CSE 302
Database Management Systems
Sessional

Lab - 5

GROUP FUNCTIONS

Group Function

- Also known as "Multiple-Row Functions".
- They operates on set of rows to give one result per group.
- These set may be the whole table or the table split into groups.
- These are similar to the "aggregate functions" or "Group By" functions in Access

Group Functions

- SUM
- AVG
- COUNT
- MIN
- MAX

Group Functions

- **GROUP BY clause**
  - To identify groups of records to be processed
- **ORDER BY clause**
  - To sort the records
- **HAVING clause**
  - To restrict the groups displayed

```
SELECT * | column1, column2, …
FROM tableName
WHERE Condition
GROUP BY column1, column2, …
ORDER BY cloumn1, column2,…
HAVING group condition
```

Group Functions

SUM function

- Calculates the total amount in a numeric field for a group of records.
  - SUM(n) - where n is a numeric column
  - SUM(ALL n) - the same as above
  - SUM(DISTINCT n) - returns only the unique numeric values

SUM function

- *Display total salary of all employees.*

```
SELECT SUM(Salary) "Total Salary"
FROM Employee;
```

- *Display total salary of the employees of e_city_001.*

```
SELECT SUM(Salary) "Total Salary of E_CITY_001"
FROM Employee
WHERE Employee_city=’e_city_001’;
```

AVG function

- AVG(column containing numeric data)

- AVG(DISTINCT [column containing numeric data])
  - DISTINCT keyword returns only unique values

AVG function

- *Display average salary of all employees.*

```
SELECT AVG(Salary) " Average Salary"
FROM Employee;
```

- *Display average salary of the employees of e_city_001.*

```
SELECT AVG (Salary) " Average Salary of E_CITY_001"
FROM Employee
WHERE Employee_city=’e_city_001’;
```

MAX and MIN function

- Returns the largest and smallest values in a specified column.

- MAX(ALL c) or MIN(ALL c)
  - where c is any numeric, character, or date field

- MAX(c) or MIN(c)
  - the same result as above

- MAX(DISTINCT c) or MIN(DISTINCT c)
  - returns the highest or lowest distinct value

MAX and MIN function

- *Display the maximum salary of employees.*

```
SELECT MAX(Salary) "Highest Salary"
FROM Employee;
```

- *Display the minimum DOB of employees.*

```
SELECT MIN(EMPLOYEE_DOB)
FROM EMPLOYEE;
```

COUNT function

- Counts the records that have non-NULL values
- Counts the total records meeting a specific condition

COUNT function

- *Display the count of cities.*

```
SELECT COUNT(EMPLOYEE_CITY)
FROM EMPLOYEE;
```

  - This counts all categories (including duplicates)

- *Display the count of unique cities only.*

```
SELECT COUNT(DISTINCT  EMPLOYEE_CITY)
FROM EMPLOYEE;
```

  - This counts unique (or distinct) categories

Group functions and NULL values

- All Group functions except COUNT(*) ignore null values in the column.

COUNT Function – NULL Values

- Including the NULL values
  - COUNT(*) counts all the records, even NULLS
  - Whenever NULL values may affect the COUNT the function, use an * as the argument, rather than a column name.

```
SELECT COUNT(*)
FROM EMPLOYEE;
```

GROUP BY Clause

GROUP BY Clause

- Divides the table of information into smaller groups.

```
SELECT .....
FROM .....
GROUP BY column1, column2,... ;
```

GROUP BY Clause

- *Divide the Employee table into groups by City. Then calculate the average salary for each group.*

```
SELECT Employee_city, Avg(Salary)
FROM Employee
GROUP BY Employee_city;
```

- The query execution goes like this:
  - The records in the Employee table are grouped by City
  - The average Salary for each City is calculated.

GROUP BY Clause

- *Display the Sum of All Balance of the Same City according to their account type.*

```
SELECT Cust_city, SUM(Balance), Type
FROM Customer NATURAL JOIN Depositor
                        NATURAL JOIN Account
GROUP BY Cust_city, Type;
```

- The GROUP BY first groups the results by cust_city
- Then groups the Account TYPE within each customer City group.
- Then the SUM function calculates the Balance total.

