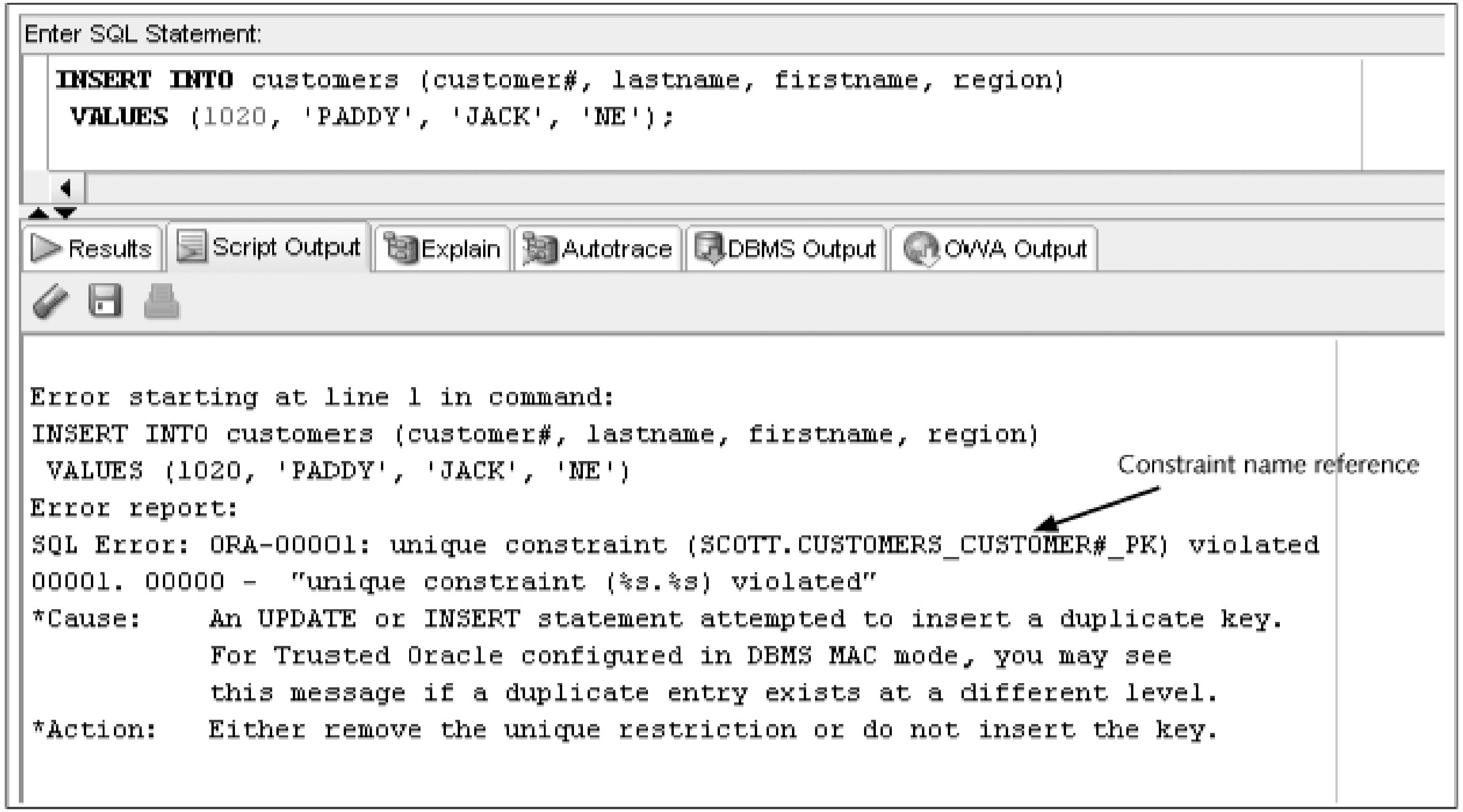
Constraint Checking on Data Input…

- If a Data Value in a Record Violates a Constraints, the ENTIRE RECORD is Rejected…

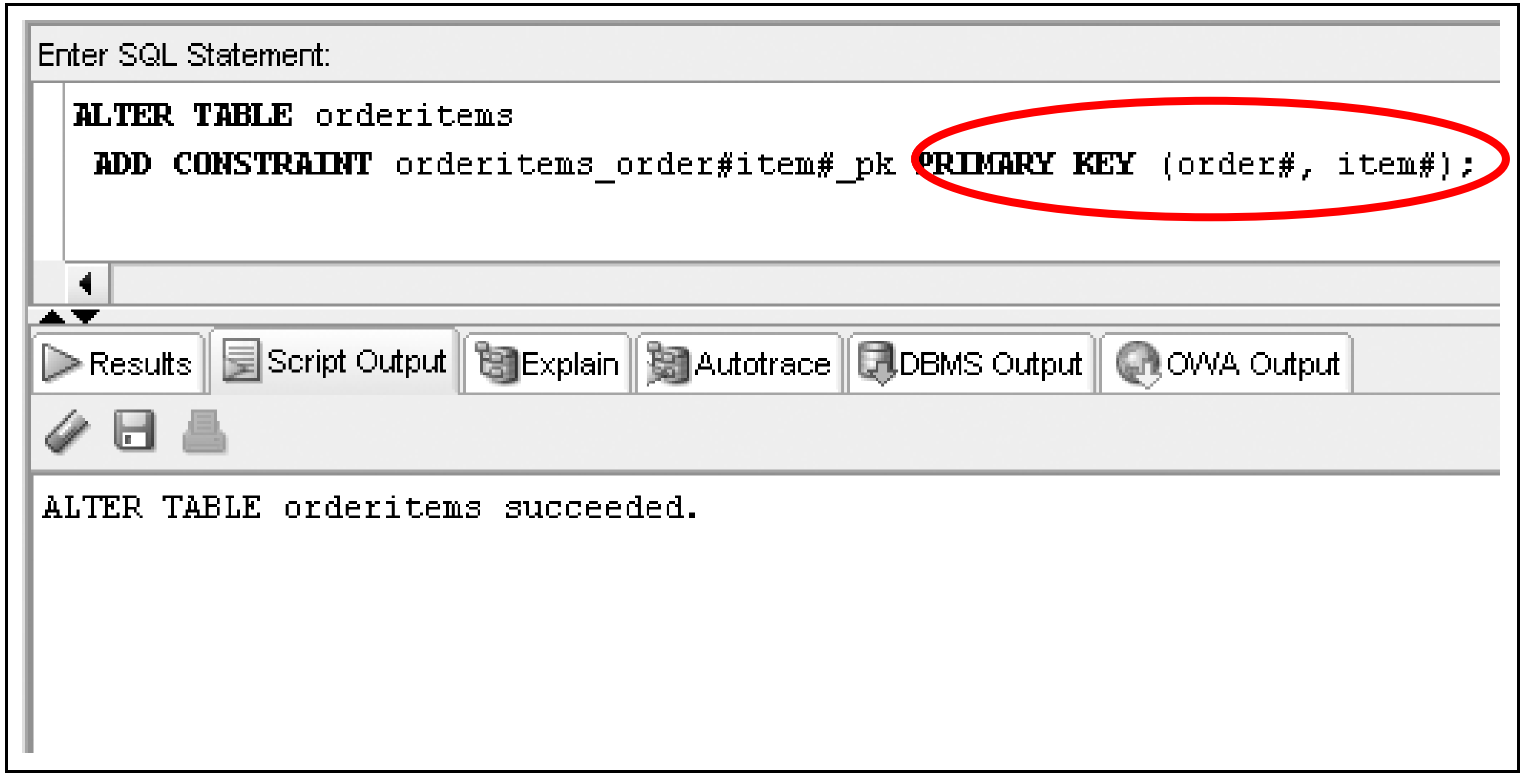


```
INSERT INTO customers (customer#, lastname, firstname, region)
 VALUES (1020, 'PADDY', 'JACK', 'NE');
```

```
Error starting at line 1 in command:
INSERT INTO customers (customer#, lastname, firstname, region)
 VALUES (1020, 'PADDY', 'JACK', 'NE')
Error report:
SQL Error: ORA-00001: unique constraint (SCOTT.CUSTOMERS_CUSTOMER#_PK) violated
00001. 00000 -  "unique constraint (%s.%s) violated"
*Cause:    An UPDATE or INSERT statement attempted to insert a duplicate key.
           For Trusted Oracle configured in DBMS MAC mode, you may see
           this message if a duplicate entry exists at a different level.
*Action:   Either remove the unique restriction or do not insert the key.
```

