COURSE TECHNOLOGY
CENGAGE Learning™

About the Presentations

- The presentations cover the objectives found in the opening of each chapter.
- All chapter objectives are listed in the beginning of each presentation.
- You may customize the presentations to fit your class needs.
- Some figures from the chapters are included. A complete set of images from the book can be found on the Instructor Resources disc.

COURSE TECHNOLOGY
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Oracle 12*c*: SQL

Chapter 6
Additional Database Objects

Objectives

- Define the purpose of a sequence and state how it can be used in a database
- Explain why gaps may appear in the integers generated by a sequence
- Use the CREATE SEQUENCE command to create a sequence
- Call and use sequence values
- Identify which options cannot be changed by the ALTER SEQUENCE command
- Delete a sequence

Objectives (continued)

- Create indexes with the CREATE INDEX command
- Explain the main index structures: B-tree and bitmap
- Verify index use with the explain plan
- Introduce variations on conventional indexes, including a function-based index and an index organized table

Objectives (continued)

- Verify index existence via the data dictionary
- Rename an index with the ALTER INDEX command
- Remove an index using the DELETE INDEX command
- Create and remove a public synonym

Database Objects

- An object is anything that has a name and defined structure
- Includes:
  - Table – stores data
  - Sequence – generates sequential integers
  - Index – allows users to quickly locate specific records
  - Synonym – alias for other database objects

Sequences

- Used for internal control purposes by providing sequential integers for auditing
- Used to generate unique value for primary key column
  - Surrogate key = no correlation with actual row contents

Creating a Sequence

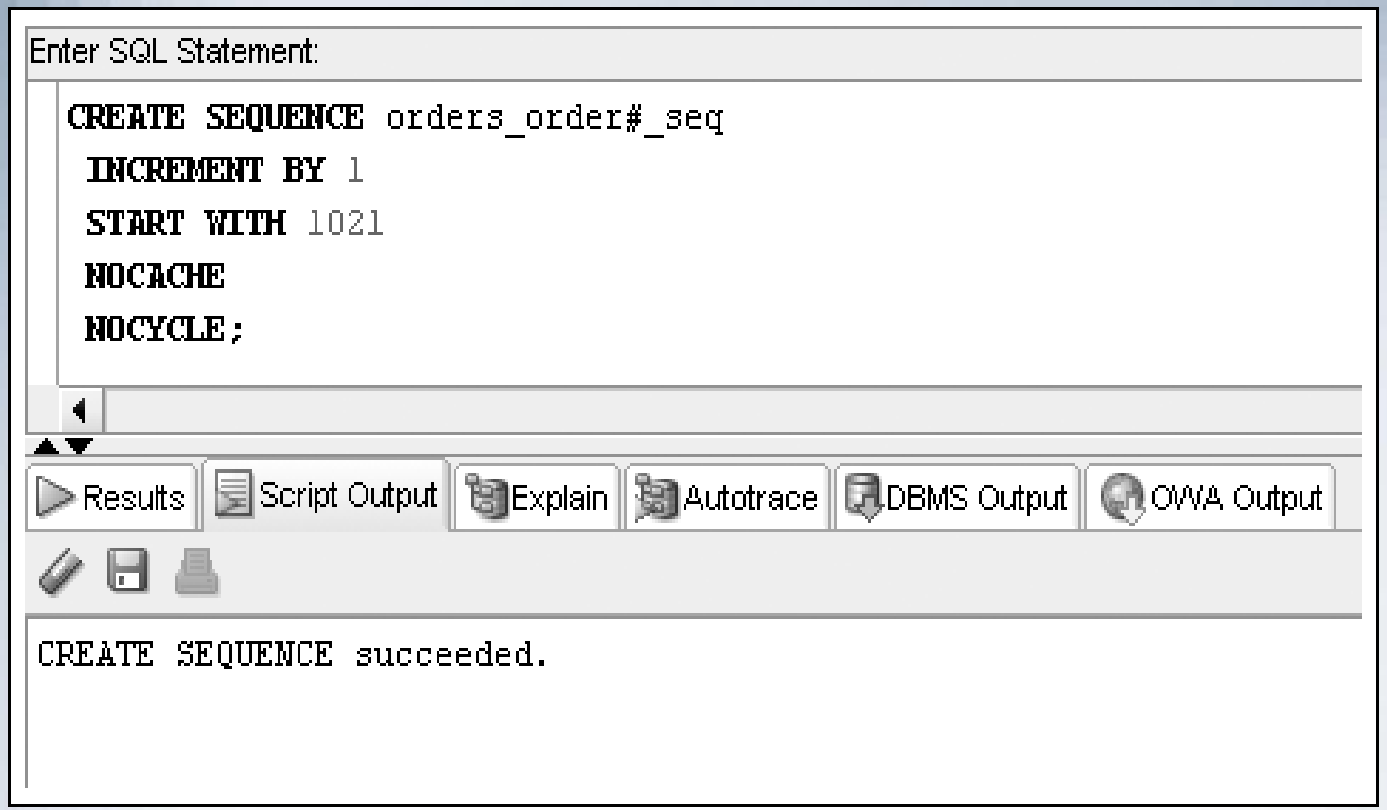
- Use the CREATE SEQUENCE command
- Various intervals are allowed – Default: 1
- You can specify the starting number – Default: 1

```
CREATE SEQUENCE sequencename
[INCREMENT BY value]
[START WITH value]
[{MAXVALUE value | NOMAXVALUE}]
[{MINVALUE value | NOMINVALUE}]
[{CYCLE | NOCYCLE}]
[{ORDER | NOORDER}]
[{CACHE value | NOCACHE}];
```

Creating a Sequence (continued)

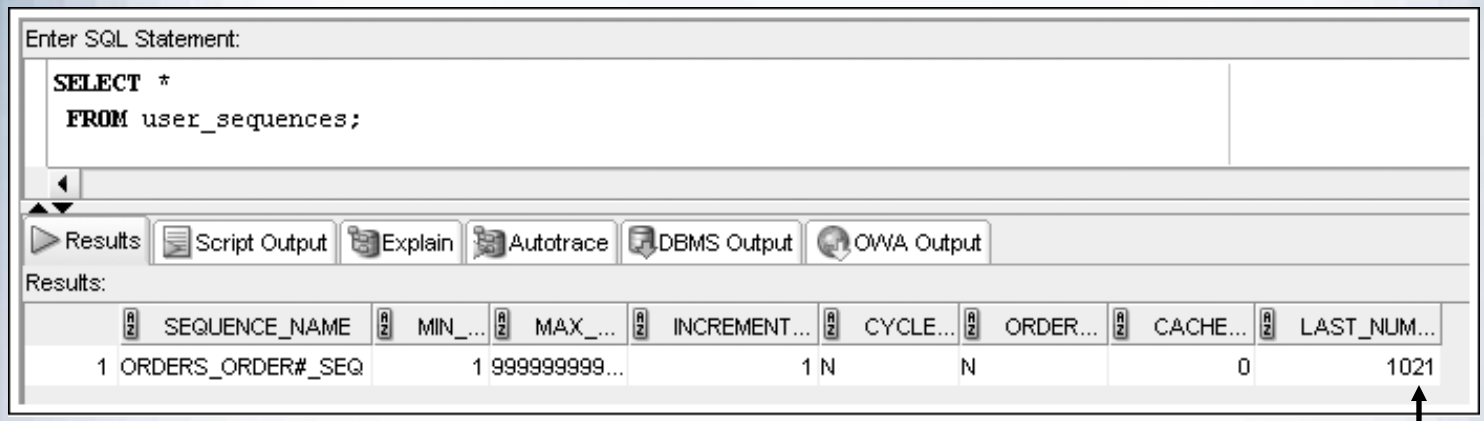
- Can specify MINVALUE for decreasing sequence and MAXVALUE for increasing sequence
- Numbers can be reused if CYCLE is specified
- ORDER clause is used in application cluster environment
- Use CACHE to pregenerate integers – Default: 20

