**Shaikh Salma Manjar**

**PRACTICAL NO:04**

**272**

**PART A**

**AIM - Create a spatial database**

**table that stores the number, name and location, which consists of four different areas say ABC, PQR, MNO and XYZ**.

**THEORY:**

**What is Spatial Database?**

**Spatial** data is associated with **geographic** locations such as cities**,** towns **etc.** A spatial **database** is optimized to store and query **data** representing **objects**. **These** are the **objects which** are **defined** in a geometric space.

**Characteristics of Spatial Database**

A spatial **database** system has the following characteristics

✔ It is a database system

✓ It offers spatial data types **(**SDTs**)** in its data model and query language.

✔ It supports spatial data types in its implementation**,** providing at least spatial

**indexing** and efficient algorithms **for spatial** join.

**Example**

A road **map is a** visualization **of geographic** information. A **road** map is **a 2-** dimensional object which contains points, lines, and polygons **that** can **represent** cities**,** roads, **and** political boundaries such as **states** or provinces.

**In general, spatial data can be of two types**

**Vector data:** This data **is** represented as discrete points**,** lines and polygons **Rastor data: This** data **is** represented as a **matrix of** square cells.

POINTS

ORACLE

SQL SERVER

LINES

SPATIAL DATA

SYBASE

POLYGONS

**DB2**

**37**

**272**

Shaikh **Salma Manjar**

The **spatial** data in the **form** of points, lines**, polygons** etc. is used by many different **databases as shown above.**

**Queries:**

1. Find the topological **intersection** of two geometries

**2.** Find whether two geometric figures are equivalent to each other

**3. Find the areas of** all different locations

4. Find **the** area **of** only one **location**

16

14

13

11

10

cola\_d

OF

cola a

cola.c

cola\_b

10 11 12 13 14 15

**SQL>** create table areas (no number(5**)** primary key**,**name varchar2(20**)**,location MDSYS.SDO\_GEOMETRY**);**

Table created.

**SQL**> **insert into** areas

values(1,'rect',MDSYS.SDO\_GEOMETRY(2003,null,**null**,MDSYS.SDO\_ELEM\_INFO\_ARRAY(

1,1003,3**),**MDSYS.SDO\_ORDINATE\_ARRAY(1,1,5,7)));

SQL> insert into areas

values(2,'poly1',MDSYS.SDO\_GEOMETRY(2003,null,null,MDSYS.SDO\_ELEM\_INFO\_ARRA

Y(1,1003,1),MDSYS.SDO\_ORDINATE\_ARRAY**(**5,1,8,1,8,6,5,7,5,1)));

SQL**>** insert **into** areas

values(**3,**'**poly2**',MDSYS.SDO\_GEOMETRY**(**2003**,**null,null,MDSYS.SDO\_ELEM\_INFO\_ARRA

Y(1,1003,1),MDSYS.SDO\_ORDINATE\_ARRAY(3,3,6,3,6,5,4,5,3,3**)**));

**SQL>** insert into areas

values(4,'circle**',**MDSYS.SDO\_GEOMETRY(2003,null,**null,**MDSYS.SDO\_ELEM\_INFO\_ARRA

Y(1,1003,4)**,**MDSYS.SDO\_ORDINATE\_ARRAY(8,7,10,9,8,11)));

**38**

**Shaikh Salma Manjar**

**272**

**SQL**> insert **into** areas

values(5,'rect2',MDSYS.SDO\_GEOMETRY(2003,null,null,MDSYS.SDO\_ELEM\_INFO\_ARRA

Y(1,1003,3**),**MDSYS.SDO\_ORDINATE\_ARRAY(1,1,5,7)));

**SQL>** select \* from areas;

**NO** NAME

LOCATION(SDO\_GTYPE, SDO\_SRID**, SDO\_POINT(X, Y, Z)**, SDO\_ELEM\_INFO, SDO\_ORDINATES)

1 rect

SDO\_GEOMETRY(2003**,** NULL, **NULL,** SDO\_ELEM\_INFO\_ARRAY(1, 1003**, 3**), SDO\_ORDINATE\_ARR

AY(1, 1, 5**,** 7))

**2** poly1

SDO\_GEOMETRY(2003, NULL, NULL, SDO\_ELEM\_INFO\_ARRAY(1, 1003, 1), SDO\_ORDINATE\_ARR

AY(5, 1**, 8, 1**, 8**,** 6**,** 5**,** 7**,** 5, 1))