Primary Key Constraint for Composite Keys…

- List Column Names Inside a Parentheses…
- Separate All Names By Commas…



Enter SQL Statement:

```
ALTER TABLE orderitems
 ADD CONSTRAINT orderitems_order#item#_pk PRIMARY KEY (order#, item#);
```

```
ALTER TABLE orderitems succeeded.
```

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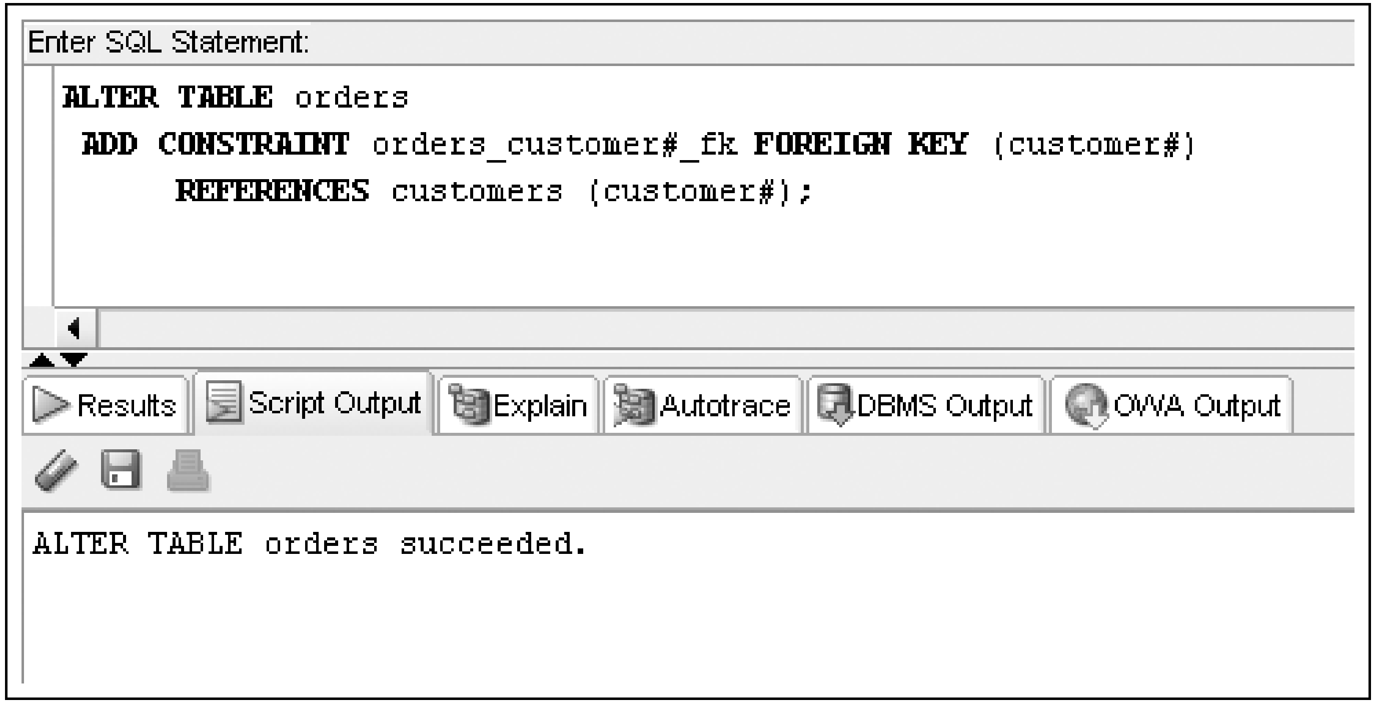
Using the Foreign Key Constraint…

- Value Needs to Exist in the Referenced Column of Another Table…Referential Integrity is Enforced…
- Maps to the PRIMARY KEY in the Parent Table…
- NULL Values Are Allowed…



Enter SQL Statement:

```
ALTER TABLE orders
 ADD CONSTRAINT orders_customer#_fk FOREIGN KEY (customer#)
      REFERENCES customers (customer#);
```

```
ALTER TABLE orders succeeded.
```

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Deleting Foreign Keys…

- Cannot Delete a Value in a Parent Table Referenced By a Row in a Child Table…
- In Other Words…You Cannot Delete a PK Value in a Table If That Value is Being Used as a FK in Another Table…
- For Example…
  - Let’s Say CS630 (CRS_ID) is the PK in the COURSE Table…
  - CRS_ID is Also Used as a FK in the STUDENT Table (i.e., This Student Took This Course)…
  - You Would NOT Be Allowed to Delete IT330 From the COURSE Table…
  - Deleting That Record in the COURSE Table, Creates an “Orphan” in the STUDENT Table (i.e., CS630 Has No Link to a PK)…

