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ST10043611
ADDB7311
Summative Project

Table of Contents

Question 1

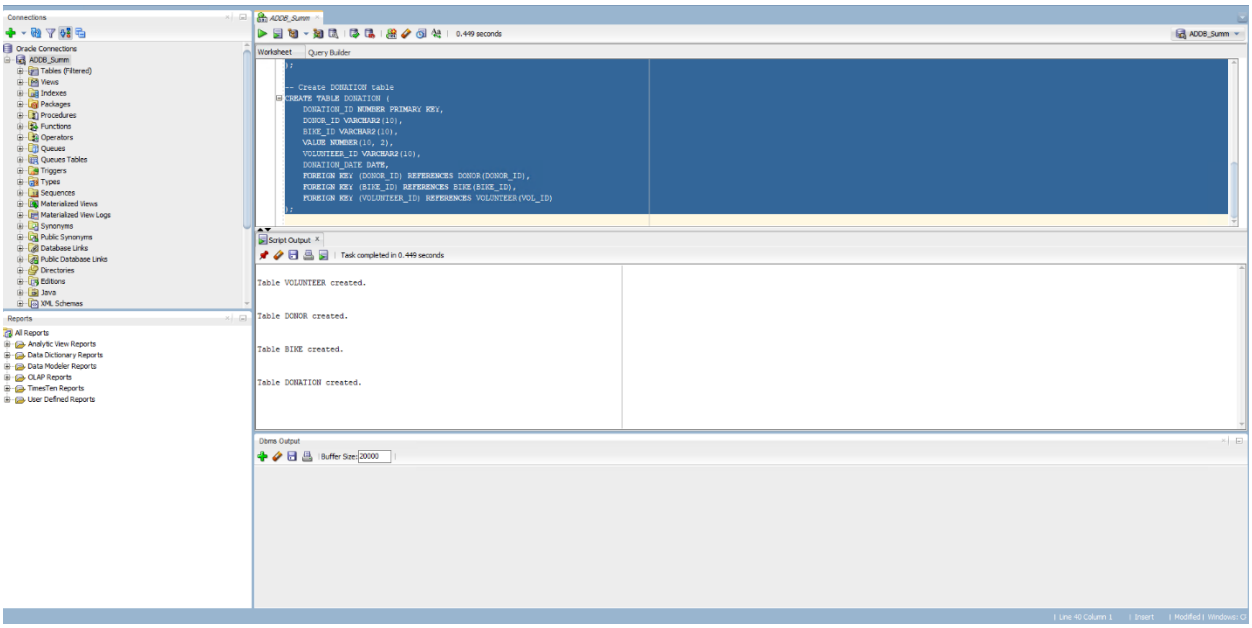
```
-- Create VOLUNTEER table
CREATE TABLE VOLUNTEER (
    VOL_ID VARCHAR2(10) PRIMARY KEY,
    VOL_FNAME VARCHAR2(50),
    VOL_SNAME VARCHAR2(50),
    CONTACT VARCHAR2(15),
    ADDRESS VARCHAR2(100),
    EMAIL VARCHAR2(100)
);

-- Create DONOR table
CREATE TABLE DONOR (
    DONOR_ID VARCHAR2(10) PRIMARY KEY,
    DONOR_FNAME VARCHAR2(50),
    DONOR_LNAME VARCHAR2(50),
    CONTACT_NO VARCHAR2(15),
    EMAIL VARCHAR2(100)
);

-- Create BIKE table
CREATE TABLE BIKE (
    BIKE_ID VARCHAR2(10) PRIMARY KEY,
    DESCRIPTION VARCHAR2(100),
    BIKE_TYPE VARCHAR2(50),
    MANUFACTURER VARCHAR2(50)
);
```

```
-- Create DONATION table
CREATE TABLE DONATION (
   DONATION_ID NUMBER PRIMARY KEY,
   DONOR_ID VARCHAR2(10),
   BIKE_ID VARCHAR2(10),
   VALUE NUMBER(10, 2),
   VOLUNTEER_ID VARCHAR2(10),
   DONATION_DATE DATE,
   FOREIGN KEY (DONOR_ID) REFERENCES DONOR(DONOR_ID),
   FOREIGN KEY (BIKE_ID) REFERENCES BIKE(BIKE_ID),
   FOREIGN KEY (VOLUNTEER_ID) REFERENCES VOLUNTEER(VOL_ID)
);

-- Insert data into VOLUNTEER table
INSERT INTO VOLUNTEER VALUES ('vol101', 'Kenny', 'Temba', '0677277521', '10 Sands Road', 'kennyt@bikerus.com');
INSERT INTO VOLUNTEER VALUES ('vol102', 'Mamelodi', 'Marks', '0737377522', '20 Langes Street', 'mamelodim@bikerus.com');
INSERT INTO VOLUNTEER VALUES ('vol103', 'Ada', 'Andrews', '0817117523', '31 Williams Street', 'adanyaa@bikerus.com');
INSERT INTO VOLUNTEER VALUES ('vol104', 'Evans', 'Tambala', '0697215244', '1 Free Road', 'evanst@bikerus.com');
INSERT INTO VOLUNTEER VALUES ('vol105', 'Xolani', 'Samson', '0727122255', '12 main road', 'xolanis@bikerus.com');
```