3 poly2

**NO** NAME

**LOCATION(SDO\_GTYPE**, SDO\_SRID, **SDO\_POINT(**X**, Y**, **Z),** SDO\_ELEM\_INFO, SDO\_ORDINATES)

SDO\_GEOMETRY(2003**,** NULL, **NULL,** SDO\_ELEM\_INFO\_ARRAY(1, 1003, 1), SDO\_ORDINATE\_ARR

AY(3, **3**, 6, 3, 6**,** 5, **4, 5,** 3, 3))

4 circle

SDO\_GEOMETRY(**2003**, **NULL,** NULL, SDO\_ELEM\_INFO\_ARRAY(1, **1003,** 4), SDO\_ORDINATE\_ARR

AY(8, **7,** 10, 9, 8**,** 11))

**5** rect2

SDO\_GEOMETRY(2003**,** NULL, NULL, SDO\_ELEM\_INFO\_ARRAY(1, 1003**, 3)**, SDO\_ORDINATE\_ARR

**NO** NAME

**39**

**Shaikh Salma Manjar**

LOCATION(SDO\_GTYPE**,** SDO\_SRID, **SDO\_POINT(X**, **Y, Z)**, SDO\_ELEM\_INFO,

SDO\_ORDINATES**)**

AY(1, 1, **5**, 7))

**a) Find the topological intersection of** two **geometries**

**272**

**SQL> select** SDO\_GEOM.SDO\_INTERSECTION(a1.location**,**a2.location,0.005) from areas a1, areas **a2** where a1.name='rect' and a2.name='poly2';

SDO\_GEOM.SDO\_INTERSECTION**(**A1.LOCATION,A2.LOCATION,0.005) (SDO\_GTYPE,

SDO\_SRID**,** SD

SDO\_GEOMETRY(2003**,** NULL, **NULL**, SDO\_ELEM\_INFO\_ARRAY(1, 1003, 1),

SDO\_ORDINATE\_ARR

AY(5**, 3**, 5**,** 5**,** 4**, 5, 3, 3, 5, 3)**)

**b) Find whether two geometric figures are equivalent to each other**

SQL> select SDO\_GEOM.RELATE(a1.location,'anyinteract**',**a2.location**,**0.005**)** from areas a1, **areas** a2 where a1.name='rect' and a2.name**=**'rect2';

SDO\_GEOM.RELATE(A1.LOCATION**,'ANYINTERACT',**A2.LOCATION,0.005**)**

**TRUE**

**c) Find the areas of all different locations**

SQL> select name,SDO\_GEOM.SDO\_AREA(location,0.005**)** from areas;

**NAME**

**rect**

SDO\_GEOM.SDO\_AREA(LOCATION,0.005)

**24**

16.5

poly1

poly2

circle

rect2

**5**

12.5663706

24

**d) Find the area of only one location**

**SQL>** select name,SDO\_GEOM.SDO\_AREA(a1.location**,**0.005) from areas **a1** where a1.name='rect2**'**;

**NAME**

**rect2**

SDO\_GEOM.SDO\_AREA(A1.LOCATION,0.005**)**

**24**

**40**

**272**

**Shaikh Salma Manjar**

**e) Find the distance** between **two geometries**.

SQL> select SDO\_GEOM.SDO\_DISTANCE(a1.location**,**a2.location**,0.005)** from areas a1, areas a2 where a1.name='poly1' and a2.name**=**'circle';

SDO\_GEOM.SDO\_DISTANCE(A1.LOCATION,A2.LOCATION,**0.005)**

.846049894

**PART B**

**AIM: create a spatial database according to the following diagram given below**.

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B. a1

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12

14

Active

SQL> create table areas2**(**no number(5) primary key,name varchar2**(20),**location MDSYS.SDO\_GEOMETRY);

Table created.

