Basic Databases – Report05

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The tasks contain exercises to practice two subjects:

1. Conceptual data model and its implementation using SQL
2. Retrieving Information using VIEWs
3. Set operations
4. The OVER clause
5. Pivoting data

Additional note:

Please carefully read through the tasks and decide which tasks you want to solve with my help

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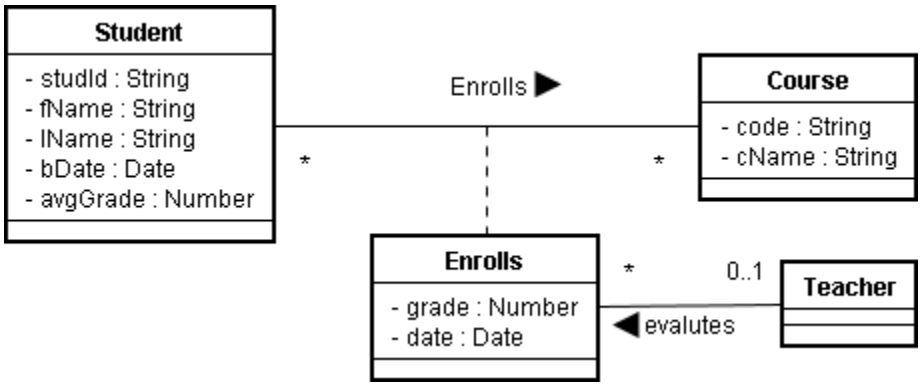
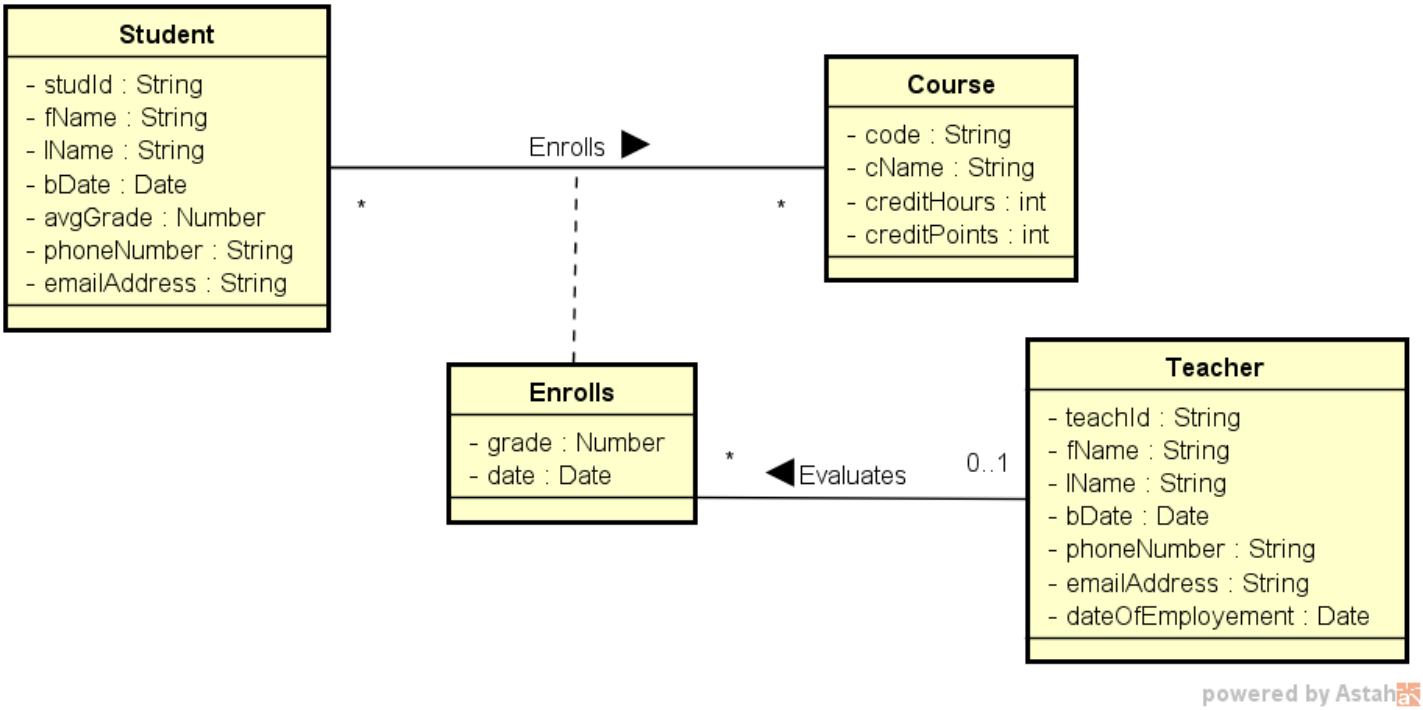
Problem 1