Creating a Sequence (continued)



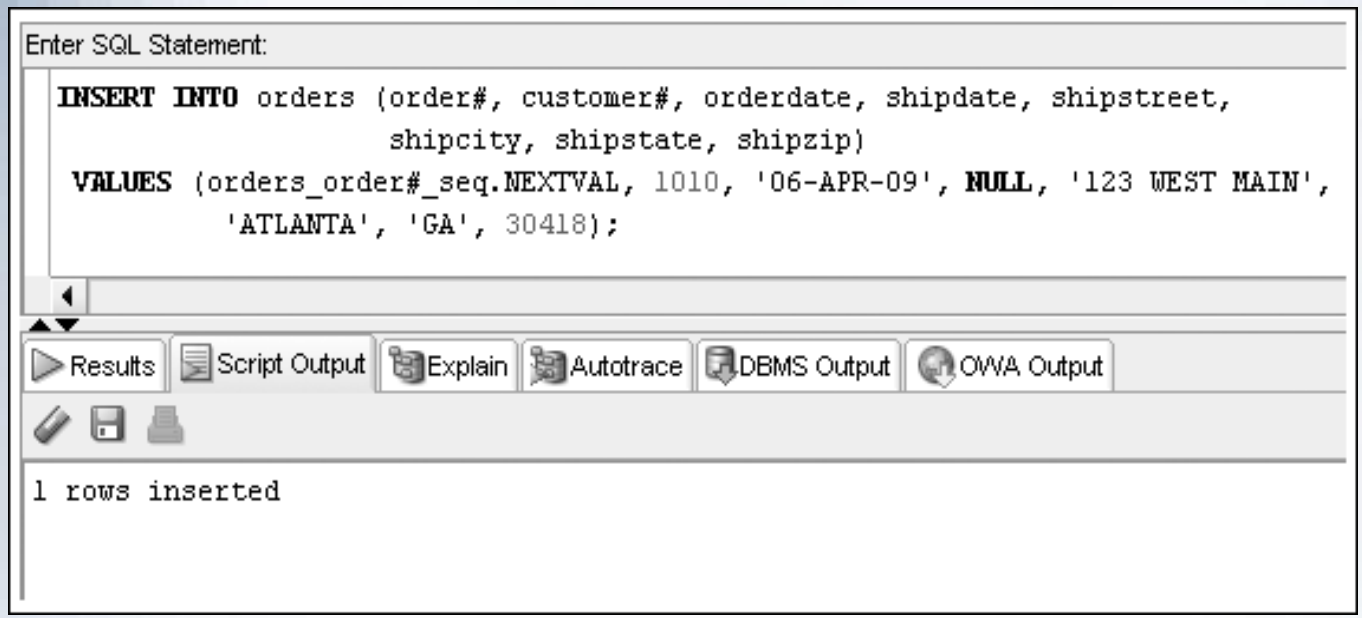
Creating a Sequence (continued)

- To verify the settings for options of a sequence, query USER_SEQUENCES data dictionary view