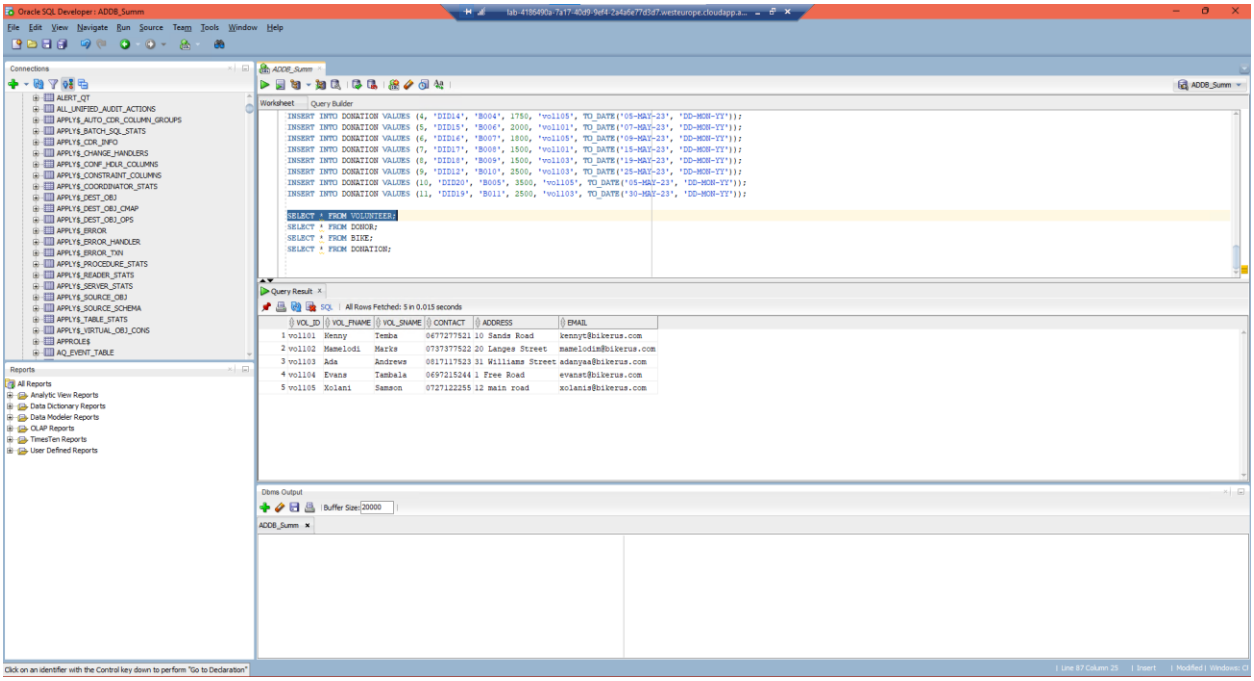
```
-- Insert data into DONOR table
INSERT INTO DONOR VALUES ('DID11', 'Jeff', 'Wanya', '0827172250', 'wanyajeff@ymail.com');
INSERT INTO DONOR VALUES ('DID12', 'Sthembeni', 'Pisho', '0837865670',
'sthepisho@ymail.com');
INSERT INTO DONOR VALUES ('DID13', 'James', 'Temba', '0878978650', 'jimmy@ymail.com');
INSERT INTO DONOR VALUES ('DID14', 'Luramo', 'Misi', '0826575650', 'luramom@ymail.com');
INSERT INTO DONOR VALUES ('DID15', 'Abraham', 'Xolani', '0797656430', 'axolani@ymail.com');
INSERT INTO DONOR VALUES ('DID16', 'Rumi', 'Jones', '0668899221', 'rjones@true.com');
INSERT INTO DONOR VALUES ('DID17', 'Xolani', 'Redo', '0614553389', 'xredo@ymail.com');
INSERT INTO DONOR VALUES ('DID18', 'Tenny', 'Stars', '0824228870', 'tenstars@true.com');
INSERT INTO DONOR VALUES ('DID19', 'Tiny', 'Rambo', '0715554333', 'trambo@ymail.com');
INSERT INTO DONOR VALUES ('DID20', 'Yannick', 'Leons', '0615554323', 'yleons@true.com');

-- Insert data into BIKE table
INSERT INTO BIKE VALUES ('B001', 'BMX AX1', 'Road Bike', 'BMX');
INSERT INTO BIKE VALUES ('B002', 'Giant Domain 1', 'Road Bike', 'Giant');
INSERT INTO BIKE VALUES ('B003', 'Ascent 26In', 'Mountain Bike', 'Raleigh');
INSERT INTO BIKE VALUES ('B004', 'Canyon 6X', 'Kids Bike', 'Canyon');
INSERT INTO BIKE VALUES ('B005', 'Marvel Gravel', 'Road Bike', 'BMX');
INSERT INTO BIKE VALUES ('B006', 'Mountain 21 Speed', 'Mountain Bike', 'BMX');
INSERT INTO BIKE VALUES ('B007', 'Canyon Roadster', 'Road Bike', 'Canyon');
INSERT INTO BIKE VALUES ('B008', 'Legion 101', 'Hybrid Bike', 'BMX');
INSERT INTO BIKE VALUES ('B009', 'Madonna 9', 'Road Bike', 'Trek');
INSERT INTO BIKE VALUES ('B010', 'Comp 2022', 'Mountain Bike', 'Trek');
INSERT INTO BIKE VALUES ('B011', 'BMX AX15', 'Road Bike', 'BMX');
```

```
-- Insert data into DONATION table

INSERT INTO DONATION VALUES (1, 'DID11', 'B001', 1500, 'vol101', TO_DATE('01-MAY-23', 'DD-MON-YY'));

INSERT INTO DONATION VALUES (2, 'DID12', 'B002', 2500, 'vol101', TO_DATE('03-MAY-23', 'DD-MON-YY'));

INSERT INTO DONATION VALUES (3, 'DID13', 'B003', 1000, 'vol103', TO_DATE('03-MAY-23', 'DD-MON-YY'));

INSERT INTO DONATION VALUES (4, 'DID14', 'B004', 1750, 'vol105', TO_DATE('05-MAY-23', 'DD-MON-YY'));

INSERT INTO DONATION VALUES (5, 'DID15', 'B006', 2000, 'vol101', TO_DATE('07-MAY-23', 'DD-MON-YY'));

INSERT INTO DONATION VALUES (6, 'DID16', 'B007', 1800, 'vol105', TO_DATE('09-MAY-23', 'DD-MON-YY'));

INSERT INTO DONATION VALUES (7, 'DID17', 'B008', 1500, 'vol101', TO_DATE('15-MAY-23', 'DD-MON-YY'));

INSERT INTO DONATION VALUES (8, 'DID18', 'B009', 1500, 'vol103', TO_DATE('19-MAY-23', 'DD-MON-YY'));

INSERT INTO DONATION VALUES (9, 'DID12', 'B010', 2500, 'vol103', TO_DATE('25-MAY-23', 'DD-MON-YY'));

INSERT INTO DONATION VALUES (10, 'DID20', 'B005', 3500, 'vol105', TO_DATE('05-MAY-23', 'DD-MON-YY'));

INSERT INTO DONATION VALUES (11, 'DID19', 'B011', 2500, 'vol103', TO_DATE('30-MAY-23', 'DD-MON-YY'));


SELECT * FROM VOLUNTEER;

SELECT * FROM DONOR;

SELECT * FROM BIKE;

SELECT * FROM DONATION;
```