1. Complete definition of classes (add needed properties)



2. Implement the data model in the MS SQL 20017 server - transform classes and relationships from the conceptual data model into the set of tables including appropriate integrity constraints (primary key, alternate key, foreign key, and check)

```
CREATE TABLE Student(
	studId CHAR(7) NOT NULL,
	fName CHAR(7) NOT NULL,
	lName CHAR(7) NOT NULL,
	bDate DATE,
	avgGrade DECIMAL(2,1),
	phoneNumber CHAR(11),
	emailAddress VARCHAR(32),
	CONSTRAINT pk_Student PRIMARY KEY (studId)
);

CREATE TABLE Course(
	code CHAR(5) NOT NULL,
	cName VARCHAR(32) NOT NULL,
	creditHours INT NOT NULL,
	creditPoints INT NOT NULL,
	CONSTRAINT pk_Course PRIMARY KEY (code)
);

CREATE TABLE Enrolls(
	id INT NOT NULL IDENTITY(1,1),
	grade DECIMAL(2,1),
	date DATE NOT NULL,
	studId CHAR(7) NOT NULL,
	code CHAR(5) NOT NULL,
	CONSTRAINT fk1_Enrolls FOREIGN KEY (studId) REFERENCES Student(studId),
	CONSTRAINT fk2_Enrolls FOREIGN KEY (code) REFERENCES Course(code),
	CONSTRAINT pk_Enrolls PRIMARY KEY (id)
);

CREATE TABLE Teacher(
	teachId CHAR(7) NOT NULL,
	fName CHAR(7) NOT NULL,
	lName CHAR(7) NOT NULL,
```

```
	bDate DATE,
	phoneNumber CHAR(11) NOT NULL,
	emailAddress VARCHAR(32) NOT NULL,
	dateOfEmployement DATE NOT NULL,
	CONSTRAINT pk_Teacher PRIMARY KEY (teachId)
);

CREATE TABLE Evaluates(
	id INT NOT NULL IDENTITY(1,1),
	teachId CHAR(7) NOT NULL,
	id_enrollment INT NOT NULL,
	CONSTRAINT fk1_Evaluates FOREIGN KEY (teachId) REFERENCES Teacher(teachId),
	CONSTRAINT fk2_Evaluates FOREIGN KEY (id_enrollment) REFERENCES Enrolls(id),
	CONSTRAINT pk_Evaluates PRIMARY KEY (id)
);
```

3. Insert some records into each table

```
INSERT INTO Student VALUES
	('2098174','Karl','Jeims','1998-10-3',3.8,'48123456789','email@mail.com'),
	('2098175','Ian','Kupel','1997-11-13',4.8,'48121111789','email2@mail.com'),
	('2098176','Krzystyna','Jon','1999-10-3',4.0,'48007456789','email3@mail.com')
;

INSERT INTO Course VALUES
	('20981','Course#1',30,2),
	('20982','Course#2',45,5),
	('20983','Course#3',60,6)
;


INSERT INTO Enrolls VALUES
	(3.7,'2017-9-27','2098174','20982'),
	(4.7,'2016-9-27','2098175','20981'),
	(4.0,'2017-9-28','2098174','20981'),
	(3.0,'2017-9-27','2098176','20981')
;


INSERT INTO Teacher VALUES
	('9998160','John','Kladt','1968-10-3','48123456123','email@mail.com','1999-1-10'),
	('9998161','Pawel','Jun','1987-11-13','48121111321','email2@mail.com','2013-10-8'),
	('9998162','Alena','P.D.','1990-10-3','48076556789','email3@mail.com','2018-10-10')
;


INSERT INTO Evaluates VALUES
	('9998161',2),
	('9998162',3)
;


SELECT * FROM Student;
```

studId	fName	lName	bDate	avgGrade	phoneNumber	emailAddress
2098174	Karl	Jeims	1998-10-03	3.8	48123456789	email@mail.com
2098175	Ian	Kupel	1997-11-13	4.8	48121111789	email2@mail.com
2098176	Krzystyna	Jon	1999-10-03	4.0	48007456789	email3@mail.com

```
SELECT * FROM Course;
```