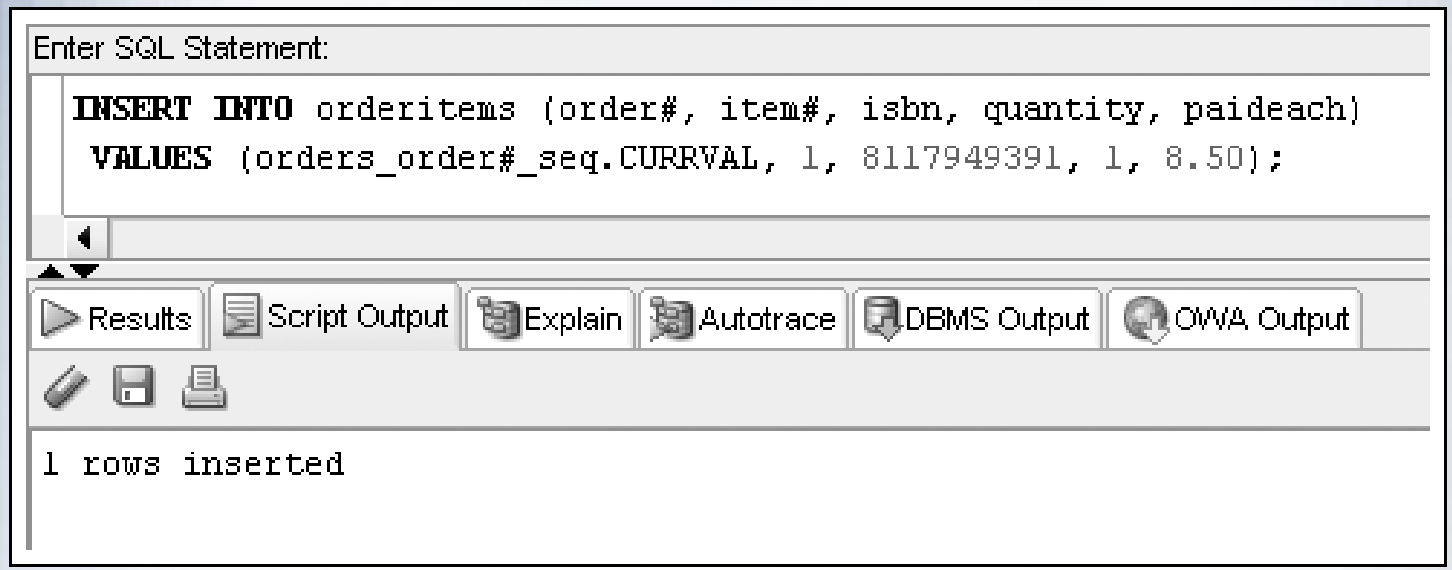
Using Sequence Values

- NEXTVAL – generates integer



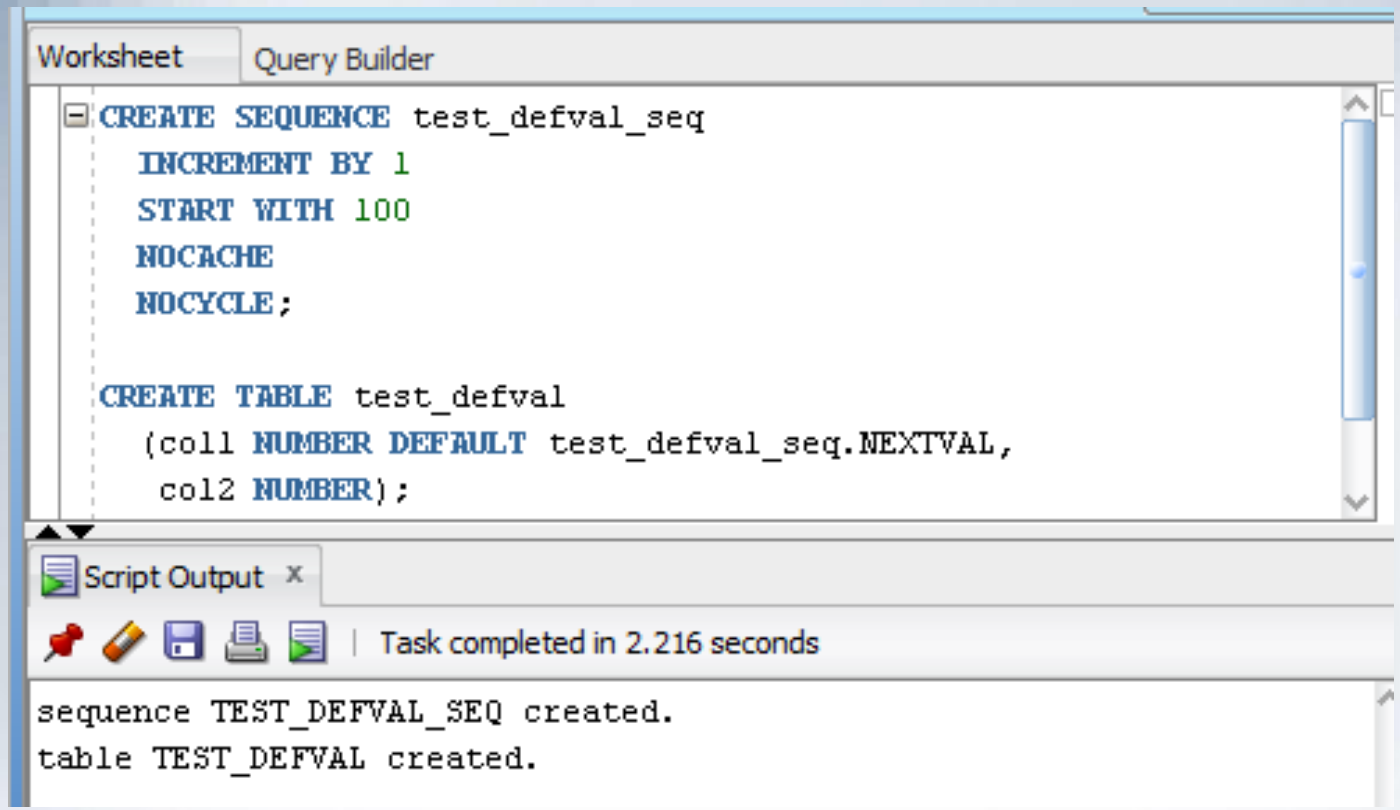
Using Sequence Values (continued)

- CURRVAL – contains last integer generated by NEXTVAL



Using Sequence Values (continued)

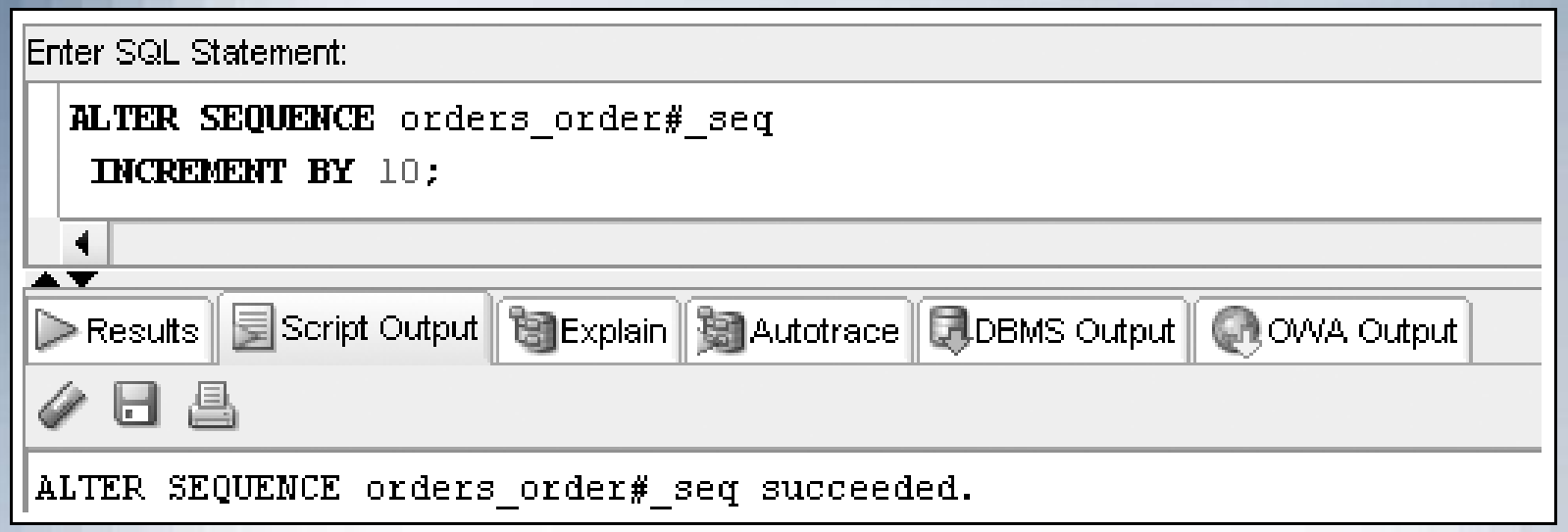
- Set column DEFAULT value



Altering Sequence Definitions

- Use ALTER SEQUENCE command to change the settings for a sequence
- START WITH value cannot be altered – drop the sequence and re-create it
- Changes cannot make current integers invalid