SQL**>** insert into areas2

values(1,'mainbldg',MDSYS.SDO\_GEOMETRY(2003,**null**,**null,**MDSYS.SDO\_ELEM\_INFO\_A

RRAY(1,1003,3**),**MDSYS.SDO\_ORDINATE\_ARRAY(1,5,2,8)));

SQL**>** insert into areas2

values(**2**,'canteen'**,**MDSYS.SDO\_GEOMETRY(2003,**null,**null,MDSYS.SDO\_ELEM\_INFO\_AR

RAY(1,1003,3**)**,MDSYS.SDO\_ORDINATE\_ARRAY**(**9,1,11,3)));

**41**

**Shaikh Salma Manjar**

SQL> insert into areas2

**272**

values**(3,**'scibldg'**,**MDSYS.SDO\_GEOMETRY(2003,null,null,MDSYS.SDO\_ELEM\_INFO\_ARR

AY(1,1003,1)**,**MDSYS.SDO\_ORDINATE\_ARRAY(4,2,7,2,8,3,7,4,4,4,4,2)));

SQL> insert into areas2

values(4,'artldg',MDSYS.SDO\_GEOMETRY(2003,null,null,MDSYS.SDO\_ELEM\_INFO\_ARRA

Y(1,1003,1)**,**MDSYS.SDO\_ORDINATE\_ARRAY**(**4,2,7,2,8,3,7,4,4,4,4,2)));

SQL> **insert** into areas2

values**(5,'**plygrd',MDSYS.SDO\_GEOMETRY(2003**,null**,**null**,MDSYS.SDO\_ELEM\_INFO\_ARR AY(1,1003,1**),**MDSYS.SDO\_ORDINATE\_ARRAY(8,10,11,10,11,13,6,13,8,11,8,10)));

**SQL**> insert into areas2

values(6,'labbldg**',**MDSYS.SDO\_GEOMETRY**(2003,null,null,**MDSYS.SDO\_ELEM\_INFO\_ARR

AY(1,1003,3**)**,MDSYS.SDO\_ORDINATE\_ARRAY(8,6,10,9)));

SQL**>** insert into areas2

values(7,'printfact**',**MDSYS.SDO\_GEOMETRY(2003,null,null,MDSYS.SDO\_ELEM\_INFO\_AR

RAY(**1,1003,3)**,MDSYS.SDO\_ORDINATE\_ARRAY(8,4,10,7)));

SQL**> select** \* from **areas2**;

**NO** NAME

**LOCATION(**SDO\_GTYPE, SDO\_SRID, SDO\_POINT**(X**, **Y, Z)**, SDO\_ELEM\_INFO, SDO\_ORDINATES)

**1** mainbldg

SDO\_GEOMETRY(**2003**, NULL, NULL, SDO\_ELEM\_INFO\_ARRAY(1, **1003**, 3), SDO\_ORDINATE\_ARR

AY(1, **5**, 2, **8))**

**2** canteen

SDO\_GEOMETRY(2003, NULL, **NULL,** SDO\_ELEM\_INFO\_ARRAY(1, 1003**, 3)**, SDO\_ORDINATE\_ARR

AY(9, **1,** 11, 3))

3 scibldg

**NO** NAME

**LOCATION(**SDO\_GTYPE, SDO\_SRID**, SDO\_POINT(X**, **Y, Z)**, **SDO\_ELEM\_INFO**, SDO\_ORDINATES)

--

**42**

**Shaikh Salma Manjar**

SDO\_GEOMETRY(**2003, NULL**, **NULL**, SDO\_ELEM\_INFO\_ARRAY(1, **1003,** 1), SDO\_ORDINATE\_ARR

AY(4**, 2, *7*, 2, 8, 3, 7, 4, 4, 4, 4, 2)**)

4 artldg

SDO\_GEOMETRY(2003**, NULL**, **NULL**, SDO\_ELEM\_INFO\_ARRAY(1, **1003,** 1), SDO\_ORDINATE\_ARR

AY(4, **2, *7*, 2, 8, 3, 7, 4, 4, 4, 4,** 2))

5 plygrd

SDO\_GEOMETRY(2003**,** NULL, NULL, SDO\_ELEM\_INFO\_ARRAY(1, 1003, 1), SDO\_ORDINATE\_ARR

**NO** NAME

LOCATION(SDO\_GTYPE, SDO\_SRID, **SDO\_POINT(**X**, Y, Z)**, SDO\_ELEM\_INFO, SDO\_ORDINATES)

AY(8**, 10,** 11, 10, 11, 13**, 6**, 13, **8,** 11, **8,** 10))