code	cName	creditHours	creditPoints
20981	Course#1	30	2
20982	Course#2	45	5
20983	Course#3	60	6

```
SELECT * FROM Enrolls;
```

id	grade	date	studId	code
1	3.7	2017-09-27	2098174	20982
2	4.7	2016-09-27	2098175	20981
3	4.0	2017-09-28	2098174	20981
4	3.0	2017-09-27	2098176	20981

```
SELECT * FROM Teacher;
```

teachId	fName	lName	bDate	phoneNumber	emailAddress	dateOfEmployement
9998160	John	Kladt	1968-10-03	48123456123	email@mail.com	1999-01-10
9998161	Pawel	Jun	1987-11-13	48121111321	email2@mail.com	2013-10-08
9998162	Alena	P.D.	1990-10-03	48076556789	email3@mail.com	2018-10-10

```
SELECT * FROM Evaluates;
```

id	teachId	id_enrollment
1	9998161	2
2	9998162	3

```
--select the student's name, course name, grade, name of the teacher who evaluates this course, his
phone and email address, for the courses, that are evaluated by a teacher
SELECT S.fName + ', ' + S.lName AS 'Student Name', cName AS 'Enrolled Course', grade AS Grade, T.fName
+ ', ' + T.lName AS 'Teacher Name',
          T.phoneNumber AS "Teacher's phone", T.emailAddress AS "Teacher's email"
FROM Student AS S, Teacher AS T, Course AS C, Enrolls AS E, Evaluates AS Ev
WHERE S.studId=E.studId AND E.code=C.code AND E.id=Ev.id_enrollment AND Ev.teachId=T.teachId;
```

Student Name	Enrolled Course	Grade	Teacher Name	Teacher's phone	Teacher's email
Ian, Kupel	Course#1	4.7	Pawel, Jun	48121111321	email2@mail.com
Karl, Jeims	Course#1	4.0	Alena, P.D.	48076556789	email3@mail.com

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Source data: **Database: AdventureWorks2017**

Task 1

Table: `SalesOrderHeader, SalesOrderDetail`

Create a view that allows retrieving information from the database of the total quantity orders in the context of employee and year

Solution

```
CREATE VIEW task2_view AS
SELECT H.SalesPersonID, YEAR(OrderDate) AS Year, SUM(OrderQty) AS NoOfOrders
FROM Sales.SalesOrderHeader AS H, Sales.SalesOrderDetail AS D
WHERE SalesPersonID IS NOT NULL AND H.SalesOrderID=D.SalesOrderID
GROUP BY SalesPersonID, YEAR(OrderDate);
```

SalesPersonID	Year	NoOfOrders
281	2014	2050
279	2011	1681
285	2013	752

Rec:3/58

Task 2

Table: **?**

Write a query that returns customer and employee pairs that had order activity (number of orders > 0) in January 2012 but not in May 2014

Solution

```
SELECT CustomerID, SalesPersonID
FROM Sales.SalesOrderHeader AS H
WHERE MONTH(OrderDate)=1 AND YEAR(OrderDate)=2012 AND SalesPersonID IS NOT NULL
        AND (SalesPersonID NOT IN(
                    SELECT SalesPersonID
                    FROM Sales.SalesOrderHeader
                    WHERE MONTH(OrderDate)=5 AND YEAR(OrderDate)=2014 AND CustomerID = H.CustomerID AND
SalesPersonID IS NOT NULL
                )
                AND CustomerID NOT IN(
                    SELECT CustomerID
                    FROM Sales.SalesOrderHeader
                    WHERE MONTH(OrderDate)=5 AND YEAR(OrderDate)=2014 AND SalesPersonID =
H.SalesPersonID AND SalesPersonID IS NOT NULL
                )
         )

--OR USING VIEWS
CREATE VIEW task3_1_view AS
SELECT CustomerID, SalesPersonID
FROM Sales.SalesOrderHeader
WHERE MONTH(OrderDate)=1 AND YEAR(OrderDate)=2012 AND SalesPersonID IS NOT NULL
```

```
CREATE VIEW task3_2_view AS
SELECT CustomerID, SalesPersonID
FROM Sales.SalesOrderHeader
WHERE MONTH(OrderDate)=5 AND YEAR(OrderDate)=2014 AND SalesPersonID IS NOT NULL


SELECT CustomerID, SalesPersonID
FROM task3_1_view AS H
WHERE (SalesPersonID NOT IN(
                    SELECT SalesPersonID
                    FROM task3_2_view
                    WHERE CustomerID = H.CustomerID
                )
                AND CustomerID NOT IN(
                    SELECT CustomerID
                    FROM task3_2_view
                    WHERE SalesPersonID = H.SalesPersonID
                )
          )
```