ORDER BY Clause

ORDER BY Clause

- *Divide the Employee table into groups by City. Then calculate the average salary for each group and order the result by average salary.*

```
SELECT Employee_city, Avg(Salary)
FROM Employee
GROUP BY Employee_city
ORDER BY Avg(Salary);
```

- *Order by Descending order-*

```
SELECT Employee_city, Avg(Salary)
FROM Employee
GROUP BY Employee_city
ORDER BY Avg(Salary) DESC;
```

HAVING Clause

HAVING Clause

- To further restrict groups returned by a query (Specifies which groups will be returned)
- Use a HAVING clause instead of a WHERE clause when group functions are involved.

HAVING(condition)

HAVING Clause

- *Display the cust_city, total balance and account type of customers with balance>1000.*

```
SELECT Cust_city, SUM(Balance), Type
FROM Customer NATURAL JOIN Depositor
                    NATURAL JOIN Account
GROUP BY Cust_city, Type
HAVING SUM(Balance)>1000;
```

WHERE and HAVING

- Both can be used in the same query.

```
SELECT Cust_city, SUM(Balance), Type
FROM Customer NATURAL JOIN Depositor NATURAL JOIN
                                                  Account
WHERE Cust_dob > '01-JAN-80'
GROUP BY Cust_city, Type
HAVING SUM(Balance)>1000;
```

```
SELECT Employee_city, Avg(Salary)
FROM Employee
WHERE Employee_startdate>'01-JAN-80'
GROUP BY Employee_city
HAVING AVG(Salary)>1000;
```

Nesting Group Functions

- Group Functions can be nested to a **depth of two.**

```
SELECT Max(Avg(Salary))
FROM Employee
GROUP BY Employee_city;
```

Some general rules

- For using a mixture of individual items(Employee_city) and group functions (AVG) in the same SELECT statement, you must include a GROUP BY Clause that specifies the individual items.

- You can’t use WHERE Clause to restrict groups.

- You have to use the HAVING Clause to restrict groups.

Practice Problems
for
Group Functions

- **Write a query to display the number of customer with the same city.**

- **Display the Manager Number and the Salary of the lowest paid employee for that manager.**

- **Display the Manager Number and the difference between the highest and the lowest Salary of the employee for that manager.**

- **Display the minimum, maximum, sum and average salary for each group of employee having the same city.**

CONSTRAINTS

Constraints

- Constraints are rules to enforce business rules, practices, and policies

- **Why do we need constraints?**
  - To keep the database reliable.
  - To prevent a user from entering non-sensical data.
  - The business or other organization has certain rules that cannot be violated.

- Constraints are used for implementing the rules.

Reasons for using Constraints

- Enforce rules at the table level whenever a row is **inserted, updated** or **deleted** from the table. The constraints must be satisfied for the operation to be succeed.

- **Prevent** the **deletion** of a table if there are **dependencies** from other tables.

- Provide **rules** fro Oracle tools such as Oracle Developer.

Types of Constraints

Constraint	Abbr.	Description
PRIMARY KEY	_pk	•Determine which column(s) uniquely identifies each record. •It can not be NULL. •Data values must be unique.
FOREIGN KEY	_fk	•In a one-to-many relationship, it is added to the 'many' table. •The constraint ensures that if a value is inserted into a specified column, it must already exist in the 'one' table, or the record is not added.
UNIQUE	_uk	•Ensures that all data values stored in a specific column are unique. •It differs from the PK in that it allows NULL values.
CHECK	_ck	•Ensures that a specified condition is true before the data value is added to the table.
NOT NULL	_nn	•Ensures that a specified column can not contain any NULL value. •It can only be created in the column level approach to table creation.