6 labbldg

SDO\_GEOMETRY(**2003,** NULL, **NULL**, SDO\_ELEM\_INFO\_ARRAY(1, **1003,** 3), SDO\_ORDINATE\_ARR

AY(8, **6, 10,** 9))

**7** printfact

SDO\_GEOMETRY(2003**,** NULL, **NULL**, SDO\_ELEM\_INFO\_ARRAY(1, 1003**, 3**), SDO\_ORDINATE\_ARR

AY(8**,** 4, **10,** 7))

**NO** NAME

LOCATION(SDO\_GTYPE**,** SDO\_SRID, **SDO\_POINT**(**X**, **Y, Z)**, SDO\_ELEM\_INFO, SDO\_ORDINATES**)**

**7 rows** selected.

**a) Display area of each object**.

**SQL**> select name,SDO\_GEOM.SDO\_AREA(location**,**0.005**)** from areas2;

**NAME**

mainbldg

**canteen**

SDO\_GEOM.SDO\_AREA(LOCATION,0.005**)**

3

**4**

**272**

**43**

**Shaikh Salma Manjar**

**272**

scibldg

artldg

plygrd

**labbldg**

printfact

**7**

**7**

11

6

6

**b) Find the distance between main building and all other buildings**.

**SQL>** select SDO\_GEOM.SDO\_DISTANCE(a1.location**,a2.location**,0.005**)** from areas2 a1, areas2 a2 where a1.name='mainbldg' and a2.name **in(**select name **from** areas2);

SDO\_GEOM.SDO\_DISTANCE(A1.LOCATION,A2.LOCATION**,0.005)**

**0**

7.28010989

2.23606798

2.23606798

6.32455532

6

6

**7 rows** selected.

**c) Find the distance between arts and science building**.

SQL**>** select SDO\_GEOM.SDO\_DISTANCE(a1.location,a2.location,0.005) from **areas2** a1, areas2 a2 where a1.name=**'**scibldg' and a2.name='artldg';

SDO\_GEOM.SDO\_DISTANCE(A1.LOCATION,A2.LOCATION**,**0.005)

**0**

**d) find the sharing area between lab and print facility**.

**SQL>** select SDO\_GEOM.SDO\_INTERSECTION(a1.location,a2.location,0.005**) from** areas2 a1, areas2 **a2** where a1.name**='labbldg'** and a2.name**=**'printfact';

SDO\_GEOM.SDO\_INTERSECTION(A1.LOCATION,**A2.LOCATION,**0.005) (SDO\_GTYPE,

SDO\_SRID**,** SD

SDO\_GEOMETRY(2003**,** NULL, **NULL,** SDO\_ELEM\_INFO\_ARRAY(1, 1003, 1), SDO\_ORDINATE\_ARR

AY(8, **6, 10, 6**, 10**, 7**, 8, 7**, 8, 6**))

**e) Find the distance between arts building and canteen**.

SQL**>** select SDO\_GEOM.SDO\_DISTANCE(a1.location,**a2.location**,0.005) from **areas2 a1,** areas2 a2 where a1.name='canteen' and a2.name='artldg**';**

**44**

**Shaikh Salma Manjar**

SDO\_GEOM.SDO\_DISTANCE(A1.LOCATION,**A2.LOCATION,0.005)**

**1**

f) **Find spatial relationship between print facility and canteen building** SQL> select SDO\_GEOM.RELATE(a1.location,'anyinteract',a2.location,**0.005)** from areas2 a1, areas2 a2 where a1.name**=**'**printfact'** and a2.name='canteen**'**;

SDO\_GEOM.RELATE(A1.LOCATION**,**'ANYINTERACT',A2.LOCATION**,**0.005**)**

**FALSE**

**g) Is there any spatial relationship between print facility and lab building**. **SQL**> select SDO\_GEOM.RELATE(a1.location**,**'anyinteract',a2.location**,**0.005) from areas2 a1, areas2 a2 where a1.name**='**printfact' and a2.name**=**'labbldg';

SDO\_GEOM.RELATE(A1.LOCATION**,'ANYINTERACT**',A2.LOCATION**,**0.005**)**

**272**

**TRUE**

**PART C**

**Aim - Create a spatial**

**database based on the following information**

**Create three relations State (region, name) City(center,region**,**name) Rivers (name, route)**

**Given: -**

1. State '**st1**' which extends from (10,10),(60,60**),**(50,10**)**,(10,40**)**

**2.** State 'st2**'** which **has** two opposite corners situated at(100,50**) &** (**150,20)**

**City '**C1' with center at (**15,35**) region **is** circular with largest road **of 10**

3.