CustomerID	SalesPersonID
29769	277
29523	277
30100	276

Rec:3/128

Task 3

Write a query that returns customer and employee pairs that had order activity in both January 2014 and May 2014 but not in 2013

Solution

```
SELECT CustomerID, SalesPersonID
FROM Sales.SalesOrderHeader AS H
WHERE MONTH(OrderDate)=1 AND YEAR(OrderDate)=2014 AND SalesPersonID IS NOT NULL
         AND (SalesPersonID NOT IN(
                    SELECT SalesPersonID
                    FROM Sales.SalesOrderHeader
                    WHERE YEAR(OrderDate)=2013 AND CustomerID = H.CustomerID AND SalesPersonID IS NOT
NULL
                )
                AND CustomerID NOT IN(
                    SELECT CustomerID
                    FROM Sales.SalesOrderHeader
                    WHERE YEAR(OrderDate)=2013 AND SalesPersonID = H.SalesPersonID AND SalesPersonID IS
NOT NULL
                )
              )
          AND (SalesPersonID IN(
                    SELECT SalesPersonID
                    FROM Sales.SalesOrderHeader
                    WHERE MONTH(OrderDate)=5 AND YEAR(OrderDate)=2014 AND CustomerID = H.CustomerID AND
SalesPersonID IS NOT NULL
                )
                AND CustomerID IN(
                    SELECT CustomerID
                    FROM Sales.SalesOrderHeader
```

```
                    WHERE MONTH(OrderDate)=5 AND YEAR(OrderDate)=2014 AND SalesPersonID =
H.SalesPersonID AND SalesPersonID IS NOT NULL
                )
          )

     Rec:0/0
```

Task 4

Write a query that returns data according to the following definition:

custID, Name (Last Name, First name), Gender, "2012. 04 –2013. 04" (Difference of orders in April 2012 and April 2013)

Solution

```
CREATE VIEW April2012Orders AS
SELECT CustomerID, COUNT(*) AS April2012Orders
FROM Sales.SalesOrderHeader
WHERE YEAR(OrderDate)=2012 AND MONTH(OrderDate)=4
GROUP BY CustomerID

CREATE VIEW April2013Orders AS
SELECT CustomerID, COUNT(*) AS April2013Orders
FROM Sales.SalesOrderHeader
WHERE YEAR(OrderDate)=2013 AND MONTH(OrderDate)=4
GROUP BY CustomerID

SELECT T1.CustomerID, P.LastName + ', ' + P.FirstName AS 'Name (Last Name, First name)',
              COALESCE(T1.April2012Orders-T2.April2013Orders, T1.April2012Orders) AS '"2012. 04 -2013.
04" (Difference of orders in April 2012 and April 2013)'
FROM April2012Orders AS T1
LEFT JOIN April2013Orders AS T2 ON T1.CustomerID=T2.CustomerID
JOIN Sales.Customer AS C ON C.CustomerID = T1.CustomerID
JOIN Person.Person AS P ON P.BusinessEntityID = C.PersonID;
```

CustomerID	Name (Last Name, First name)	"2012. 04 –2013. 04" (Difference of orders in April 2012 and April 2013)
11395	Gutierrez, Beth	1
11412	Bryant, Sydney	1
11421	Sun, Amy	1

Task 5

Write a query that returns the total sum of orders for each customer according to the following definition:

CustID	Name	No	Total due	Date	Sum of total due
11000	Yang, Jon	1	3756,989	2011-07-03	9115.13
…	…	2	…	…	…
11001	Huang, Eugene	1	2674,0227	2013-06-30	7054.19
…		2			7054.19
11002	Torres, Ruben	1	3756,989	2011-06-21	8966.01
…	…	…	…	…	…
11003	Zhu, Christy	1	2674,4757	2013-10-22	8993.92
…	…	…	…	…	…

---------- Explanation / Example ----------

The OVER clause exposes a window of rows to certain kinds of calculations. Aggregate and ranking functions are the types of calculations that support the OVER clause. In this case you don't have to group the data (GROUP BY)

SELECT …
, <aggregate / ranking function> (aggregation element>)
OVER([PARTITION BY <list of attributes>
[ORDER BY <list of attributes>]]) AS <column alias>
, …
FROM <source data>