ON DELETE CASCADE – BE CAREFUL!!!…

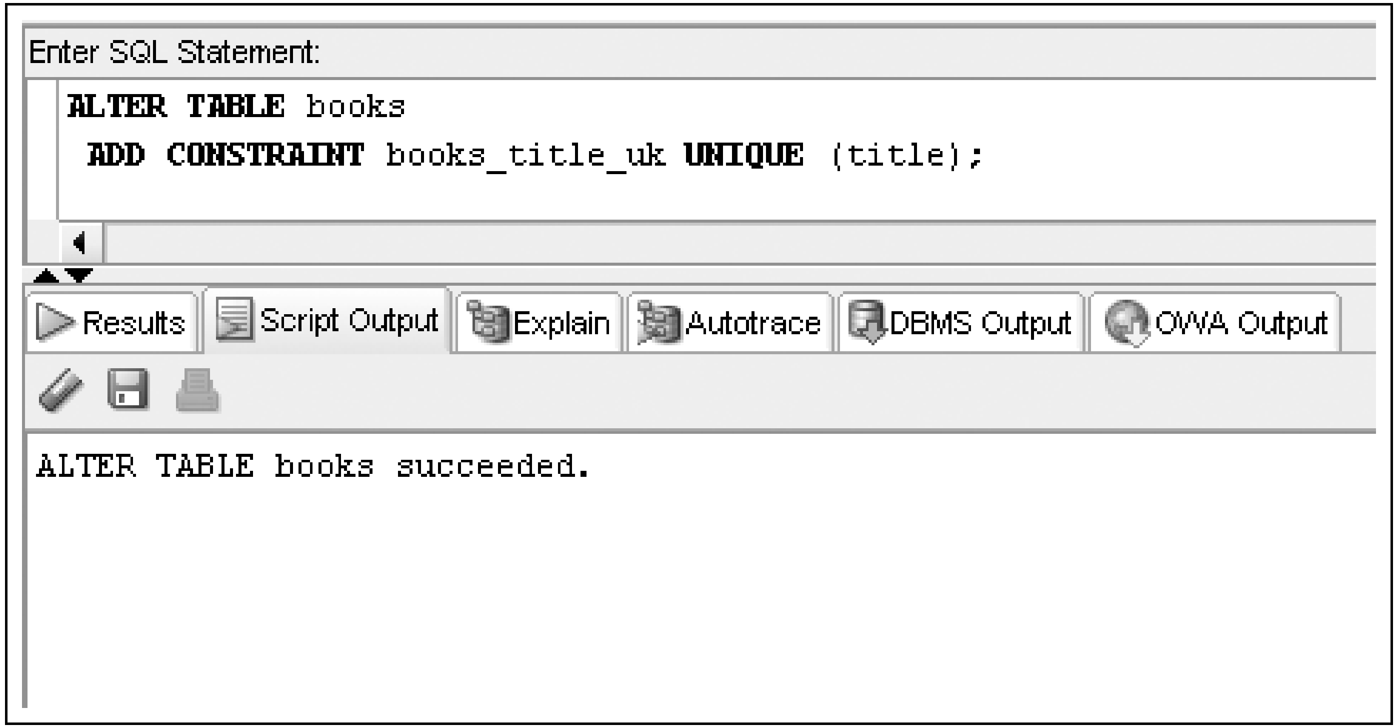
- Using "ON DELETE CASCADE" When Creating a FK Constraint Will Automatically Delete the Rows in the Child Table When the Record in the Parent Row is Deleted…
- From Our Previous Example…
  - Deleting CS630 From the COURSE Table Will AUTOMATICALLY Delete Any Record in the STUDENT Table With a CRS_ID of CS630…
  - **THIS IS NOT RECOMMENDED…**
  - There Are Better Ways of Doing This…

ON UPDATE CASCADE – BE CAREFUL!!!…

- Using “ON UPDATE CASCADE” When Creating a FK Constraint Will Automatically UPDATE Rows in the Child Table When the Record in the Parent Row is Updated…
- From Our Previous Example…
  - Updating IT330 to NN330 in the COURSE Table Will AUTOMATICALLY UPDATE Any Record in the STUDENT Table With a CRS_ID of CS630 to NN630…
  - **THIS IS NOT RECOMMENDED…**
  - Impacts of This Kind of Change (and ON DELETE CASCADE) are Potentially Severe…

Using the UNIQUE Constraint...

- No Duplicates Are Allowed in the Referenced Column…
- NULL Values Are Permitted…



```
ALTER TABLE books
 ADD CONSTRAINT books_title_uk UNIQUE (title);
```

```
ALTER TABLE books succeeded.
```

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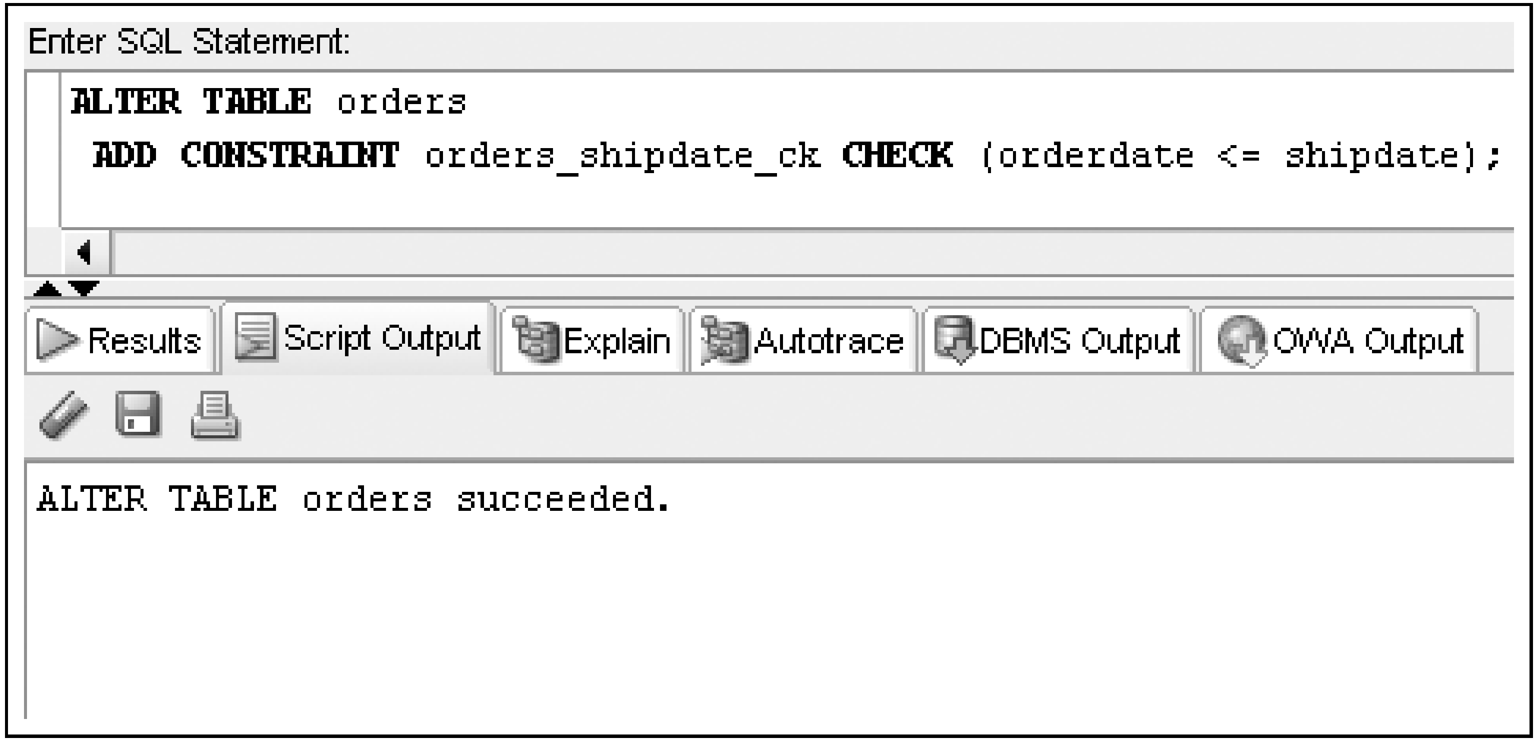
Using the CHECK Constraint...