Ways of applying Constraints

- As part of a **CREATE TABLE** command

or

- As part of an **ALTER TABLE** command

Syntax for entering a constraint name

TableName_ColumName_ConstraintType

Apply the Primary Key constraint on the CUST_ID column of Customer table.

```
ALTER TABLE CUSTOMER
ADD CONSTRAINT CUSTOMER_CUST_ID_pk PRIMARY KEY (CUST_ID)
```

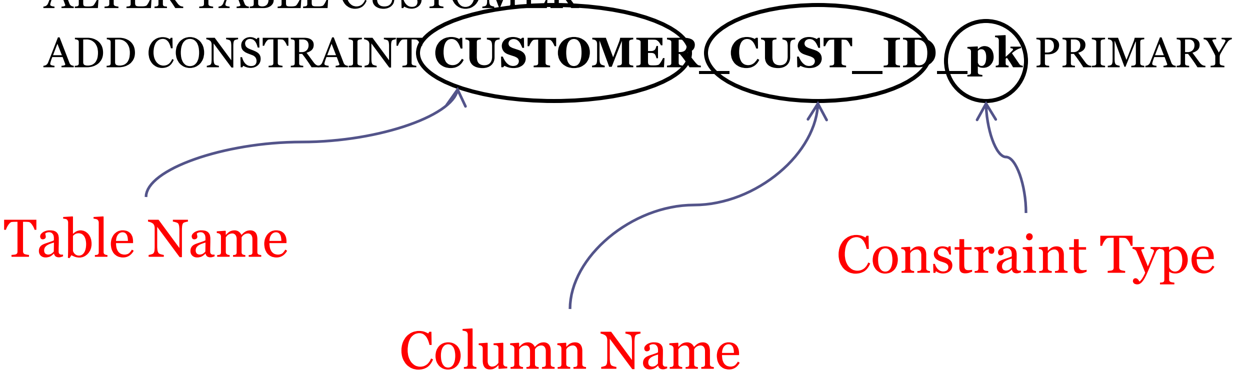


Table Name

Column Name

Constraint Type

PRIMARY KEY

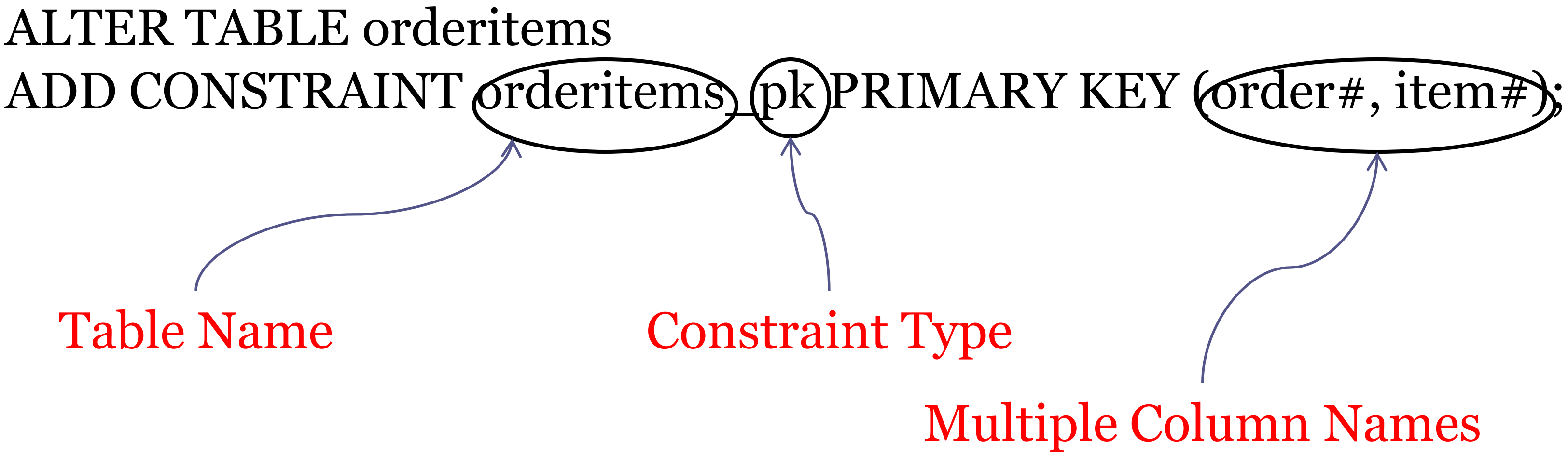
```
Create table Customer
(
    Cust_id VARCHAR2(12) PRIMARY KEY,
    Cust_nam VARCHAR2(12),
    Cust_dob DATE,
    Cust_street VARCHAR2(12),
    Cust_city VARCHAR2(12),
);
```

```
Create table Customer
(
    Cust_id VARCHAR2(12) ,
    Cust_nam VARCHAR2(12),
    Cust_dob DATE,
    Cust_street VARCHAR2(12),
    Cust_city VARCHAR2(12),
    CONSTRAINT Customer_CUST_ID_pk PRIMARY KEY(CUST_ID)
);
```

```
ALTER TABLE CUSTOMER
ADD CONSTRAINT Customer_CUST_ID_pk PRIMARY KEY(CUST_ID);
```