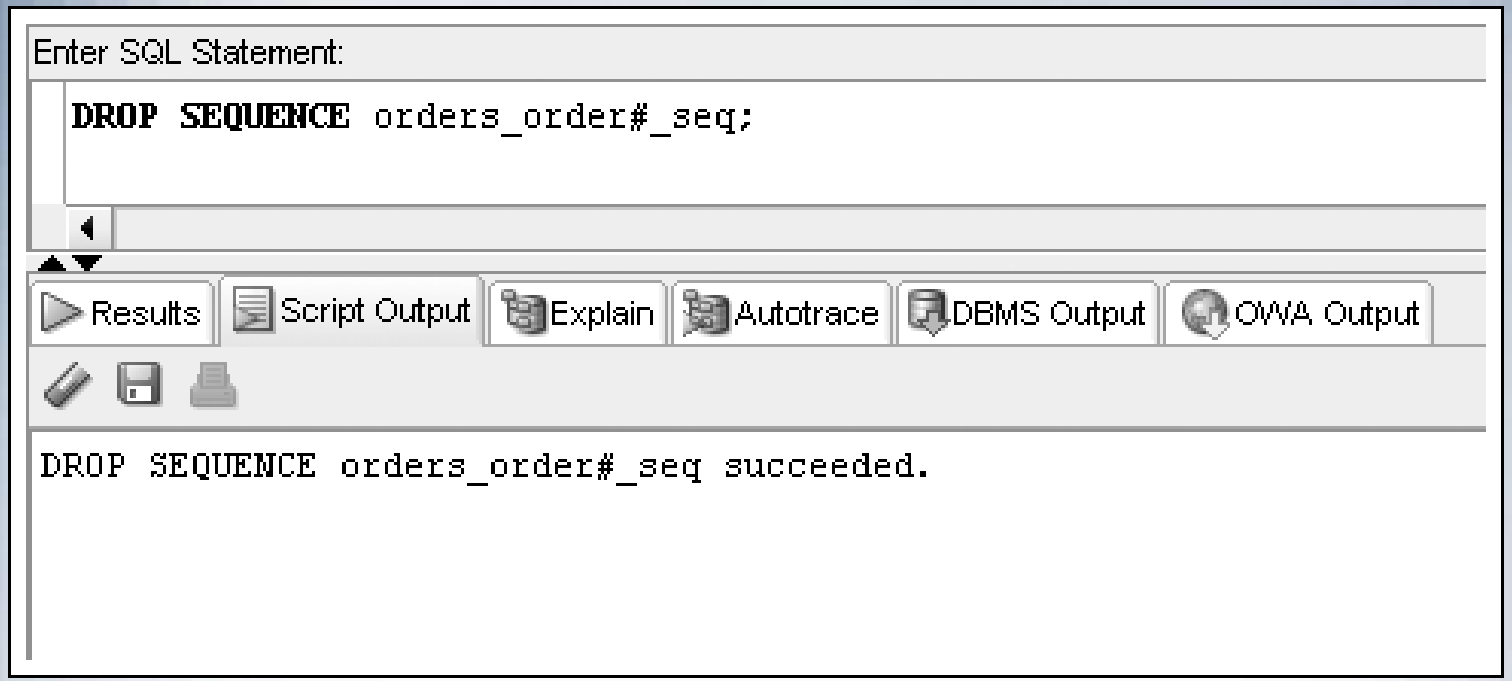
ALTER SEQUENCE Command Example



Removing a Sequence

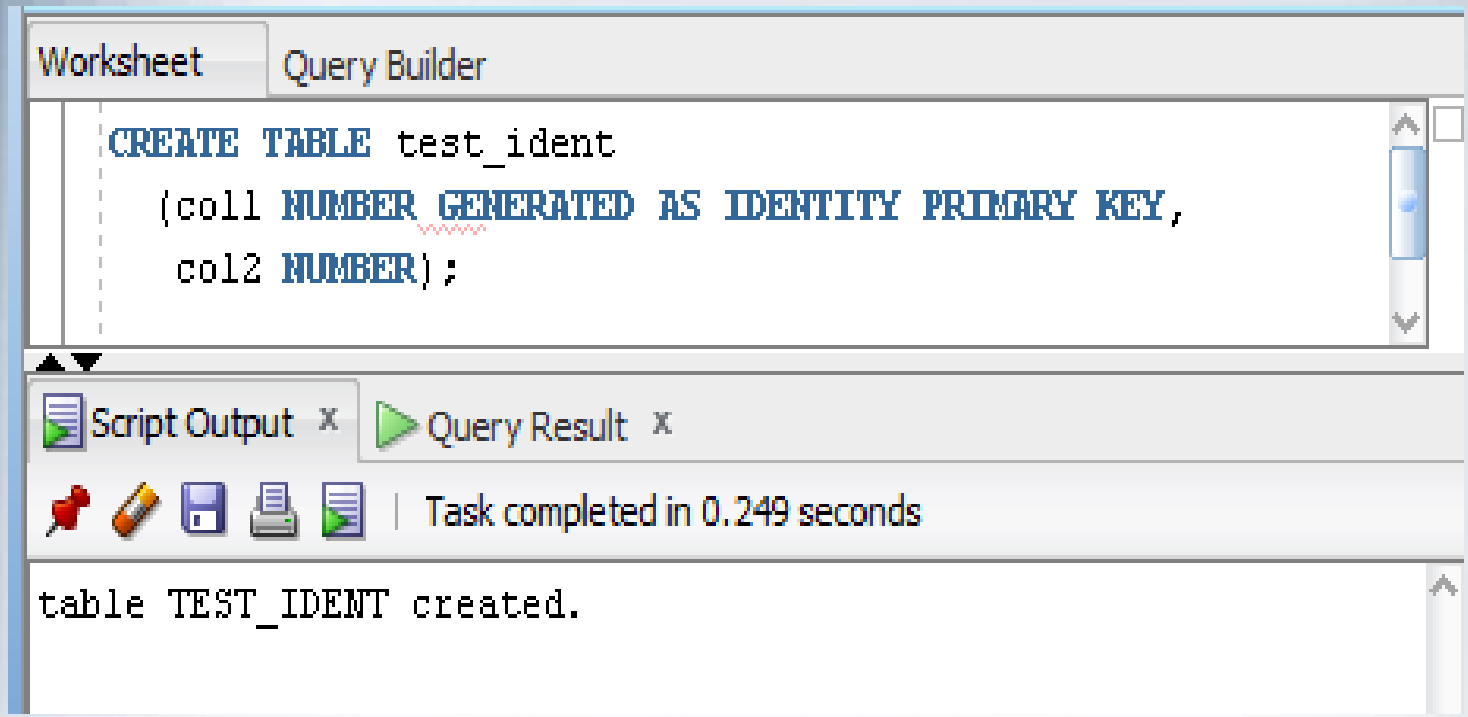
- Use the DROP SEQUENCE command to delete a sequence
- Previous values generated are not affected by removing a sequence from a database

Removing a Sequence (continued)