- Updates and Additions Must Meet Specified Condition…

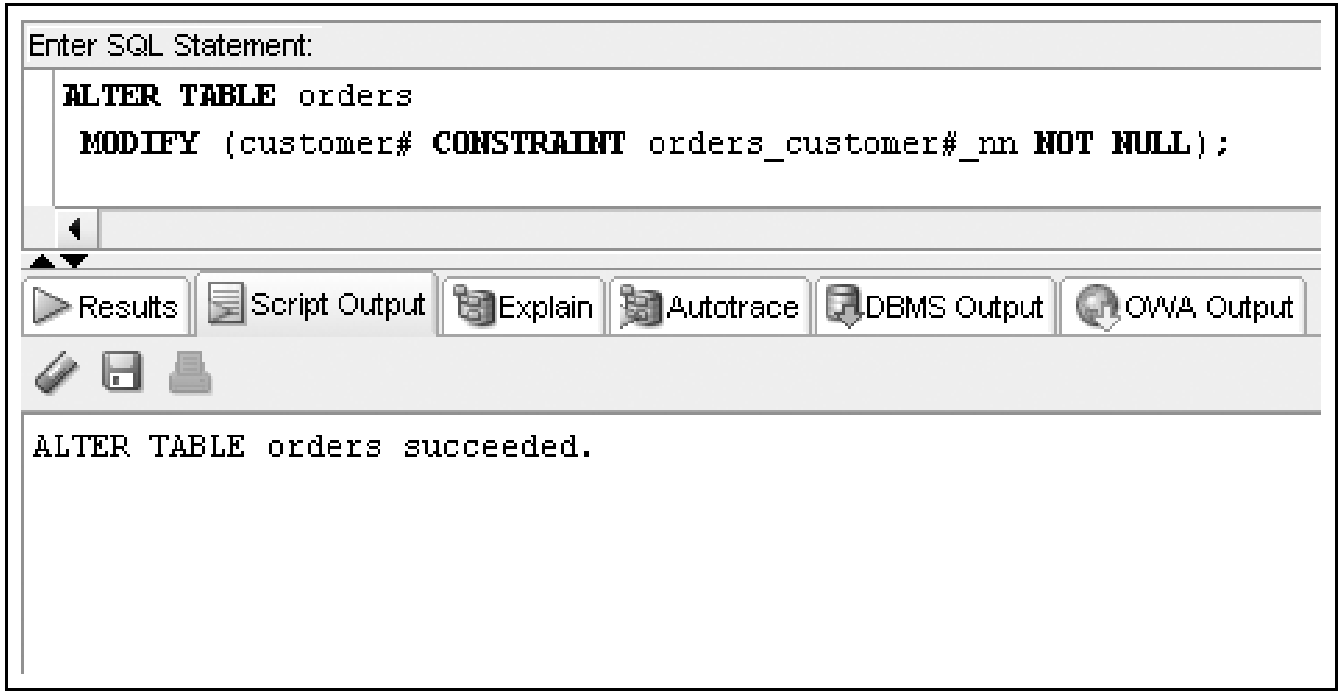


```
ALTER TABLE orders
 ADD CONSTRAINT orders_shipdate_ck CHECK (orderdate <= shipdate);
```

```
ALTER TABLE orders succeeded.
```

Using the NOT NULL Constraint…

- Special CHECK Constraint With “IS NOT NULL” Condition…
- Can Only Be Created At Column Level…
- Included In Output Of DESCRIBE Command…
- Can Only Be Added to an Existing Table Using ALTER TABLE…MODIFY Command…

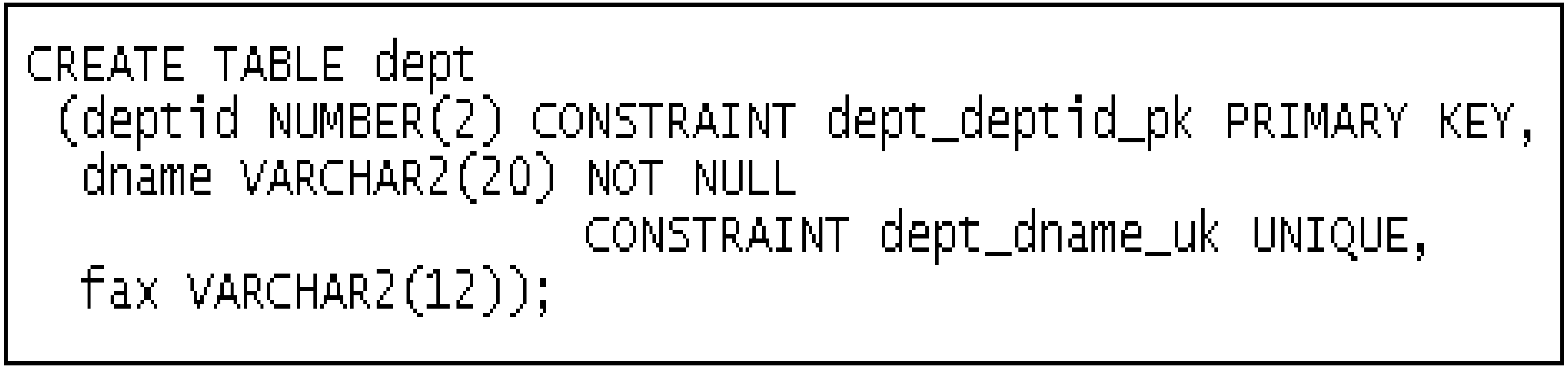


```
ALTER TABLE orders
 MODIFY (customer# CONSTRAINT orders_customer#_nn NOT NULL);
```

```
ALTER TABLE orders succeeded.
```