PRIMARY KEY - COMPOSITE

- Simply list the column names within parentheses after the constraint type.



```
ALTER TABLE orderitems
ADD CONSTRAINT orderitems_pk PRIMARY KEY (order#, item#);
```

Table Name

Constraint Type

Multiple Column Names

- After this constraint is added to the ORDERITEMS table, a user can enter only a unique combination of Order# and Item# for each new row.

FOREIGN KEY

```
ALTER TABLE Depositor
ADD CONSTRAINT Depositor_Cust_ID_fk FOREIGN KEY (Cust_ID)
    REFERENCES Customer (Cust_ID);
```

- A record cannot be deleted in the parent table (CUSTOMER) if matching entries exist in the child table.

- That is, you cannot delete a customer form the CUSTOMERS table if there are Account in the DEPOSITOR table that Customer.

- But what if you really want to remove a customer (from the CUSTOMERS table) that does have related Account (in the DEPOSITOR table).

FOREIGN KEY

- **The conventional method is to**
  - First, remove the related records from the child table (DEPOSITOR)
  - Then, remove the customer record form the CUSTOMER table.

- **A simpler method is available:**

ALTER TABLE DEPOSITOR
ADD CONSTRAINT DEPOSITOR _CUST_ID_fk
FOREIGN KEY (CUST_ID) REFERENCES CUSTOMER (CUST_ID) **ON DELETE CASCADE**;

- **If a record is deleted from the parent table, then any corresponding records in the child table are also automatically deleted.**
  - To try the above, you have to first remove the original FOREIGN KEY constraint:

ALTER TABLE DEPOSITOR
DROP CONSTRAINT DEPOSITOR _CUST_ID_fk;

FOREIGN KEY - Composite

```
CREATE TABLE Depositor
(
    Cust_id VARCHAR2(12) NOT NULL,
    Account_id VARCHAR2(12) NOT NULL,
    COSNTRAINT DEPOSITOR_CUST_ID_FK FOREIGN KEY(CUST_ID) REFERENCES CUSTOMER(CUST_ID),
    COSNTRAINT DEPOSITOR_ACCOUNT_ID_FK FOREIGN KEY(ACCOUNT_ID) REFERENCES ACCOUNT(ACCOUNT_ID)
);
```

CHECK

```
Create table Account
(
Account_id VARCHAR2(12) NOT NULL UNIQUE,
Balance NUMBER(20,5) CHECK( Balance>0),
Type VARCHAR2(8)
);
```

```
Create table Account
(
Account_id VARCHAR2(12) NOT NULL UNIQUE,
Balance NUMBER(20,5) CHECK( Balance>0),
Type VARCHAR2(8)
CONSTRAINT Account_Balance_ck  CHECK(Balance>0)
);
```

UNIQUE

```
Create table Account
(
Account_id VARCHAR2(12) NOT NULL ,
Balance NUMBER(20,5),
Type VARCHAR2(8),
CONSTRAINT Account_ACCID_uk UNIQUE(Account_id)
);
```

```
ALTER TABLE ACCOUNT
ADD CONSTRAINT ACCOUNT_ACCOUNT_ID_uk
   UNIQUE(ACCOUNT_ID);
```

UNIQUE

- A **UNIQUE** constraint allows **NULL** values unless define **NOT NULL** in the same column
- A **PRIMARY KEY** constraint does not allow **NULL** values

NOT NULL

```
Create table Customer
(
  Cust_id   VARCHAR2(12)  NOT NULL,
  Cust_name       VARCHAR2(12),
  Cust_dob        DATE,
  Cust_street     VARCHAR2(12),
  Cust_city       VARCHAR2(12)
);

ALTER TABLE CUSTOMER
MODIFY (CUST_ID NOT NULL);
```

ADD Constraints

- You can add, drop, enable or disable a constraint, but you cannot modify its structure.