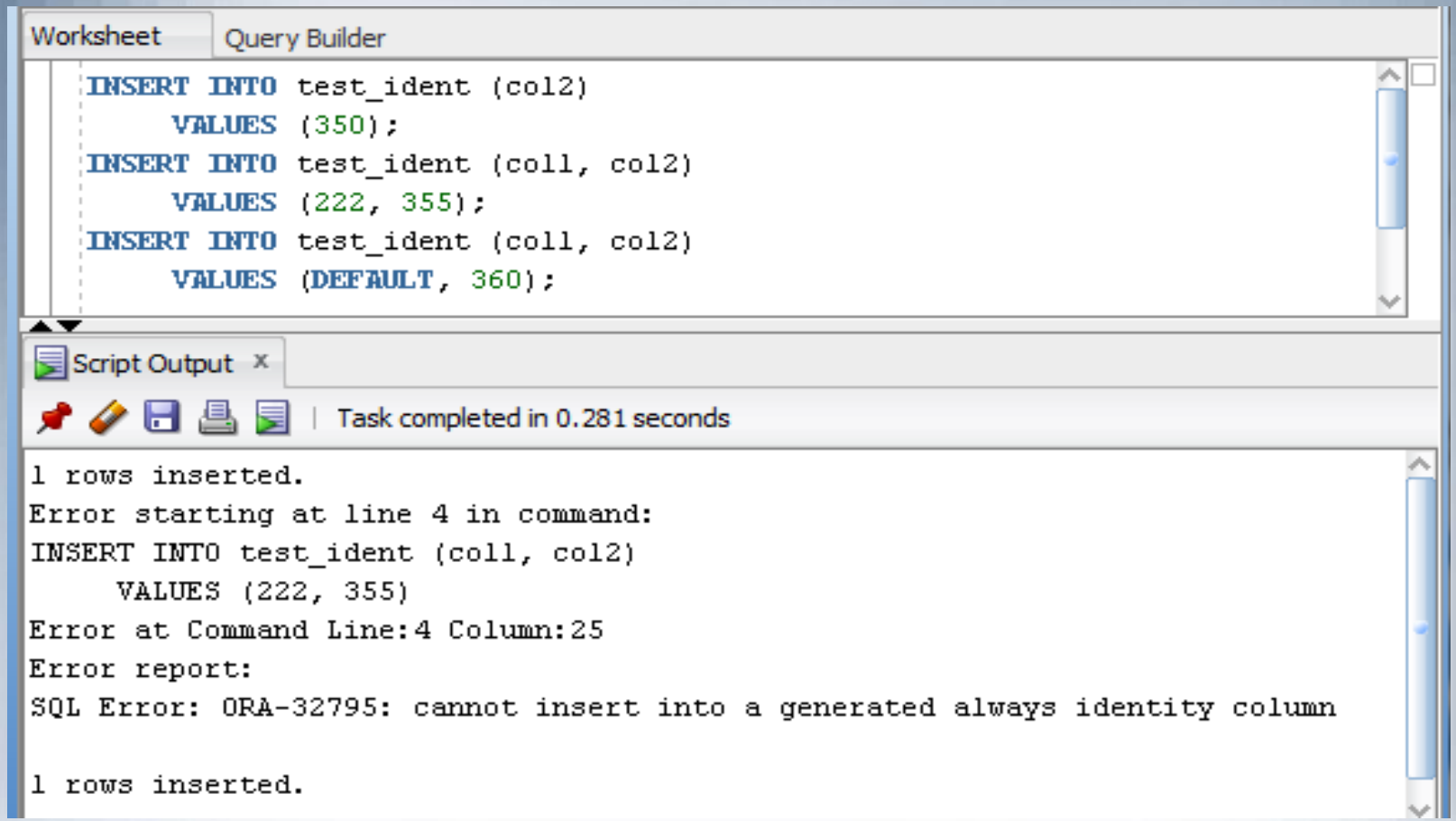


Create an Identity Column

- Alternative to using sequences to populate primary key columns



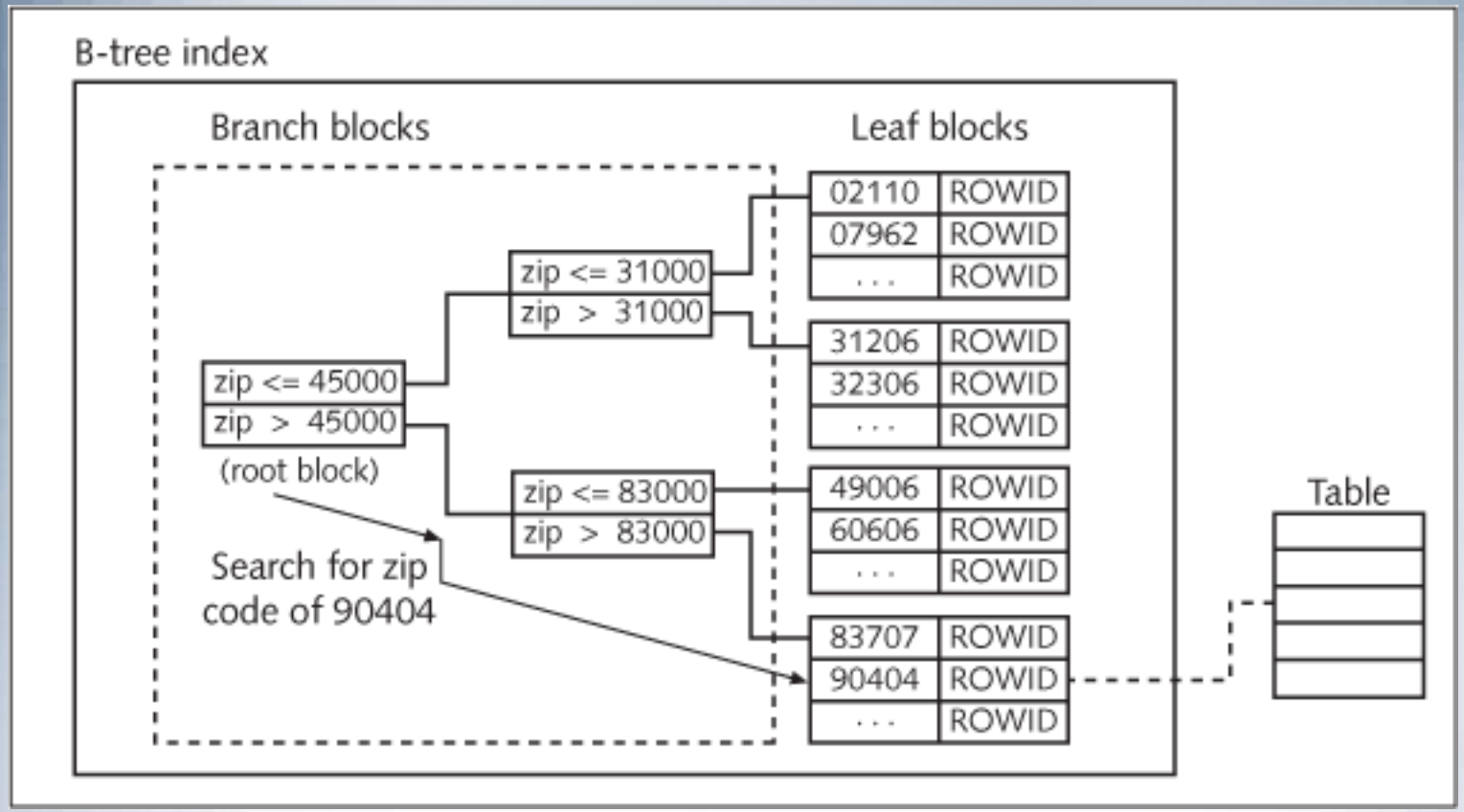
Using an Identity Column



Indexes

- An index stores frequently referenced values and ROWIDs
- Can be based on one column, multiple columns, functions, or expressions

