National University of Computer and Emerging Sciences

Lab Manual 4

“Data Retrieval Select-from-where, Joins, Order by, Aggregate functions, Group by”

Database Systems Lab

Fall 2023

Department of Computer Science
FAST-NU, Lahore, Pakistan

1. Contents

2. Objective

- The purpose of this manual is to get stared with data retrieval queries, starting from Simple Select-From-Where, going towards Join operation, covering Order by clause and Aggregate functions, Group by.

3. Pre-requisites

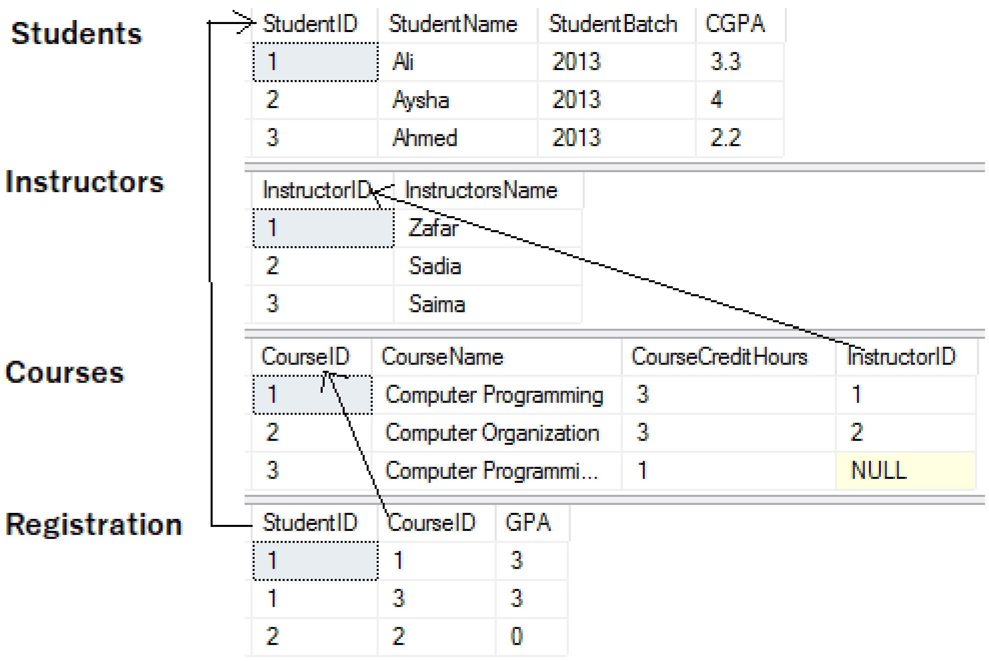
- Lab 3 manual, on how to get started with MS-SQL server
- How Select from Where clause work
- How Joining and all its type work
- How Order by clause works
- Aggregate functions, Group by

Task Distribution

Total Time	170 Minutes
Select from where	15 Minutes
Order by	15 Minutes
Joining	15 Minutes
Group by	15 Minutes
Exercise	90 Minutes
Evaluation	Last 20 Minutes

4. SELECT-FROM-WHERE

Select from where is equivalent to projection and selection in Relational Algebra, it will give output in form of a table.
The most basic select statement includes Select and from clause, and it will retrieve all columns and rows from the table.
We will use the following schema and database for the examples. Script to create this schema is given in Lab4Manual.sql file



Students

StudentID	StudentName	StudentBatch	CGPA
1	Ali	2013	3.3
2	Aysha	2013	4
3	Ahmed	2013	2.2

Instructors

InstructorID	InstructorsName
1	Zafar
2	Sadia
3	Saima

Courses

CourseID	CourseName	CourseCreditHours	InstructorID
1	Computer Programming	3	1
2	Computer Organization	3	2
3	Computer Programmi...	1	NULL

Registration

StudentID	CourseID	GPA
1	1	3
1	3	3
2	2	0

Most Basic Select:

SELECT *
FROM <tableName>

* after select means that all columns will be retrieved

Try this

Results

Retrieving certain Columns from Select

To retrieve only certain columns give a comma separated list of those columns after Select keyword

```
SELECT ColumnX, ColumnY, ColumnZ
FROM <tableName>
```