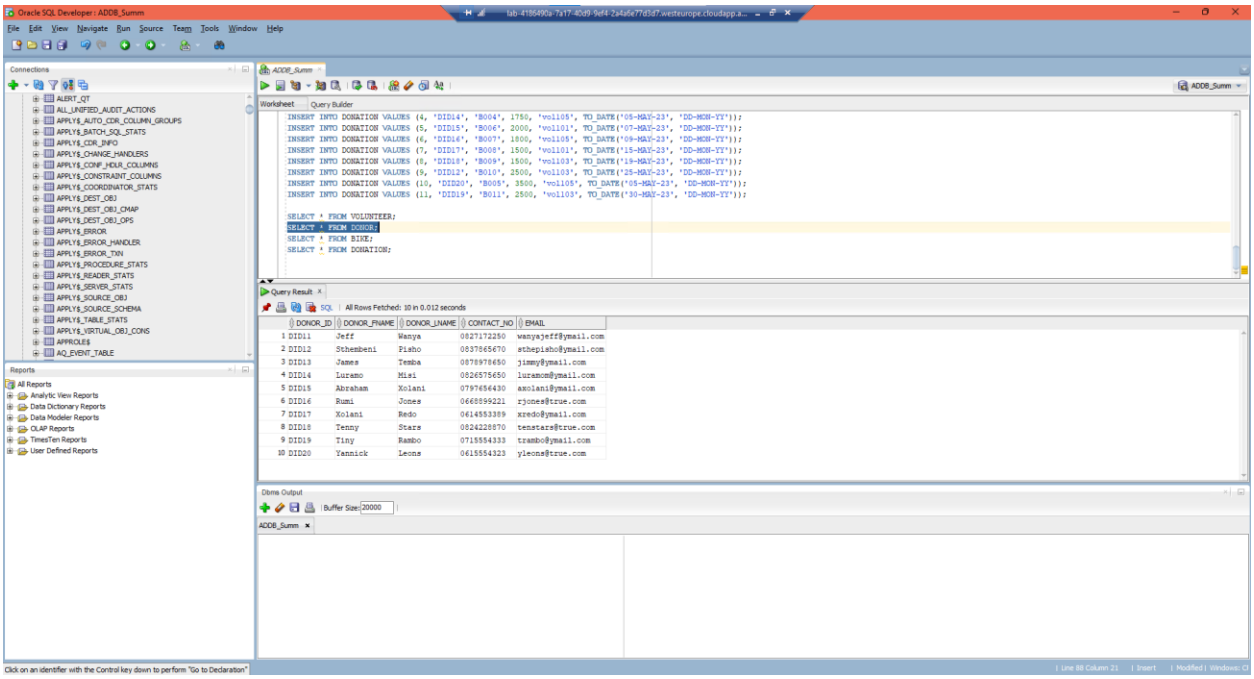
Proof Question 1 Tables Created (Please Zoom in to see image clearer)