Constraints During Table Creation…

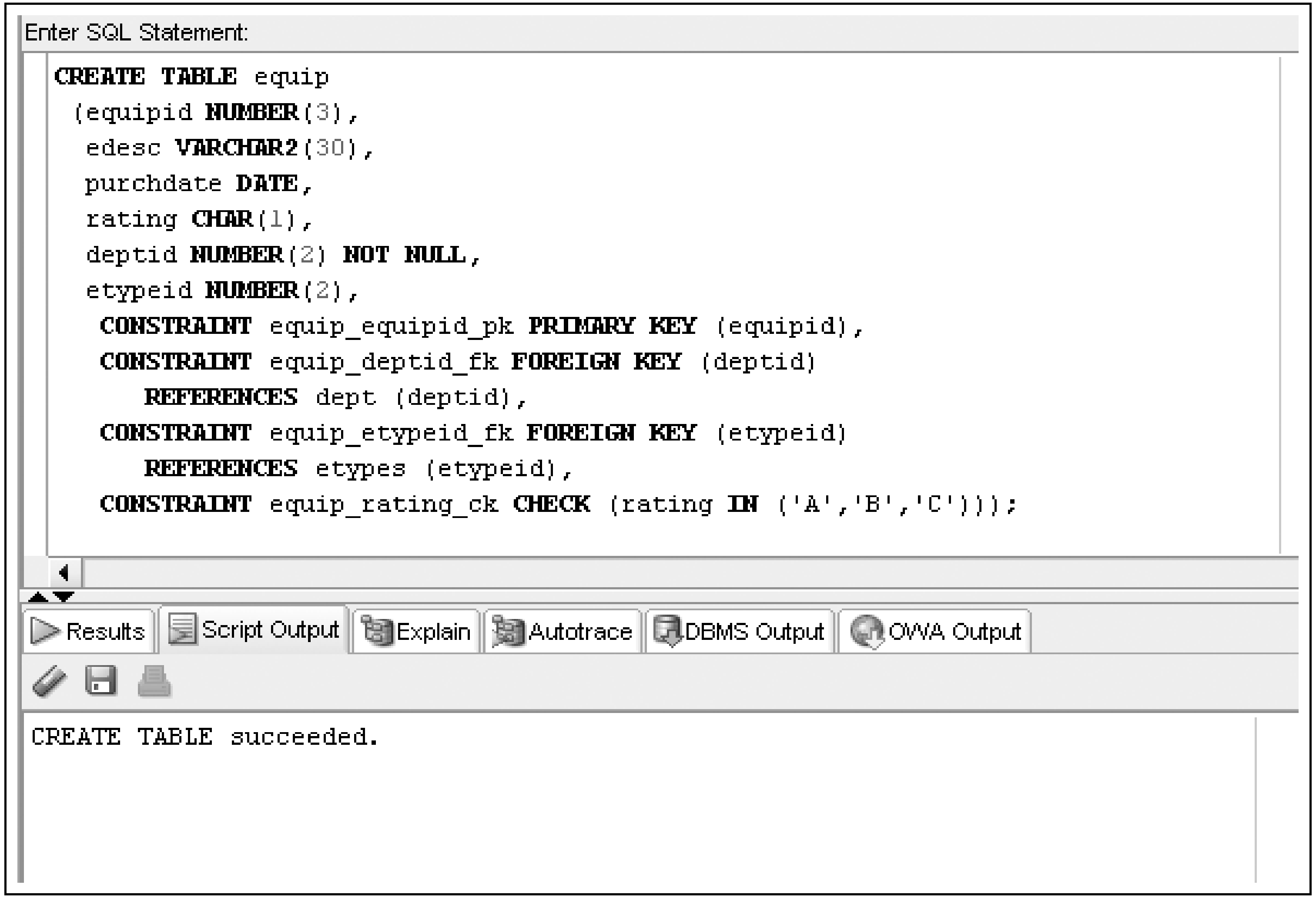
- Can Also Create Constraints During Table Creation…
- Must Be Included in Column Definition…
- Included At the End of the Column List…



```
CREATE TABLE dept
 (deptid NUMBER(2) CONSTRAINT dept_deptid_pk PRIMARY KEY,
  dname VARCHAR2(20) NOT NULL
                     CONSTRAINT dept_dname_uk UNIQUE,
  fax VARCHAR2(12));
```

Constraints During Table Creation - Example…

- For Right Now, I Want You to Create All Constraints Using ALTER and NOT at the End of Table Creation…



```
CREATE TABLE equip
 (equipid NUMBER(3),
  edesc VARCHAR2(30),
  purchdate DATE,
  rating CHAR(1),
  deptid NUMBER(2) NOT NULL,
  etypeid NUMBER(2),
   CONSTRAINT equip_equipid_pk PRIMARY KEY (equipid),
   CONSTRAINT equip_deptid_fk FOREIGN KEY (deptid)
      REFERENCES dept (deptid),
   CONSTRAINT equip_etypeid_fk FOREIGN KEY (etypeid)
      REFERENCES etypes (etypeid),
   CONSTRAINT equip_rating_ck CHECK (rating IN ('A','B','C')));
```

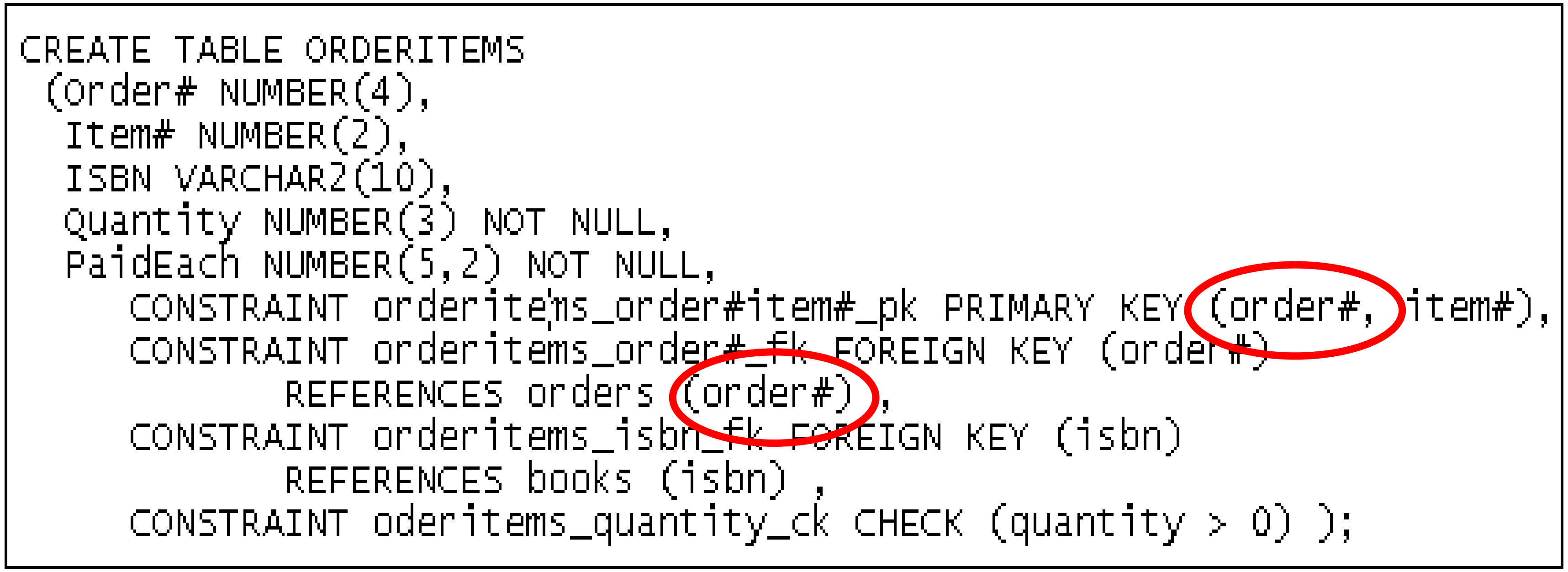
```
CREATE TABLE succeeded.
```

So What Does That Mean to Me?...

- When You Submit Any Work, I Want to See…
  - ✓ ALL DELETES…
  - ✓ ALL CREATES…
  - ✓ ALL CONSTRAINTS…
  - ✓ ALL INSERTS…
  - ✓ ALL DESCRIBES…
- This Will Keep All Like Items Together…
- Will Also Make It Easier to Debug Issues…
- Trust Me On This One!...