Try this

Results

Retrieving certain Rows from Select- WHERE CLAUSE

Like Selection in RA, rows are filter in SQL using WHERE clause, rows that fulfill where clause conditions will be projected in result. Where clause can put condition on original columns of tables mentioned on from clause, or derived columns.

```
SELECT *
FROM <tableName>
where <conditions>
```

Try this

Results

Renaming Resulting Column

You can rename a column in result by using AS keyword also called Alias. The scope of this renaming is only to that select query, this is useful in joining where more than one table have same column names.

```
SELECT ColumnX as X , ColumnY as Y, ColumnZ
FROM <tableName> as Table1
```

Try this

Results

5. Order by Clause

Order by clause is used to arrange the rows in ascending or descending order of one or more columns

```
SELECT ColumnX as X , ColumnY as Y, ColumnZ
FROM <tableName> as Table1
ORDER BY ColumnX asc/desc, ColumnZ asc/desc
```

Try this

Results

TOP Clause

Top n clause will give you first n rows from result instead of all the rows.

SELECT TOP <n> *
FROM <tableName>
where <conditions>
Order by <column Name> asc/desc

Try this

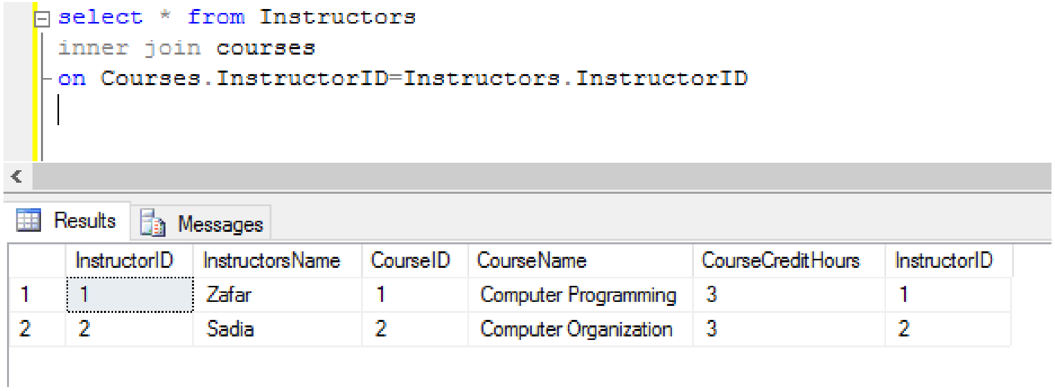
6. Join Operation

We will use the following tables in examples

Inner Join:

Returns only those rows that match in both tables.