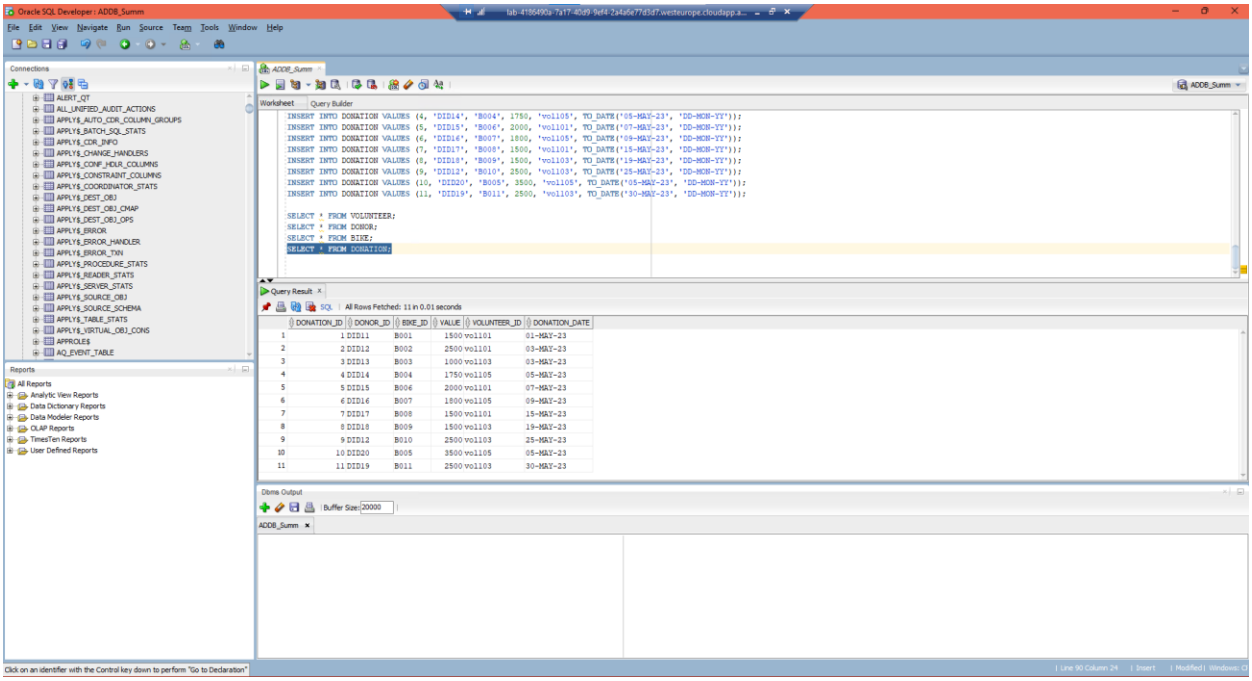
Proof Question 1 Volunteer Table Created and inserted data (Please Zoom in to see image clearer)