Multiple Constraints on a Single Column…

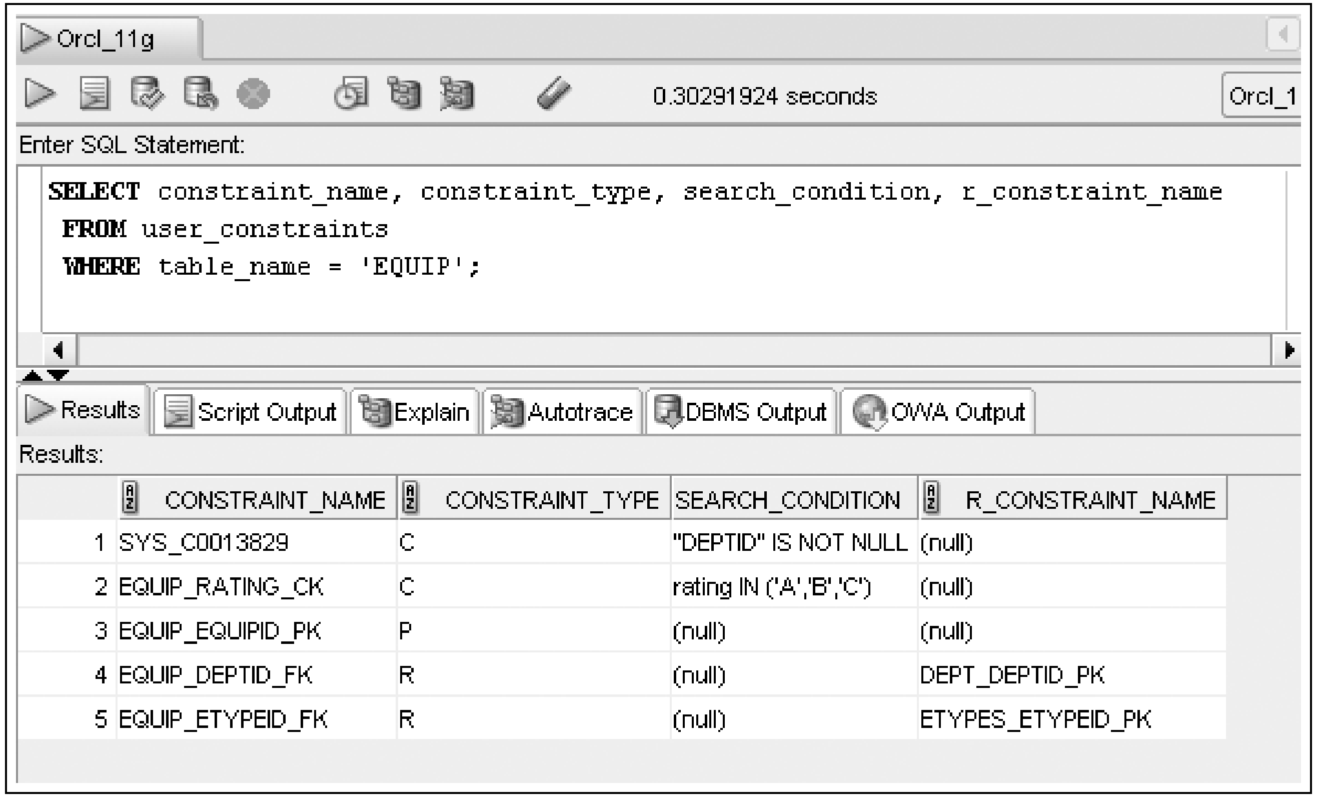
- Column May Be Included in Multiple Constraints…
- In This Example, ORDER# Is Included in Both a PK and FK Constraint…



```
CREATE TABLE ORDERITEMS
 (Order# NUMBER(4),
  Item# NUMBER(2),
  ISBN VARCHAR2(10),
  Quantity NUMBER(3) NOT NULL,
  PaidEach NUMBER(5,2) NOT NULL,
     CONSTRAINT orderitems_order#item#_pk PRIMARY KEY (order#, item#),
     CONSTRAINT orderitems_order#_fk FOREIGN KEY (order#)
            REFERENCES orders (order#),
     CONSTRAINT orderitems_isbn_fk FOREIGN KEY (isbn)
            REFERENCES books (isbn) ,
     CONSTRAINT oderitems_quantity_ck CHECK (quantity > 0) );
```

Viewing Constraints – USER_CONSTRAINTS…

- Should Be Used With DESC to Show All Definitions for Your Database…
- Display Constraints for a Specific Table…

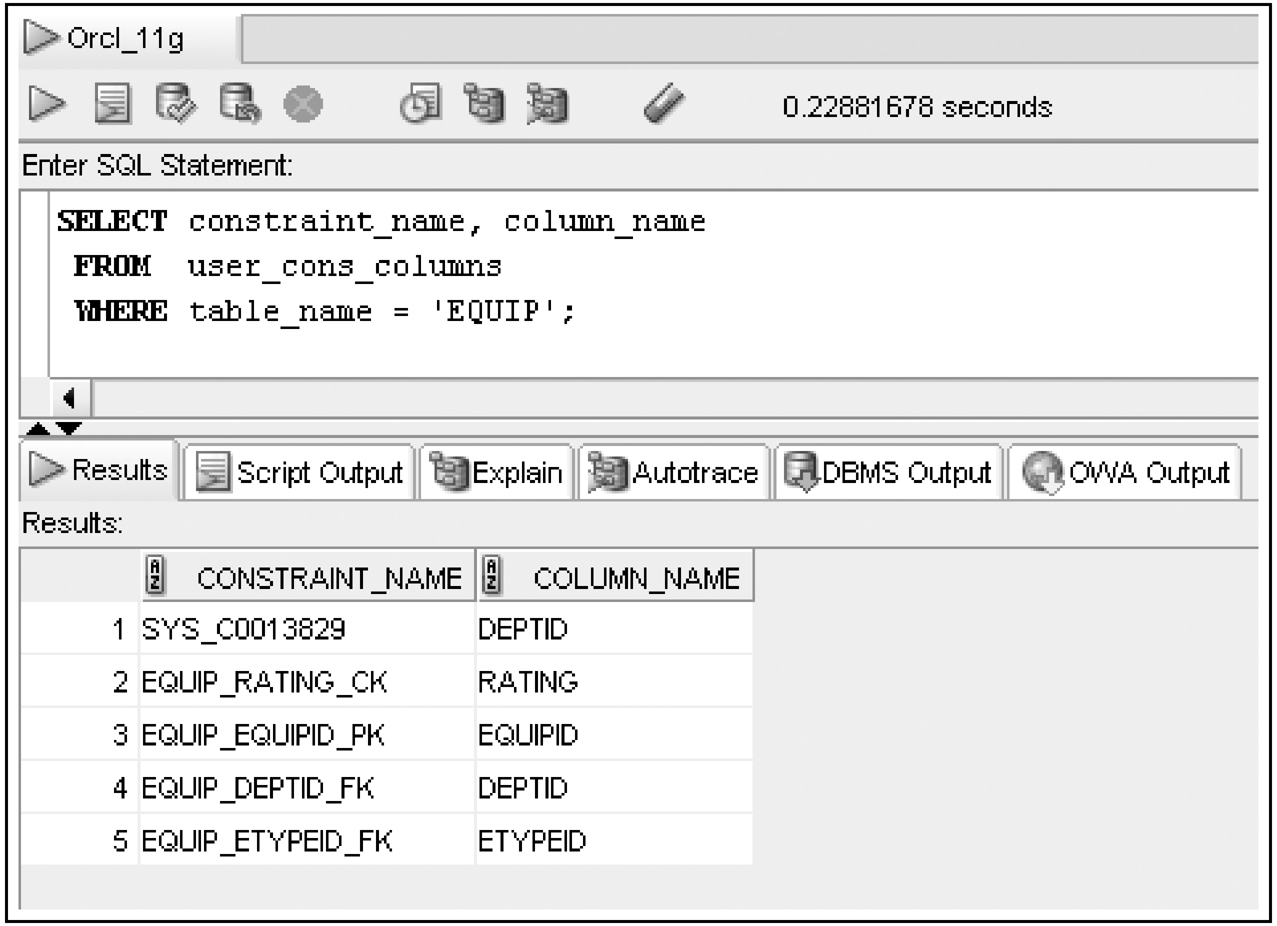


```
SELECT constraint_name, constraint_type, search_condition, r_constraint_name
 FROM user_constraints
 WHERE table_name = 'EQUIP';
```