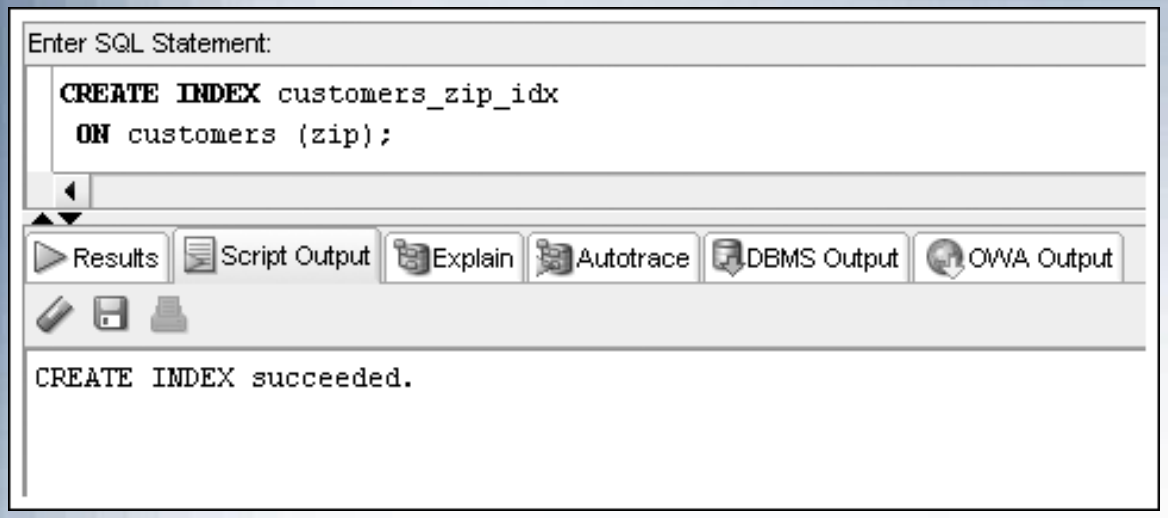
B-Tree Index

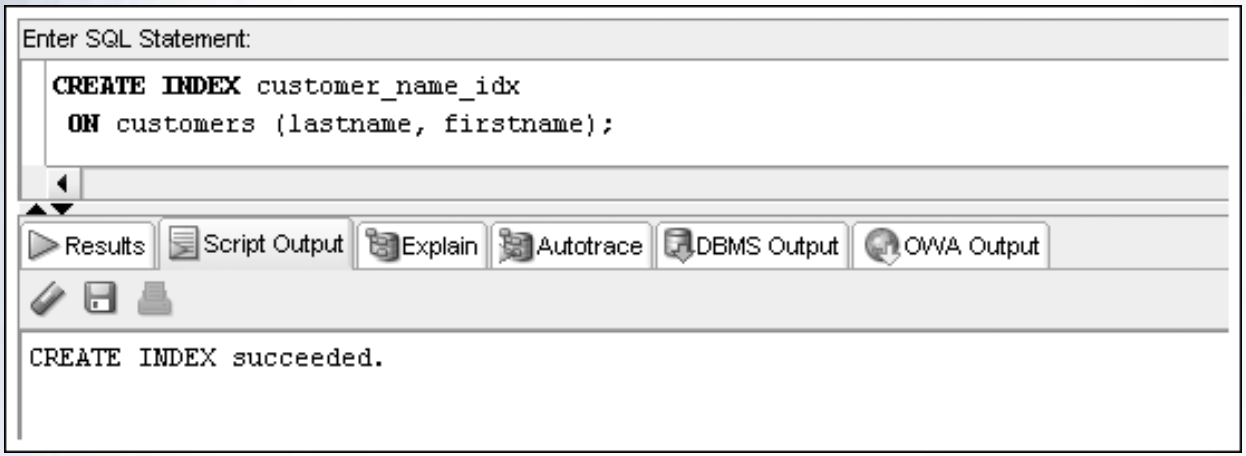


B-Tree Index (continued)

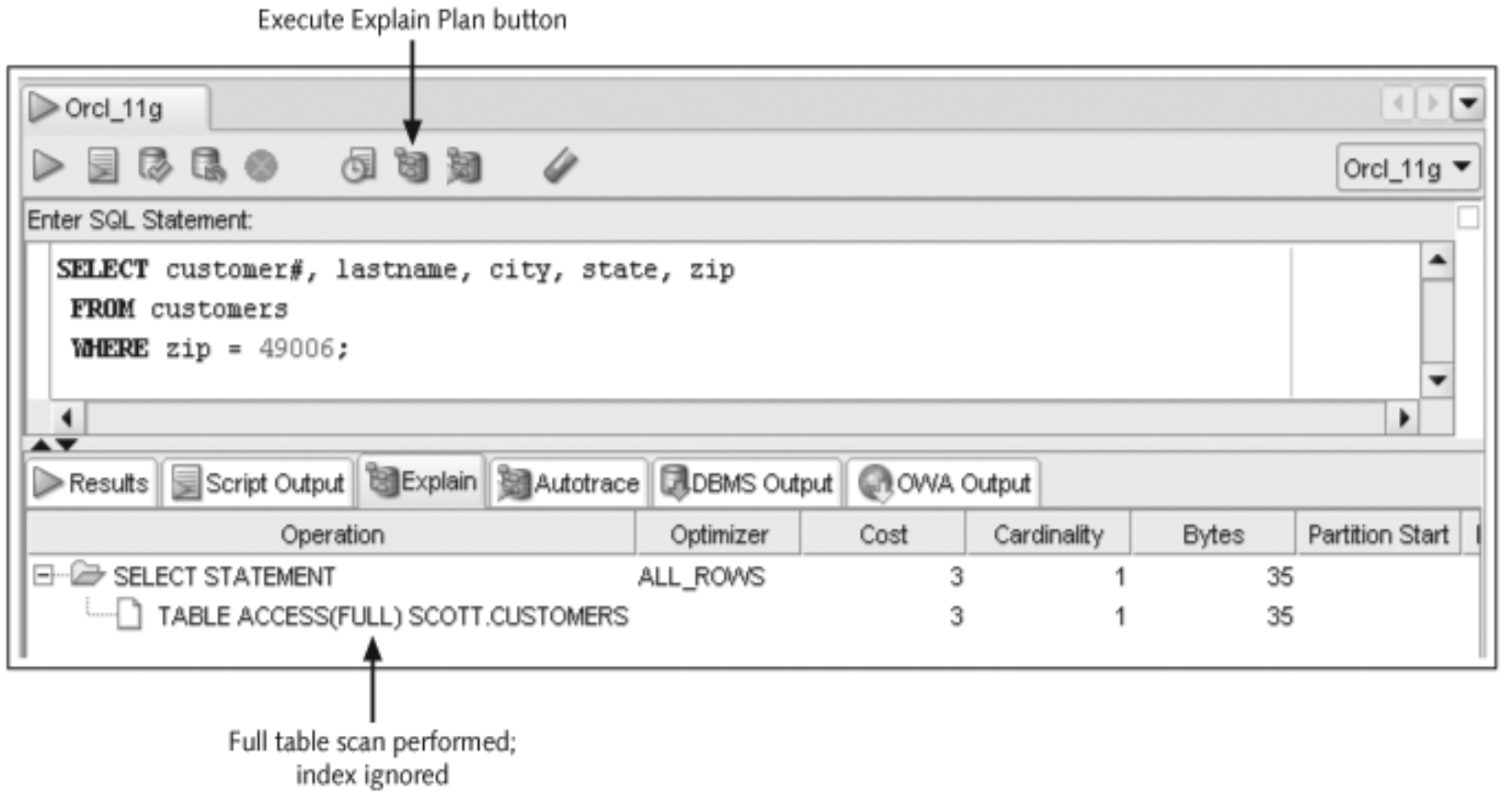
- Implicitly create an index by PRIMARY KEY and UNIQUE constraints
- Explicitly create an index by using the CREATE INDEX command

CREATE INDEX Command Examples





The Explain Plan



Bitmap Indexes

Enter SQL Statement:

```
CREATE BITMAP INDEX customers_region_idx
 ON customers (region);
```

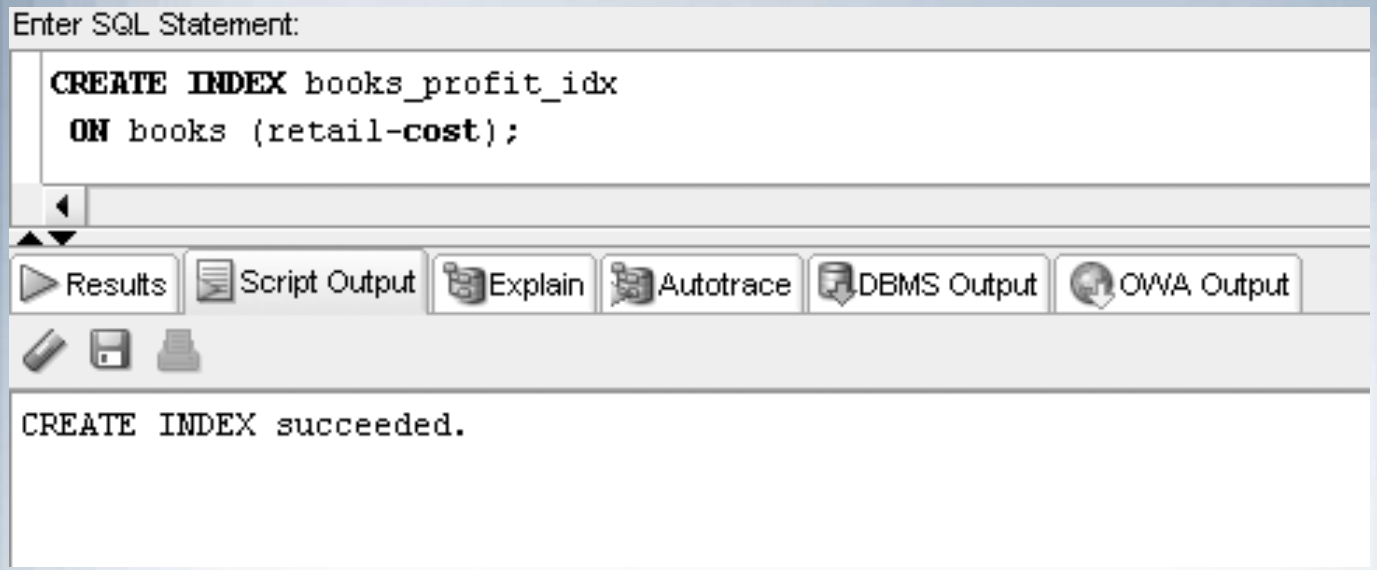
Results | Script Output | Explain | Autotrace | DBMS Output | OWA Output

```
CREATE BITMAP succeeded.
```