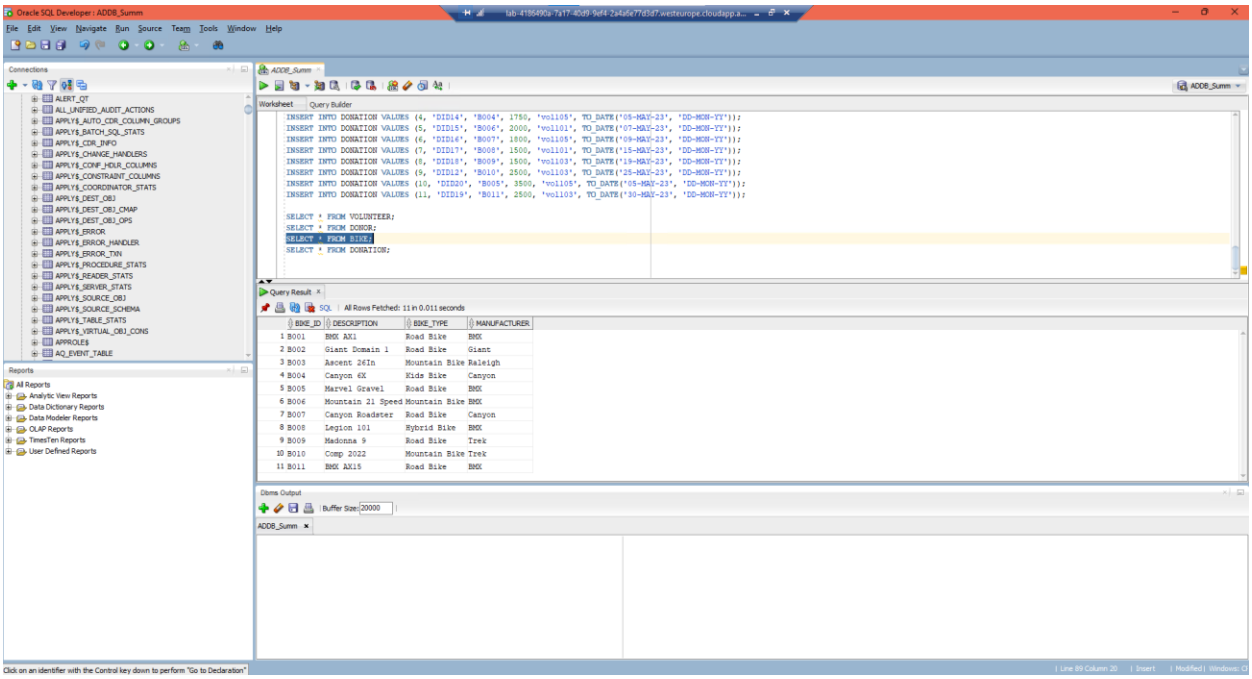
Proof Question 1 Donor Table Created and inserted data (Please Zoom in to see image clearer)