SELECT *
FROM <table1> inner join <table2>
ON <Joining Condition>



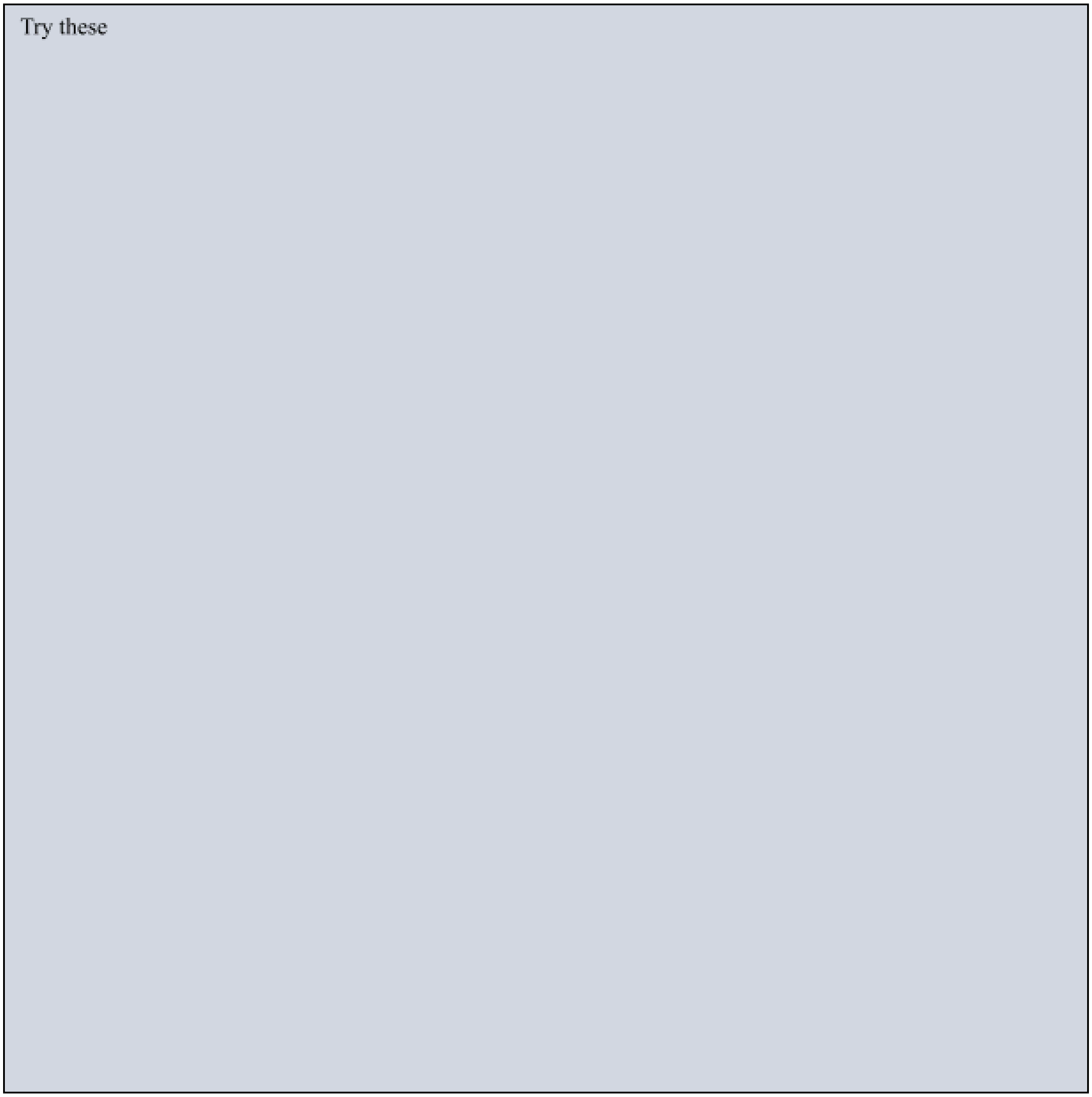
```
select * from Instructors
inner join courses
on Courses.InstructorID=Instructors.InstructorID
```

	InstructorID	InstructorsName	CourseID	CourseName	CourseCreditHours	InstructorID
1	1	Zafar	1	Computer Programming	3	1
2	2	Sadia	2	Computer Organization	3	2

Left/Right/Full Outer Join

Left Join: Returns all the rows of Left table with corresponding row or null row of right table
Right Join: Returns all the rows of Right table with corresponding row or null row of Left table

Full Join: Union of Left and Right Outer join
SELECT * FROM <table1> Left/Right/Full join <table2> ON <Joining Condition>



Try these

Cross Join

It’s a cross product of two tables, no ON condition is required here

```
SELECT *  FROM <table1> cross Join <table2>
```

Try this

Joining More than two tables

```
SELECT *
FROM <table1>
Left/Right/Full/Inner join <table2> ON <Joining Condition>
Left/Right/Full/Inner join <table3> ON <Joining Condition>
Left/Right/Full/Inner join <table4> ON <Joining Condition>
```

Try this

7. Aggregation-Grouping

Aggregation allows you to apply calculation on values of column, and it will return a scalar value. Adding the GROUP BY Clause allows you to aggregate on groups of data, a scalar value will be returned for each group of data.
Some examples of Aggregate functions are given below.