Bitmap index
Region

N	NW	NE	S	SE	SW	W	E
0	1	0	0	0	0	0	0
0	0	0	0	1	0	0	0
1	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0
0	0	0	0	0	1	0	0

Function-Based Indexes




```
CREATE INDEX orders_shipdate_idx
  ON orders(NVL(shipdate,'null'));
```

Index Organized Tables

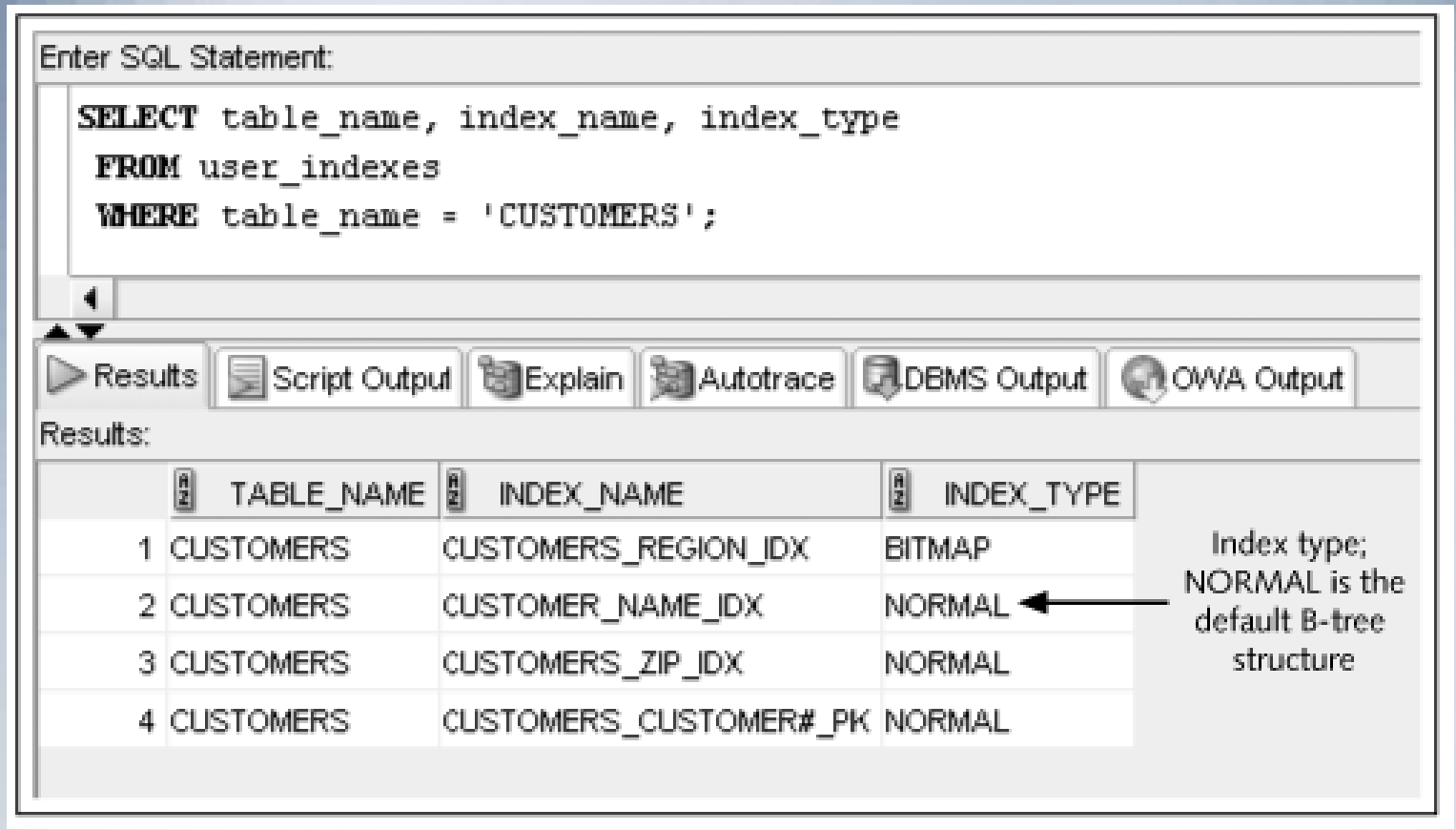
- An IOT stores table contents in a B-tree index structure
- Use the “ORGANIZATION INDEX” option in a CREATE TABLE statement to build an IOT

```
CREATE TABLE books2
(ISBN VARCHAR2(10),
 title VARCHAR2(30),
 pubdate DATE,
 pubID NUMBER (2),
 cost NUMBER (5,2),
 retail NUMBER (5,2),
 category VARCHAR2(12),
   CONSTRAINT books2_isbn_pk PRIMARY KEY(isbn))
 ORGANIZATION INDEX;
```

Verifying an Index

- Use the USER_INDEXES data dictionary view to determine that the index exists
- Use the USER_IND_COLUMNS data dictionary view to determine the column index information

Verifying an Index (continued)



USER_IND_COLUMNS

Enter SQL Statement:

```
SELECT table_name, index_name, column_name
 FROM user_ind_columns
 WHERE table_name = 'CUSTOMERS';
```