Proof Question 1 Donation Table Created and inserted data (Please Zoom in to see image clearer)



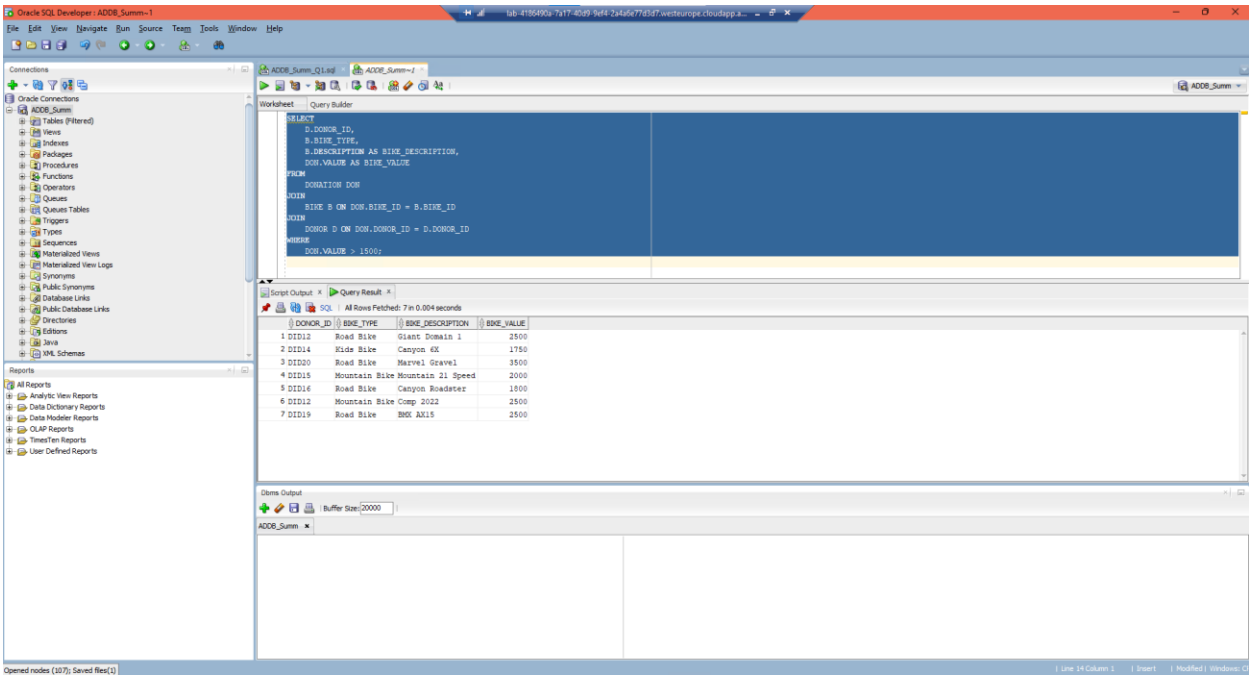
Proof Question 1 Bike Table Created and inserted data (Please Zoom in to see image clearer)



Question 2

```
SELECT
    D.DONOR_ID,
    B.BIKE_TYPE,
    B.DESCRIPTION AS BIKE_DESCRIPTION,
    DON.VALUE AS BIKE_VALUE
FROM
    DONATION DON
JOIN
    BIKE B ON DON.BIKE_ID = B.BIKE_ID
JOIN
    DONOR D ON DON.DONOR_ID = D.DONOR_ID
WHERE
    DON.VALUE > 1500;
```

Proof of Question 2 (Please Zoom in to see image clearer)