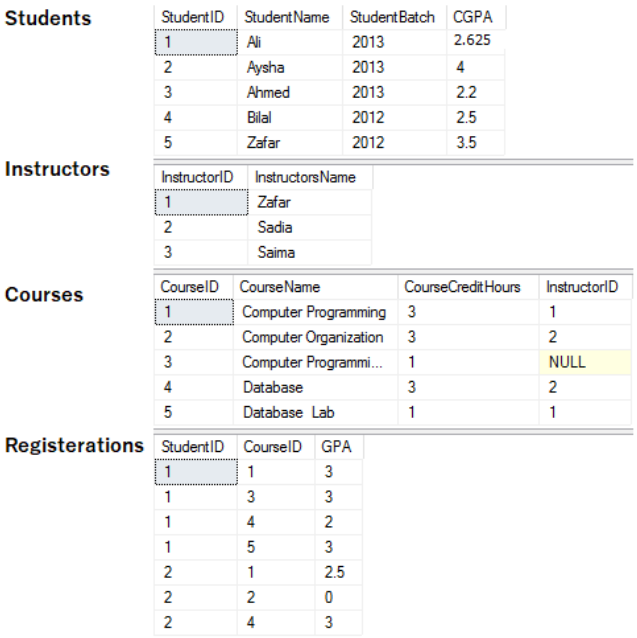
Aggregation Function Key work	How it works	No of Column Function can work on
AVG()	Returns the average of the values in a group. Null values are ignored.	Single column
COUNT()	Returns the number of items in a group. This function always returns an int data type value	Single Column or List of Columns or *
MAX()	Returns the maximum value in the expression.	Single column
MIN()	Returns the minimum value in the expression.	Single column
SUM()	Returns the sum of all the values in the expression. SUM can be used on numeric columns only and it ignores all the NULL values.	Single column

Figure 1 Aggregation Functions

Following is the syntax of Aggregation without grouping.

```
Select <AggregationFunction>(COLUMNs/Column) AS <AliasName>
From <TableName>
```

Use the script (Lab4TryManual.sql Figure 1) to create database to try the following queries.



Students

StudentID	StudentName	StudentBatch	CGPA
1	Ali	2013	2.625
2	Aysha	2013	4
3	Ahmed	2013	2.2
4	Bilal	2012	2.5
5	Zafar	2012	3.5