ཉ་

4. City '**C2**' with center at (22,35) region **is** circular with largest road of 4.

5. City '**C3**' with center as (55,40**)** region is point

6. City '**C4**' with center (**48,33**) which **is** rectangular with **corner** situated at (**40,30)** & (55,15)

**7.** City '**C5**' with center (120,35) extending from (**120,40**) to(130,30)

**8.**

River 'r1' **with** route extending from (15,25) to (52,58)

9. **River** 'r2' with route extending from (10,30) to (60,45)

10. River '**r3'** with route extending from (**55,30**) to (**110,30**)

**Queries:**

1. Locate **all cities in state** '**st1'.**

2. **Locate all** cities in **state 'st2'.**

3. Locate all cities not **more** than 10km from '**c3'**.

4. Locate **the** cities touching city 'c2**'**.

**45**

**Shaikh Salma Manjar**

5. Locate city within 5km from 'r2**'.**

6. Locate cities intersected by river '**r2'**.

**7.** Find cities intersected **by '**r3'.

8. Find the population in every city **of** state 'st1' **if** population **per** sq.km. **is 6**.. 9. Find distance between two **states**.

100

50

**R1**

A

ST1

C4

TRZ

0

50

**$12**

CS

R3

100

150

x**-**axis

1 unit 10 **km**

y-axis

1 **unit** 10 **km**

**272**

**STEPS:**

**Create the following tables**:

State with attributes

Name of type varchar2 and primary key and region as mdsys.sdo\_geometry >>create table state(name varchar2(50) primary key,region mdsys.sdo\_geometry);

**City** with attributes

Name of type varchar2 and primary key and region as mdsys.sdo\_geometry

>>create table city(name varchar2(50) primary key,center mdsys.sdo\_geometry,region mdsys.sdo\_geometry);

River with attributes

Name **of** type varchar2 and primary key and region as mdsys.sdo\_geometry

**>>**create table river**(**name varchar2**(50**) primary key,route **mdsys.sdo\_geometry**);

**Inserting values**:

**Inserting values in state table**:

>>insert into state

values**(**'**s1**',mdsys.sdo\_geometry(2003,null,null,mdsys.sdo\_elem\_info\_array(**1,1003,1),m**

dsys.sdo\_ordinate\_array(10,10,60,60,50,10,10,40,10,10**))**);

>>**insert into** state

values(**'s2**',mdsys.sdo\_geometry(**2003**,**null,null,**mdsys.sdo\_elem\_info\_array(1,1003,3**),m**

dsys.sdo\_ordinate\_array(100,50,150,20**)**));

**Inserting values in city table**:

>>insert **into city**

values('c1',mdsys.sdo\_geometry**(2001,**null,null,mdsys.sdo\_elem\_info\_array(1,1,1),mdsy

**46**

**Shaikh Salma Manjar**

**272**

s.sdo\_ordinate\_array(15,35**))**,mdsys.sdo\_geometry(2003**,null,null,**mdsys.sdo\_elem\_info\_

array(1,1003,4**),**mdsys.sdo\_ordinate\_array(15,30,20,35,15,40**))**);

>>insert into **city**

values('**c2**',mdsys.sdo\_geometry(2001,null,**null,**mdsys.sdo\_elem\_info\_array(1,1,1),**mdsy** s.sdo\_ordinate\_array(**22,35)**),mdsys.sdo\_geometry(2003,null,null**,**mdsys.sdo\_elem\_info\_

array(1,1003,4),mdsys.sdo\_ordinate\_array(**22,33,24,35,22,37**)));

>>insert into city

values('c3',mdsys.sdo\_geometry(2001,null,null,mdsys.sdo\_elem\_info\_array(1,1,1),**mdsy** s.sdo\_ordinate\_array(55,40)**),**mdsys.sdo\_geometry(2001,null**,null,mdsys.sdo\_elem\_info\_**

array(1,1,1),mdsys.sdo\_ordinate\_array**(55,40**)));