Example:

```
SELECT  so.SalesPersonID, p.LastName +', ' + p.FirstName Name
       , ROW_NUMBER() OVER(PARTITION BY so.SalesPersonID ORDER BY  so.SalesPersonID) No
       , so.SubTotal, CAST(so.DueDate AS DATE) Date
       , COUNT(*) OVER(PARTITION BY so.SalesPersonID) "No of records"
FROM [Sales].[SalesOrderHeader] so JOIN [Person].[Person] p
       ON so.[SalesPersonID] = p.[BusinessEntityID]
ORDER BY so.SalesPersonID, No;
```

Exemplary result of the query:

SalesPersonID	Name	No	SubTotal	Date	No of records
274	Jiang, Stephen	1	20544,7015	2011-07-13	48
274	Jiang, Stephen	2	2039,994	2011-08-13	48
274	Jiang, Stephen	3	4194,589	2011-10-13	48
274	Jiang, Stephen	4	2146,962	2011-10-13	48
…	…	…	…	…	…
275	Blythe, Michael	1	2942,418	2014-05-13	450
275	Blythe, Michael	2	5496,018	2014-05-13	450
275	Blythe, Michael	3	2995,188	2014-05-13	450
275	Blythe, Michael	4	3595,188	2014-05-13	450
…	…	…	…	…	…

Solution

```
SELECT SH.CustomerID, P.LastName +', ' + P.FirstName AS Name,
              ROW_NUMBER() OVER(PARTITION BY SH.CustomerID ORDER BY SH.CustomerID) No,
              SH.TotalDue AS 'Total due',
              CAST(SH.DueDate AS DATE) Date,
              SUM(TotalDue) OVER(PARTITION BY SH.CustomerID) 'Sum of total due'
FROM Sales.SalesOrderHeader SH
JOIN Sales.Customer AS SC
ON SC.CustomerID = SH.CustomerID
JOIN Person.Person P
ON SC.PersonID = P.BusinessEntityID
ORDER BY SH.CustomerID, No;
```

CustomerID	Name	No	Total due	Date	Sum of total due
11000	Yang, Jon	1	3756,989	2011-07-03	9115,1341
11000	Yang, Jon	2	2587,8769	2013-07-02	9115,1341
11000	Yang, Jon	3	2770,2682	2013-10-15	9115,1341

Rec:3/31465

Task 6

Write a query that returns the count of orders for each employee who prepared orders in 2012, 2013, and 2014

---------- Explanation / Example ----------

Pivoting means rotating data from a state of rows to a state of columns.

Every pivoting request involves three logical processing phases:

1. A grouping phase

2. A spreading phase
3. An aggregating phase

The general form of a query with PIVOT operator is:

SELECT …
FROM <source data>
PIVOT
(
<Aggregate function> (aggregation element>)
FOR <spreading element> IN (<list of target columns>)
) AS <result table alias>

Exemplary result of the query

- Simplified solution

empId	2011	2012	2013	2014
284	0	24	82	34
278	30	80	89	35
281	33	74	98	37
275	65	148	175	62

- Extended solution (more readable)

Employer	empId	2011	2012	2013	2014
Mensa-Annan, Tete	284	0	24	82	34
Vargas, Garrett	278	30	80	89	35
Ito, Shu	281	33	74	98	37
Blythe, Michael	275	65	148	175	62
Mitchell, Linda	276	46	151	162	59

Solution

```
SELECT *
FROM(
SELECT SalesPersonID AS empId, LEFT(DATENAME(YEAR,OrderDate),4) AS YearOfOrder, SalesOrderNumber
FROM Sales.SalesOrderHeader
WHERE SalesPersonID IS NOT NULL
) source
PIVOT(
       COUNT(SalesOrderNumber)
       FOR YearOfOrder
       IN ([2012],[2013],[2014])
)
AS Pivotable
```

empId	2012	2013	2014
284	24	82	34
278	80	89	35
281	74	98	37

Rec: 3/17

Task 7

Define query using SQL table value constructor with 5 records as elements of a dictionary. Each record should contain a pair of values: **id** (from 1 through 5) and a **name** of programming language, e.g. `(1, 'SQL'), (2, 'Python')`, …

id	language
1	SQL
2	Python
…	…

---------- Syntax ----------

SELECT *
FROM
(VALUES
(…)
) AS <name of table> (<definition of table structure>)

Solution

```
SELECT *
FROM(
	VALUES
		(1,'Python'),
		(2, 'Java'),
		(3,'C++'),
		(4,'C'),
		(5,'JavaScript')
) AS Dictionary(id, name);
```

id	name
1	Python
2	Java
3	C++
4	C
5	JavaScript