- You can add a NOT NULL constraint to an existing column by using the MODIFY Clause of the ALTER TABLE statement.

DROP Constraints

- To drop a constraint, you can identify the constraint name from the USER_CONSTRAINTS and then use ALTER TABLE command with the DROP clause.

- To remove the primary key constraint from the Customer Table and drop the associated FOREIGN KEY constraint-

```
ALTER TABLE CUSTOMER
DROP PRIMARY KEY CASCADE;
```

Viewing constraints

- Query the USER_CONSTRAINTS table to view all the constraint definition and names.

```
SELECT CONSTRAINT_NAME, CONSTRAINT_TYPE,
   SEARCH_CONDITION
FROM USER_CONSTRAINTS
WHERE TABLE_NAME=’CUSTOMER’;
```

- *Viewing The Columns Associated With Constraints*

```
SELECT CONSTRAINT_NAME,COLUMN_NAME
FROM USER_CONS_COLUMNS
WHERE TABLE_NAME=’CUSTOMER’;
```

Practice Problems for Constraints

- **Add a FOREIGN KEY CONSTRAINT on the EMPLOYEE table that ensures that each Employee's Manager also exists in Employee Table.**

- **CREATE TABLE BORROWER in such a way that Cust_ID must be in Customer table and Loan_ID must be in LOAN table.**

FUNCTIONS

CASE Based Functions

CASE CONVERSION FUNCTIONS

- To convert letters to lower or upper case

- Most database administrators rarely need to use character functions

- Application developers frequently include them to create user-friendly database interfaces

- In Oracle, the comparisons of data are case-sensitive.

CASE CONVERSION FUNCTIONS

```
SELECT branch_name
FROM branch
WHERE branch_city = “HORSENECK”;
```

- Executing it No rows will be returned.
  - Why?
    - The branch city we’re looking for is stored in as “Horseneck”. But the search key has been entered in upper case as “HORSENECK”.

CASE CONVERSION FUNCTIONS

- 2 Functions
  - **LOWER** – Converts character strings to lower-case
  - **UPPER** - Converts character strings to upper-case

LOWER

```
SELECT branch_name
FROM branch
WHERE lower(branch_city) = “horseneck”;
```

- The LOWER function temporarily converts the branch_city values to lower case.
- Thus, the “Horseneck” branch_city is converted to “horseneck”, which matches the search key “horseneck”

UPPER

```
SELECT branch_name
FROM branch
WHERE upper(branch_city) = “HORSENECK”;
```

INITCAP

- To convert character strings to mixed case, with each word beginning with a capital letter.

  ```
  SELECT INITCAP(branch_name)
  FROM branch
  WHERE branch_name='North town';
  ```

```
SELECT INITCAP(branch_name) AS Branch_Name
FROM branch
WHERE branch_name='North town';
```

CHARACTER MANIPULATION FUNCTIONS

SUBSTR

- Used to return a substring, or portion of a string

  SUBSTR(character string, beginning character position, length of string to be returned)

- SELECT branch_name, SUBSTR(branch_name,1,3) FROM branch;

- SELECT branch_name, SUBSTR(branch_name,4,2) FROM branch;

LENGTH

LENGTH(character string)

```
SELECT branch_name, LENGTH(branch_name)
FROM branch;
```

LPAD

LPAD(string to be padded, length of string after padding, symbol used to pad)

```
SELECT branch_name, LPAD(branch_name,12,' ')
FROM branch;
```

RPAD

RPAD(string to be padded, length of string after padding, symbol used to pad)

```
SELECT branch_name, RPAD(branch_name,12,' ')
FROM branch;
```

LTRIM

- Removes a specific string of characters from the left side of the data

  LTRIM(data, specific string to be removed from the left side of the data)

```
SELECT cust_id, LTRIM(cust_id,'C')
FROM customer;
```

RTRIM

- Removes a specific string of characters from the right side of the data

  RTRIM(data, specific string to be removed from the right side of the data)

```
SELECT cust_id, LTRIM(cust_id,'C')
FROM customer;
```

