

# Course ISE 326: Database Systems Engineering

## Recitations 13–14: OLAP Queries

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### 1 Introduction

In this recitation we will explore the use of the new query operators which were introduced in lecture in this week. As noted in class, not all of the functionality of SQL:1999 is available our MS SQL Server instance, so we will not be able to write all of the queries as elegantly as we might like.

In this lab you will use the following functions built into SQL: Rank(), Dense\_Rank(), and Ntile(*n*). We explained about Rank() and Dense\_Rank() in class.

#### 1.1 Ntile

Ntile(*n*) divides the results into *n* groups. Like Rank() and Dense\_Rank() it is defined over a PARTITION BY and ORDER BY clause.

### 2 Tables

The data tables for the queries are as follows:

Locations(locid:integer, city:string, state:string, country:string)

Products(pid:integer, pname:string, category:string, price:real)

Times(timeid:integer, date:string, week:integer, month:integer, quarter:integer, year:integer, holiday\_flag:boolean)

Sales (pid:integer, timeid:integer, locid:integer, sales:real)

The SQL to define the above tables is as follows:

```
CREATE TABLE Locations (locid INTEGER PRIMARY KEY,  
city VARCHAR(20), state VARCHAR(5),  
country VARCHAR(20));
```

```
CREATE TABLE Products (pid INTEGER PRIMARY KEY,  
pname VARCHAR(20), category VARCHAR(20), price REAL);
```

```
CREATE TABLE Times (timeid INTEGER PRIMARY KEY, date VARCHAR(20),  
week INTEGER, month INTEGER, quarter INTEGER, year INTEGER,  
holiday_flag BIT);
```

```
CREATE TABLE Sales (locid INTEGER, pid INTEGER, timeid INTEGER, sales REAL,  
PRIMARY KEY (locid, pid, timeid),
```

```
FOREIGN KEY (locid) REFERENCES Locations,  
FOREIGN KEY (pid) REFERENCES Products,  
FOREIGN KEY (timeid) REFERENCES Times);
```

I have prepared insert statements for the above tables so that you will have sample data to work with them. The insert script can be found at the end of this document in section 4 and in a separate file on the course web page.

### 3 Exercises

Consider the Locations, Products, and Sales relations shown in above. Write the following queries in MS SQL using the PARTITION clause whenever you need it. Keep in mind that you may need to define temporary intermediate tables (or views) to calculate some of the queries.

1. Find the percentage change in the total monthly sales for each location.
2. Find the percentage change in the total quarterly sales for each product.
3. Calculate the total sales for each product per month. Rank the results based on the product (i.e. order by the highest selling month for each product)
4. For each product, show the top 2 locations in terms of total sales (show the location id, product id, total sales, and rank)
5. Find the top 3 months in terms of total sales (show the month and total sales amount)
6. Find the 4th and 5th ranked months in terms of total sales (show the month and total sales amount) (Hint: Calculate the top 5 and then remove the ones you don't want)
7. For each product, find the top sales events in each quartile (top quarter, second quarter, third quarter, fourth quarter)