	CONSTRAINT_NAME	CONSTRAINT_TYPE	SEARCH_CONDITION	R_CONSTRAINT_NAME
1	SYS_C0013829	C	"DEPTID" IS NOT NULL	(null)
2	EQUIP_RATING_CK	C	rating IN ('A','B','C')	(null)
3	EQUIP_EQUIPID_PK	P	(null)	(null)
4	EQUIP_DEPTID_FK	R	(null)	DEPT_DEPTID_PK
5	EQUIP_ETYPEID_FK	R	(null)	ETYPES_ETYPEID_PK

Viewing Constraints – USER_CONS_COLUMNS

- Displaying Constraints By Column…

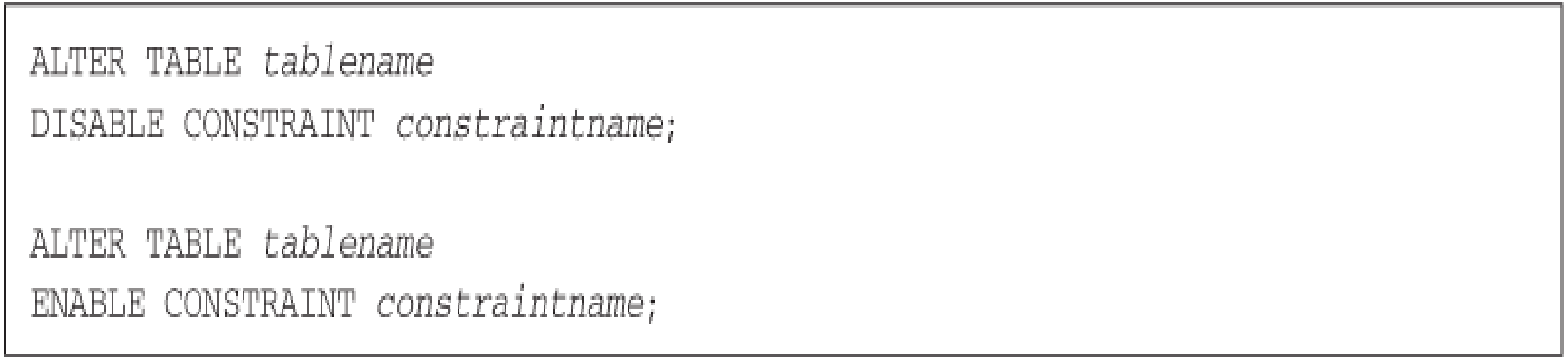


```
SELECT constraint_name, column_name
 FROM  user_cons_columns
 WHERE table_name = 'EQUIP';
```

	CONSTRAINT_NAME	COLUMN_NAME
1	SYS_C0013829	DEPTID
2	EQUIP_RATING_CK	RATING
3	EQUIP_EQUIPID_PK	EQUIPID
4	EQUIP_DEPTID_FK	DEPTID
5	EQUIP_ETYPEID_FK	ETYPEID

Using DISABLE/ENABLE…

- Use DISABLE or ENABLE clause of ALTER TABLE command to Turn Constraints Off and On…

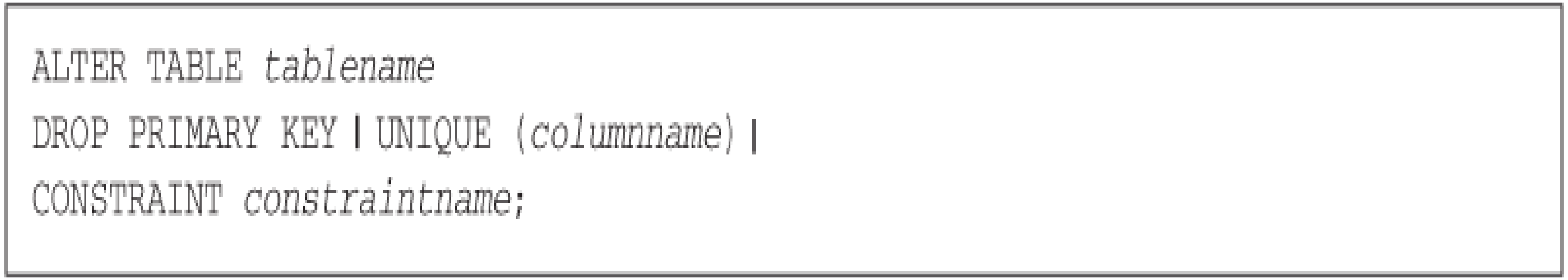


```
ALTER TABLE tablename
DISABLE CONSTRAINT constraintname;

ALTER TABLE tablename
ENABLE CONSTRAINT constraintname;
```