REPLACE

- Similar to "search and replace" in some application programs

  REPLACE(column, string to be found, string replacement)

```
SELECT cust_id, REPLACE(cust_id, 'C000', 'Cust')
FROM customer;
```

CONCAT

- Concatenates the data from two columns
- Combines only two items (columns or string literals)

CONCAT(column or string, column or string)

```
SELECT cust_name, CONCAT('Customer Number: ', cust_id) "Number"
FROM customer;
```

- To concatenate more than two items, you must nest a CONCAT function inside another CONCAT function

NUMERIC FUNCTIONS

ROUND

- To round numeric fields to the stated precision
  - If position is a positive number, it refers to the right side of the decimal point.
  - If position is a negative number, function rounds to the left side of the decimal point.

ROUND(numeric field to be rounded, position of the digit to which the data should be rounded)

ROUND

```
SELECT ROUND(3162.845, 1) AS ROUNDED
FROM dual;
```

- 3162.8

```
SELECT ROUND(3162.8451297, 5) AS ROUNDED
FROM dual;
```

- 3162.84513

ROUND

SELECT ROUND(3162.845, -2) AS ROUNDED FROM dual;

- 3200

SELECT ROUND(1234,-2) AS ROUNDED FROM dual;

- 1200

TRUNC

- To truncate a numeric value to a specific position
  - If position is a positive number, it refers to the right side of the decimal point.
  - If position is a negative number, function rounds to the left side of the decimal point.

TRUNC(numeric field to be rounded, position of the digit from which the data should be removed)

TRUNC

```
SELECT TRUNC(15.79,1) "Truncate"
FROM DUAL;
```

- 15.7

```
SELECT TRUNC(123456.76,-4) "Truncate"
FROM DUAL;
```

- 120000

DATE FUNCTIONS

DATE

- DATE function displays date values in a
  DD-MON-YY format

Difference between Two dates

```
SELECT Employee_id, Employee_dob,
  Employee_startdate,
  Employee_startdate – Employee_dob
FROM Employee;
```

Difference between Two dates

- The delay between the two dates in weeks:

```
SELECT Employee_id, Employee_dob,
Employee_startdate,
(Employee_startdate – Employee_dob)/7
"DELAY IN WEEKS"
FROM Employee;
```

MONTHS_BETWEEN

- Determines the number of months between two dates

```
MONTHS_BETWEEN(later date, earlier date)
```

```
SELECT Employee_id,
MONTHS_BETWEEN (Employee_startdate,
Employee_dob) “Delay in Months”
FROM Employee;
```

ADD_MONTHS

ADD_MONTHS(beginning date, number of months to add to the date)

```
SELECT Employee_id, ADD_MONTHS
(Employee_startdate, 60) “First Promotion
date”
FROM Employee
Order by “First Promotion date”;
```

NEXT_DAY

- Determines the next occurrence of a specific day of the week after a given date

```
NEXT_DAY(starting date, day of week to be
  identified)
```

```
SELECT Employee_id,
  NEXT_DAY(Employee_startdate, “MONDAY”)
  “First Monday After Joining”
FROM Employee;
```

TO_DATE

- The default format for entering a date in an Oracle database is

  DD-MON-YY

  Example: 31-MAR-03

- The TO_DATE function enables a database application user to enter a date in a familiar common format.
- Syntax: TO_DATE(date entered by user, format model for the date entered)
- Both arguments are character strings; thus enclose each in single quotation marks

The Nesting of Functions

- A function is used as an argument inside another function

- Rules
    - One must include all arguments for each function.
    - For every open parenthesis, there must be a corresponding closed parenthesis.
    - The inner function is resolved first, then the outer function.

The Nesting of Functions

- To determine the number of months between the Employee_startdate and Employee_dob, we use the MONTHS_BETWEEN function.

  SELECT Employee_id, **MONTHS_BETWEEN (Employee_startdate, Employee_dob)** “Delay in Months” FROM Employee;

- To suppress the decimal places generated by the Months_Between function, we can use the result of the Months_Between function as an input to the TRUNC function.

  SELECT Employee_id, **TRUNC(MONTHS_BETWEEN (Employee_startdate, Employee_dob),0)** “Delay in Months” FROM Employee;

THANK YOU