Instructors

InstructorID	InstructorsName
1	Zafar
2	Sadia
3	Saima

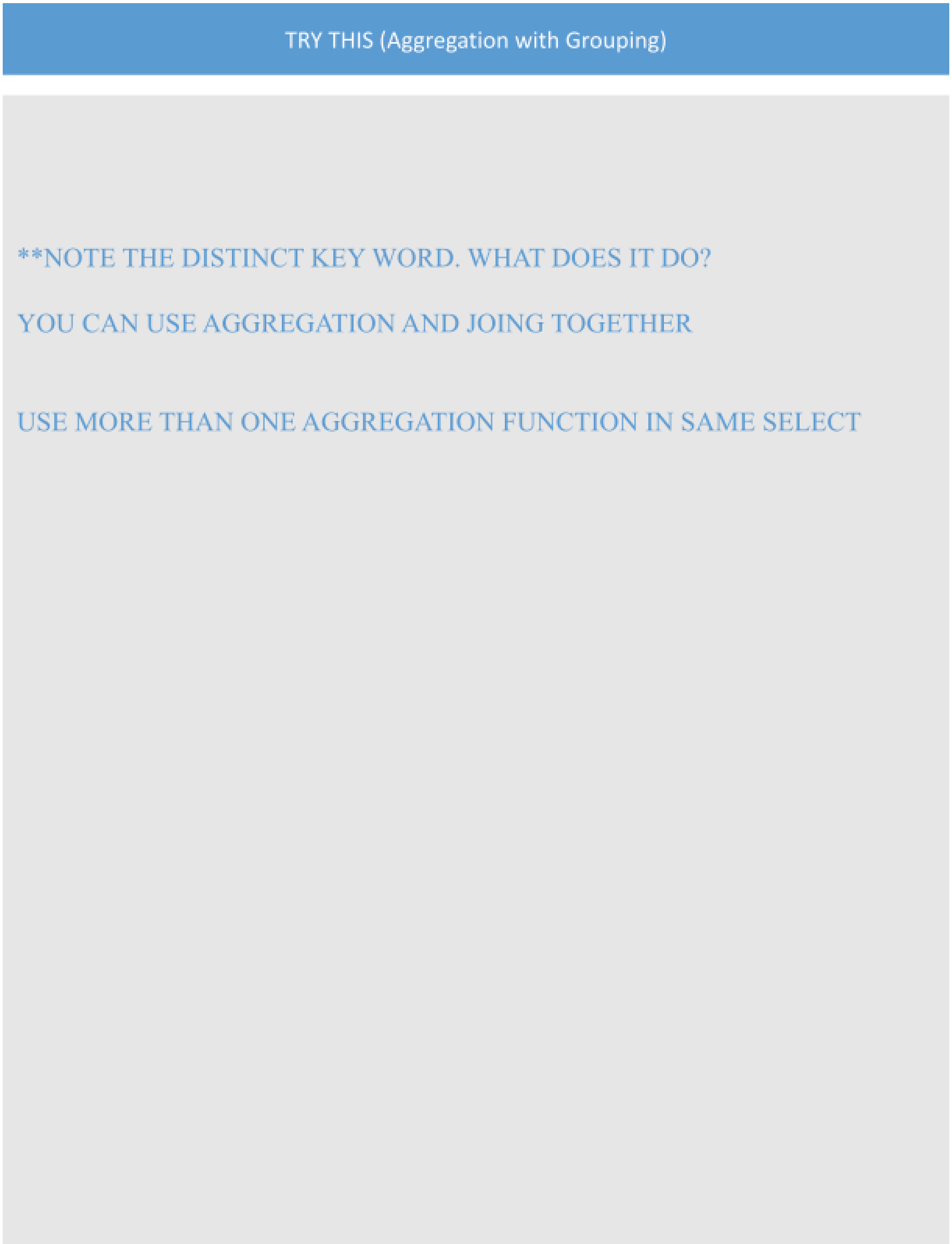
Courses

CourseID	CourseName	CourseCreditHours	InstructorID
1	Computer Programming	3	1
2	Computer Organization	3	2
3	Computer Programmi...	1	NULL
4	Database	3	2
5	Database Lab	1	1

Registerations

StudentID	CourseID	GPA
1	1	3
1	3	3
1	4	2
1	5	3
2	1	2.5
2	2	0
2	4	3

Figure 2 University Database



TRY THIS (Aggregation with Grouping)

**NOTE THE DISTINCT KEY WORD. WHAT DOES IT DO?

YOU CAN USE AGGREGATION AND JOING TOGETHER

USE MORE THAN ONE AGGREGATION FUNCTION IN SAME SELECT

Grouping:

Syntax:

```
Select T.ColumnX, T.ColumnY Aggreation Function(Column/Columns) AS [Alias]
from TableName T
Group by T.ColumnX, T.ColumnY --comma seperated list of all the column of which
                              --groping is to be done
```

NOTE: ONLY THE COLUMNS THAT ARE USED IN GROUPING CAN BE USED IN SELECT CLAUSE

TRY THIS (Aggregate with grouping)

Having Clause

Having Clause allows us to filter the data based on the result of aggregation function, it’s the same as where clause except that we cannot use aggregate functions in where clause and we cannot use simple columns having clause.

Try this (aggregate group having)

NOTE: THE ORDER OF EACH CLAUSE IS TO BE MAINTAINED AS FOLLOW

1. SELECT (COMPULSORY)
2. FROM (COMPULSORY)
3. WHERE
4. GROUP
5. HAVING

8. Set operations

Result of two (or more) select queries can be combined using Set operations such as UNION, INTESECT, EXCEPT.

Syntax

```
Select ColumnX, ColumnY
From Table1

Union/Intersect/Except

Select ColumnA, ColumnB
From Table2
```

NOTE: The output of first select query should have same number and type of column as of second select query.

Try this –Set operations

Try this- error to look out for in set operations