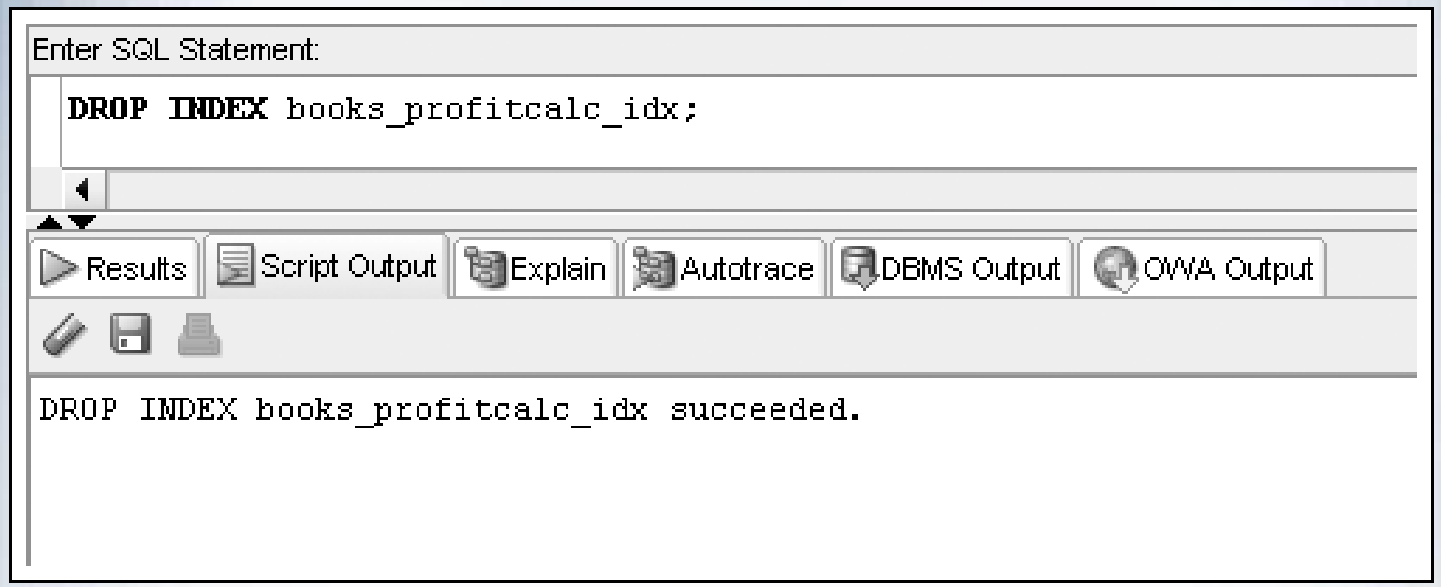
Results | Script Output | Explain | Autotrace | DBMS Output | OVVA Output

Results:

	TABLE_NAME	INDEX_NAME	COLUMN_NAME
1	CUSTOMERS	CUSTOMERS_CUSTOMER#_PK	CUSTOMER#
2	CUSTOMERS	CUSTOMERS_ZIP_IDX	ZIP
3	CUSTOMERS	CUSTOMER_NAME_IDX	LASTNAME
4	CUSTOMERS	CUSTOMER_NAME_IDX	FIRSTNAME
5	CUSTOMERS	CUSTOMERS_REGION_IDX	REGION

Removing an Index

- Use the DROP INDEX command to remove an index



Synonyms

- Synonyms serve as permanent aliases for database objects
- Simplify object references
- Can be private or public
  - Private synonyms are only available to the user who created them
  - PUBLIC synonyms are available to all database users

CREATE SYNONYM Command Syntax

```
CREATE [PUBLIC] SYNONYM synonymname
  FOR objectname;
```

CREATE SYNONYM Command

Enter SQL Statement:

```
CREATE SYNONYM orderentry
 FOR orders;
```

Results | Script Output | Explain | Autotrace | DBMS Output | OWA Output

```
CREATE SYNONYM succeeded.
```

Synonym used in place of table name

Enter SQL Statement:

```
SELECT *
 FROM orderentry
 WHERE customer# = 1010;
```

Results | Script Output | Explain | Autotrace | DBMS Output | OWA Output

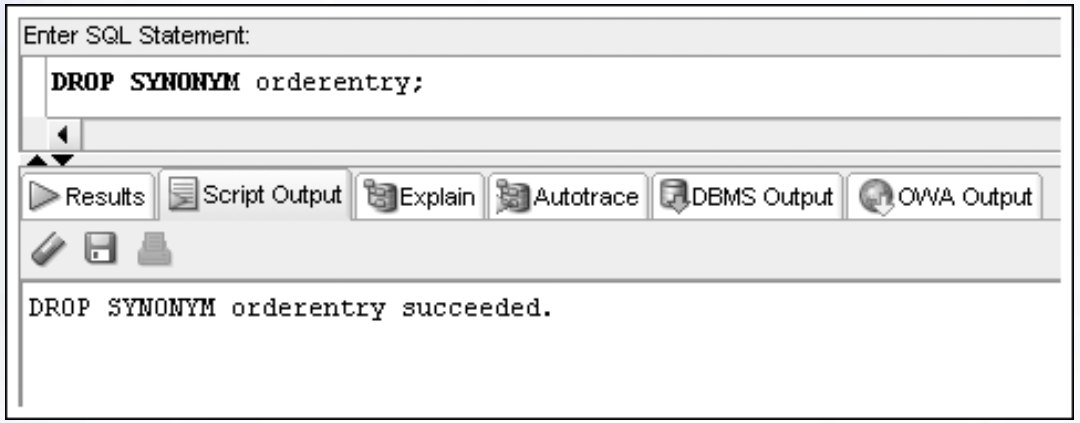
Results:

	ORDER#	CUSTOMER#	ORDERDATE	SHIPDATE	SHIPSTREET	SHIPCITY	SHIPSTATE	SHIPZIP	SHIPCOST
1	1001	1010	31-MAR-09	01-APR-09	114 EAST SAVANNAH	ATLANTA	GA	30314	3
2	1011	1010	03-APR-09	05-APR-09	102 WEST LAFAYETTE	ATLANTA	GA	30311	2
3	1021	1010	06-APR-09	(null)	123 WEST MAIN	ATLANTA	GA	30418	(null)

Deleting a SYNONYM

- A private synonym can be deleted by its owner
- A PUBLIC synonym can only be deleted by a user with DBA privileges

```
DROP [PUBLIC] SYNONYM synonymname;
```



Summary

- A sequence can be created to generate a series of integers
- The values generated by a sequence can be stored in any table
- A sequence is created with the CREATE SEQUENCE command
- Gaps in sequences might occur if the values are stored in various tables, if numbers are cached but not used, or if a rollback occurs
- A value is generated by using the NEXTVAL pseudocolumn
- The CURRVAL pseudocolumn is NULL until a value is generated by NEXTVAL
- The USER_OBJECTS data dictionary object can be used to confirm the existence of all schema objects
- The USER_SEQUENCES data dictionary object is used to view sequence settings
- A sequence may be set as a column DEFAULT value
- An identity column can be created to manage primary key population as an alternative to using sequences

Summary (continued)

- The ALTER SEQUENCE command is used to modify an existing sequence; the only settings that can't be modified are the START WITH option and any option that would be invalid because of previously generated values
- The DUAL table is helpful for testing sequence value generation
- The DROP SEQUENCE command deletes an existing sequence
- An index can be created to speed up the query process
- DML operations are always slower when indexes exist
- Oracle 11*g* creates an index for PRIMARY KEY and UNIQUE constraints automatically
- An explicit index is created with the CREATE INDEX command
- An index can be used by Oracle 11*g* automatically if a query criterion or sort operation is based on a column or an expression used to create the index

Summary (continued)

- The two main structures for indexes are B-tree and bitmap
- The explain plan can verify whether an index is used in a query
- Function-based indexes are used to index an expression or the use of functions on a column or columns
- An index organized table is a table stored in a B-tree structure to combine the index and table into one database object
- Information about an index can be retrieved from the USER_INDEXES and USER_IND_COLUMNS views
- An index can be dropped with the DROP INDEX command
- An index can be renamed with the ALTER INDEX command

Summary (continued)

- Except for a name change, an index can't be modified; it must be deleted and then re-created
- A synonym provides a permanent alias for a database object
- A public synonym is available to any database user
- A private synonym is available only to the user who created it
- A synonym is created by using the CREATE SYNONYM command
- A synonym is deleted by using the DROP SYNONYM command
- Only a user with DBA privileges can drop a public synonym