>>insert into city

values('**c4**',mdsys.sdo\_geometry(2001,null,null,mdsys.sdo\_elem\_info\_array(1,1,1),mdsy s.sdo\_ordinate\_array(**48,33))**,mdsys.sdo\_geometry**(**2003,**null**,**null,**mdsys.sdo\_elem\_info\_

array(1,1003,3**),**mdsys.sdo\_ordinate\_array(40,30,55,15)));

>>insert into city

values**(**'**c5**',mdsys.sdo\_geometry(2001,null,null,mdsys.sdo\_elem\_info\_array(1,1,1**),mdsy** s.sdo\_ordinate\_array(120,35**)**),**mdsys.sdo\_geometry**(2003,**null**,null,mdsys.sdo\_elem\_inf

o\_array(1,1003,3**),**mdsys.sdo\_ordinate\_array(120,40,130,30**)**));

**Inserting values into** river **table**:

>>insert into river

values**(**'r1**',mdsys.sdo\_geometry**(2002,null,null,mdsys.sdo\_elem\_info\_array(1,2,1**),mdsy**

s.sdo\_ordinate\_array(**15,25,52,58)**));

>>insert into river

values('r2**',mdsys.sdo\_geometry(**2002,null**,null,**mdsys.sdo\_elem\_info\_array(1,2,1),mdsy

s.sdo\_ordinate\_array(10,30,60,45**)**));

>>insert into river

values('**r3',**mdsys.sdo\_geometry**(**2002,null,null,mdsys.sdo\_elem\_info\_array(1,2,1),mdsy

s.sdo\_ordinate\_array(**55,30,110,30**)**)**);

**QUERIES**:

**a) Locate all cities in state 's1'**

**>>**select c.name from city **c,** state s where sdo\_geom.RELATE (c.region, 'INSIDE', s.region, 0.005**)='INSIDE**' and s.name='s1';

**NAME**

**c3**

**47**

**Shaikh Salma Manjar**

**b) Locate** all **cities in state's2**'

**>>select** c.name from **city c, state** s where sdo\_geom.RELATE (c.region**,** 'INSIDE', s.region**,** 0.005)='INSIDE' and s.name='**s2**';

**NAME**

C5

**c)** Locate **all** cities **not more than 10km from 'c3**'

**272**

**>>select** c.name from **city** c where sdo\_geom.WITHIN\_DISTANCE (c.region, **10,** (select ct.region from **city ct** where ct.name='**c3')**, 0.005)= 'TRUE' and **c.name<**>'c3';

**NAME**

C4

**d) Locate the cities touching city 'c2**'

**>>**select c.name from city **c** where sdo\_geom.RELATE (c.region, 'TOUCH', (select ct.region from city ct where ct.name**=**'**c2'**)**,** 0.005)= 'TOUCH';

**NAME**

C1

**e) Locate city within 5km from** '**r2**'

**>>**select distinct c.name from city **c,** river r **where** sdo\_geom.WITHIN\_DISTANCE **(**c.region**,5,**r.route, 0.005)= **'**TRUE' and r.name='r2';

**NAME**

**c1**

**c2**

**c3**

f) Locate cities **intersected by river 'r2**'

**>>**select **c.name** from **city c,** river r **where sdo\_geom**. SDO\_INTERSECTION **(**c.region**,**r.route, **0.005)** IS NULL and **r.** name**=**'r2'**;**

NAME

**c3**

c4

**c5**

**48**

**Shaikh Salma Manjar**

**g)Find cities** intersected **by 'r3'**

**>>**select c.name from city **c,** river r where sdo\_geom**.** SDO\_INTERSECTION **(**c.region,r.route, 0.005**) IS** NULL and r.name='r3';

**NAME**

**c1**

**c2**

**272**

**c3**

**c5**

**h) Find** the **population in every city of state** '**s1**' **if population per sq.km. is 6**.

>>select 6\*SDO\_GEOM.SDO\_AREA(s.region,0.005**)** population\_of\_state\_s1 from state s where s.name**=**'**s1';**

POPULATION\_OF\_STATE\_S1

2400

**i) Find the distance between two states**.

**>>**select distinct SDO\_GEOM.SDO\_Distance((select **s1.region** from state s1 where s1.name**='s1**'), **(select** s2.region from state s2 where s2.name**=**'**s2**'**)**,**0.005)**Distance\_Between\_Two\_State from state s;

DISTANCE\_BETEEN\_TWO\_STATE

41.1843884

**49**