## 4 Insert Script

```
INSERT INTO Locations (locid, city, state, country) VALUES (1, 'Madison', 'WI', 'USA');
INSERT INTO Locations (locid, city, state, country) VALUES (2, 'Fresno', 'CA', 'USA');
INSERT INTO Locations (locid, city, state, country) VALUES (3, 'Afula', 'IL', 'Israel');
INSERT INTO Locations (locid, city, state, country) VALUES (4, 'Tel Aviv', 'IL', 'Israel');
INSERT INTO Locations (locid, city, state, country) VALUES (5, 'Chennai', 'TN', 'India');
INSERT INTO Locations (locid, city, state, country) VALUES (6, 'New York', 'NY', 'USA');
INSERT INTO Locations (locid, city, state, country) VALUES (7, 'Tiberias', 'IL', 'Israel');

INSERT INTO Products (pid, pname, category, price) VALUES (11, 'Lee Jeans', 'Apparel', 25);
INSERT INTO Products (pid, pname, category, price) VALUES (12, 'Zord', 'Toys', 18);
INSERT INTO Products (pid, pname, category, price) VALUES (13, 'Biro Pen', 'Stationery', 2);

INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (1, '1 Jan 09', 1, 1, 1, 2009, 'True');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (2, '8 Jan 09', 2, 1, 1, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (3, '15 Jan 09', 3, 1, 1, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (4, '22 Jan 09', 4, 1, 1, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (5, '29 Jan 09', 5, 1, 1, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (6, '5 Feb 09', 6, 2, 1, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (7, '12 Feb 09', 7, 2, 1, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (8, '19 Feb 09', 8, 2, 1, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (9, '26 Feb 09', 9, 2, 1, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (10, '5 Mar 09', 10, 3, 1, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (11, '12 Mar 09', 11, 3, 1, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (12, '19 Mar 09', 12, 3, 1, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (13, '26 Mar 09', 13, 3, 1, 2009, 'True');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (14, '2 Apr 09', 1, 4, 2, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (15, '9 Apr 09', 2, 4, 2, 2009, 'True');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (16, '16 Apr 09', 3, 4, 2, 2009, 'True');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (17, '23 Apr 09', 4, 4, 2, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (18, '30 Apr 09', 5, 4, 2, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (19, '7 May 09', 6, 5, 2, 2009, 'False');
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INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (20, '14 May 09', 7, 5, 2, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (21, '21 May 09', 8, 5, 2, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (22, '28 May 09', 9, 5, 2, 2009, 'True');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (23, '4 Jun 09', 10, 6, 2, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (24, '11 Jun 09', 11, 6, 2, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (25, '18 Jun 09', 12, 6, 2, 2009, 'False');
INSERT INTO Times (timeid, date, week, month, quarter, year, holiday_flag)
VALUES (26, '25 Jun 09', 13, 6, 2, 2009, 'False');

```

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INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,1,1,25);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,1,2,35);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,1,6,25);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,1,7,35);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,18,2,10);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,2,1,86);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,2,2,22);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,2,4,86);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,2,5,8);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,2,6,8);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,2,7,22);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,21,2,8);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,22,2,87);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,22,5,86);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,25,2,86);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,3,1,15);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,3,2,10);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,3,7,15);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,5,1,64);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,6,1,86);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,7,1,51);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,7,5,70);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,9,1,70);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,9,4,70);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,9,6,70);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (11,9,7,70);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,1,1,30);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,1,2,26);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,1,3,26);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,1,7,30);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,10,2,72);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,10,4,20);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,11,2,72);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,12,1,49);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,12,2,57);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,13,1,49);

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INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,2,1,20);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,2,2,45);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,2,3,45);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,2,7,20);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,20,1,49);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,20,2,104);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,20,3,72);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,21,4,50);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,23,3,87);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,24,2,72);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,24,3,104);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,25,4,293);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,3,1,20);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,3,2,104);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,3,3,104);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,3,4,104);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,3,6,104);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,4,4,50);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,5,1,64);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,5,2,72);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,6,4,57);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,7,1,49);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,7,4,70);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,8,2,57);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (12,9,4,57);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,1,1,8);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,1,2,193);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,10,7,293);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,12,2,193);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,13,2,193);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,14,2,143);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,14,4,153);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,15,2,133);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,15,3,133);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,17,2,13);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,17,7,13);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,18,2,293);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,18,3,93);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,18,4,93);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,18,7,293);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,19,1,10);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,19,2,153);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,2,1,10);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,2,2,193);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,2,4,40);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,2,6,40);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,20,2,193);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,20,4,5);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,21,2,153);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,22,2,143);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,22,4,153);

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```
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,22,7,133);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,23,6,93);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,23,7,13);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,24,7,93);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,25,2,193);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,25,4,143);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,25,7,133);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,26,2,143);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,26,7,13);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,3,1,10);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,3,6,20);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,3,2,5);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,3,7,10);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,4,6,20);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,6,1,86);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,7,1,51);
INSERT INTO Sales(pid, timeid, locid, sales) VALUES (13,9,2,72);
```