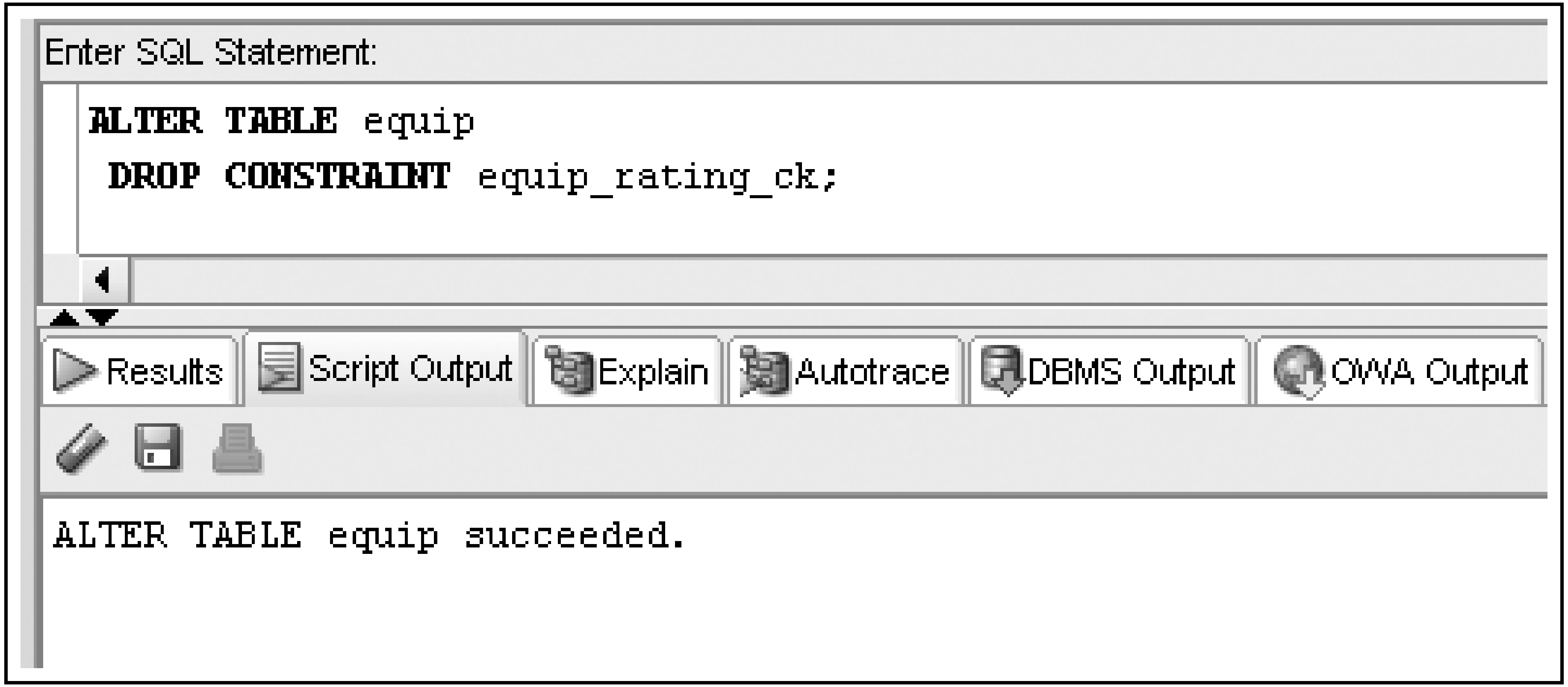
Dropping Constraints…

- Constraints Cannot Be Modified…They Must Be Dropped and Recreated…
- Actual Syntax Depends on Type of Constraint…
  - PRIMARY KEY – Just List Type of Constraint…
  - UNIQUE – Include Column Name…
  - All Others – Reference Constraint Name…



```
ALTER TABLE tablename
DROP PRIMARY KEY | UNIQUE (columnname) |
CONSTRAINT constraintname;
```

Successful DROP CONSTRAINT Example…

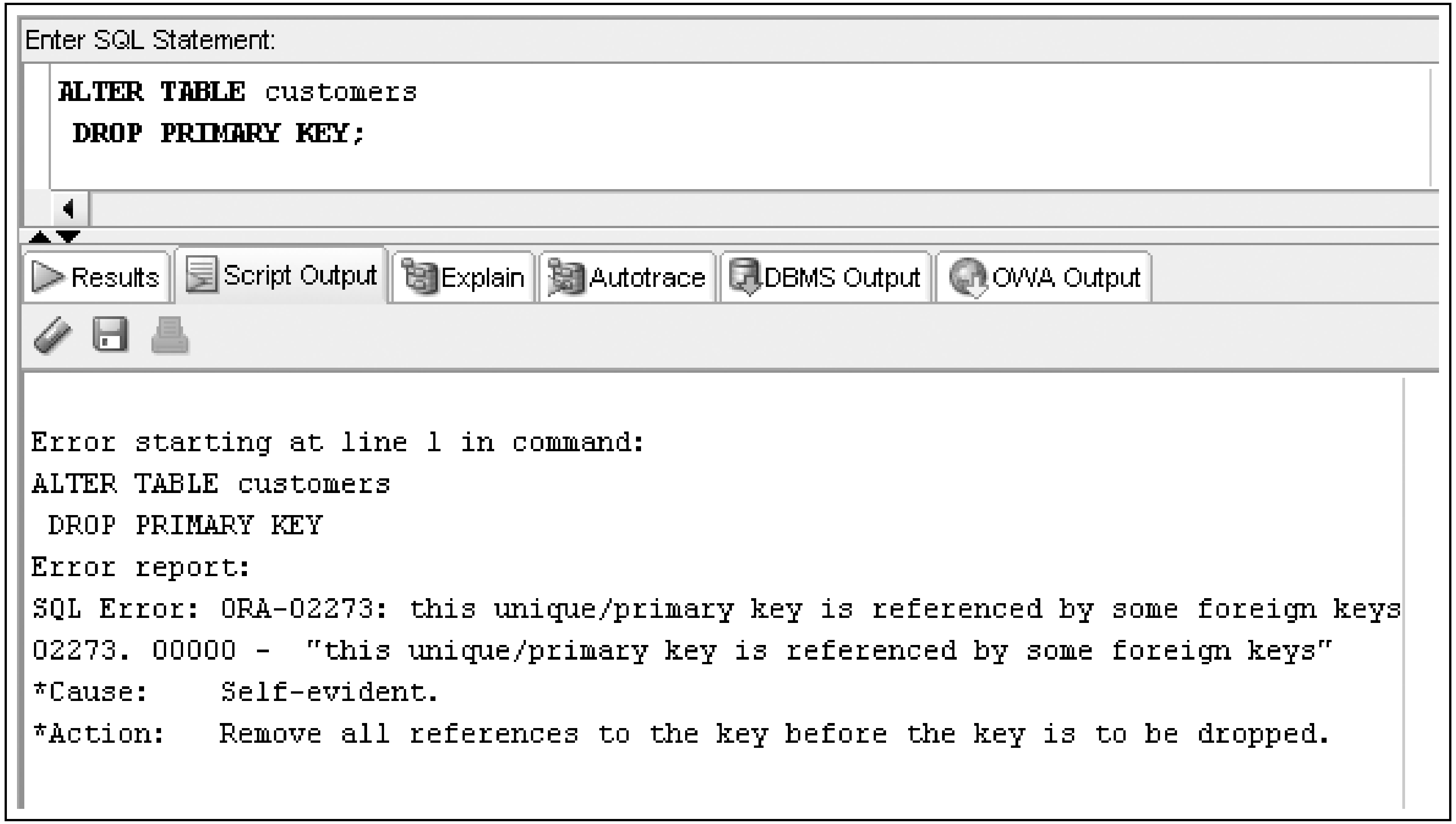


```
ALTER TABLE equip
 DROP CONSTRAINT equip_rating_ck;
```

```
ALTER TABLE equip succeeded.
```

Unsuccessful DROP CONSTRAINT Example…

- Notice the Error Message…
- DBMS Will Always Look to Maintain the Integrity of the Database…



```
ALTER TABLE customers
 DROP PRIMARY KEY;
```

```
Error starting at line 1 in command:
ALTER TABLE customers
 DROP PRIMARY KEY
Error report:
SQL Error: ORA-02273: this unique/primary key is referenced by some foreign keys
02273. 00000 -  "this unique/primary key is referenced by some foreign keys"
*Cause:    Self-evident.
*Action:   Remove all references to the key before the key is to be dropped.
```

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Questions…