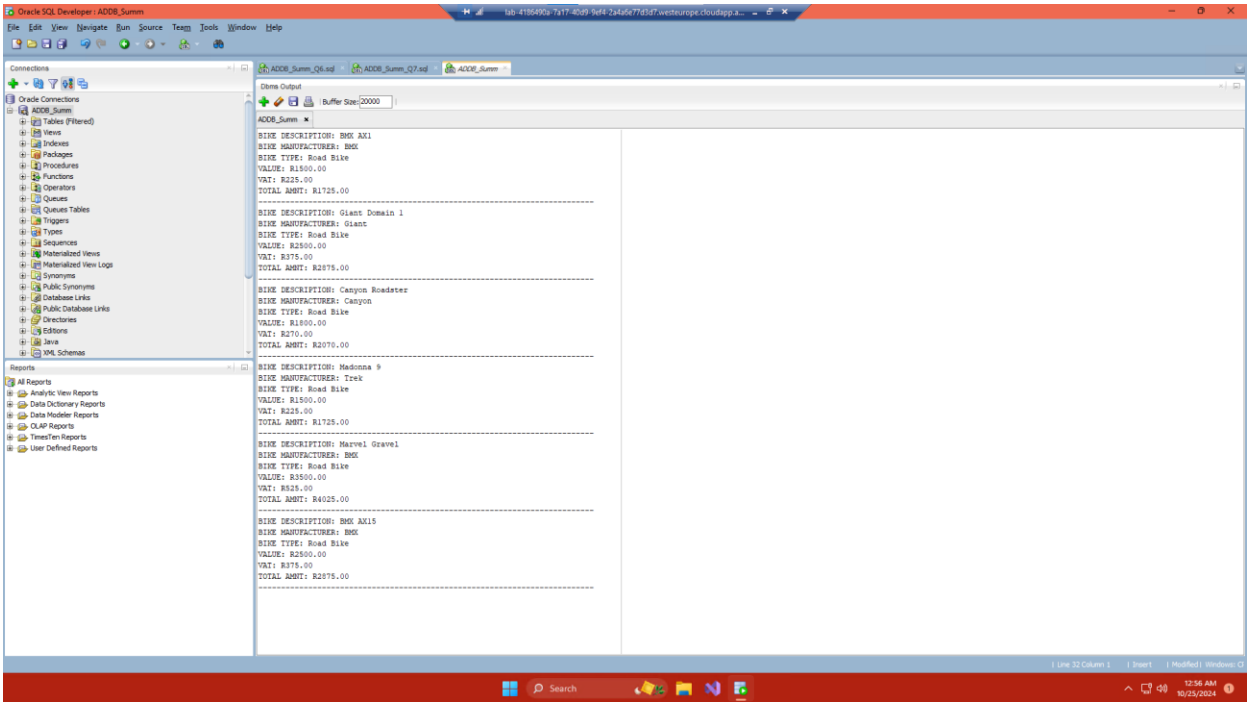


Question 3

```
-- Define VAT constant
DECLARE
   VAT_RATE CONSTANT NUMBER := 0.15;  -- 15% VAT
BEGIN
   -- Query to fetch bike details along with VAT and total amount
   FOR rec IN (
      SELECT
         b.DESCRIPTION AS bike_description,
         b.MANUFACTURER AS bike_manufacturer,
         b.BIKE_TYPE AS bike_type,
         d.VALUE AS value,
         ROUND(d.VALUE * VAT_RATE, 2) AS vat,
         ROUND(d.VALUE + (d.VALUE * VAT_RATE), 2) AS total_amount
      FROM
         BIKE b
      JOIN
         DONATION d ON b.BIKE_ID = d.BIKE_ID
      WHERE
         b.BIKE_TYPE = 'Road Bike'
   ) LOOP
      -- Output the formatted result
      DBMS_OUTPUT.PUT_LINE('BIKE DESCRIPTION: ' || rec.bike_description);
      DBMS_OUTPUT.PUT_LINE('BIKE MANUFACTURER: ' || rec.bike_manufacturer);
      DBMS_OUTPUT.PUT_LINE('BIKE TYPE: ' || rec.bike_type);
      DBMS_OUTPUT.PUT_LINE('VALUE: R' || TO_CHAR(rec.value, 'FM9999999.00'));
      DBMS_OUTPUT.PUT_LINE('VAT: R' || TO_CHAR(rec.vat, 'FM9999999.00'));
      DBMS_OUTPUT.PUT_LINE('TOTAL AMNT: R' || TO_CHAR(rec.total_amount, 'FM9999999.00'));
```

```
        DBMS_OUTPUT.PUT_LINE('--------------------------------------------------------------------------------');
    END LOOP;
END;
/
```

Proof of Question 3 (Please Zoom in to see image clearer)



Question 4

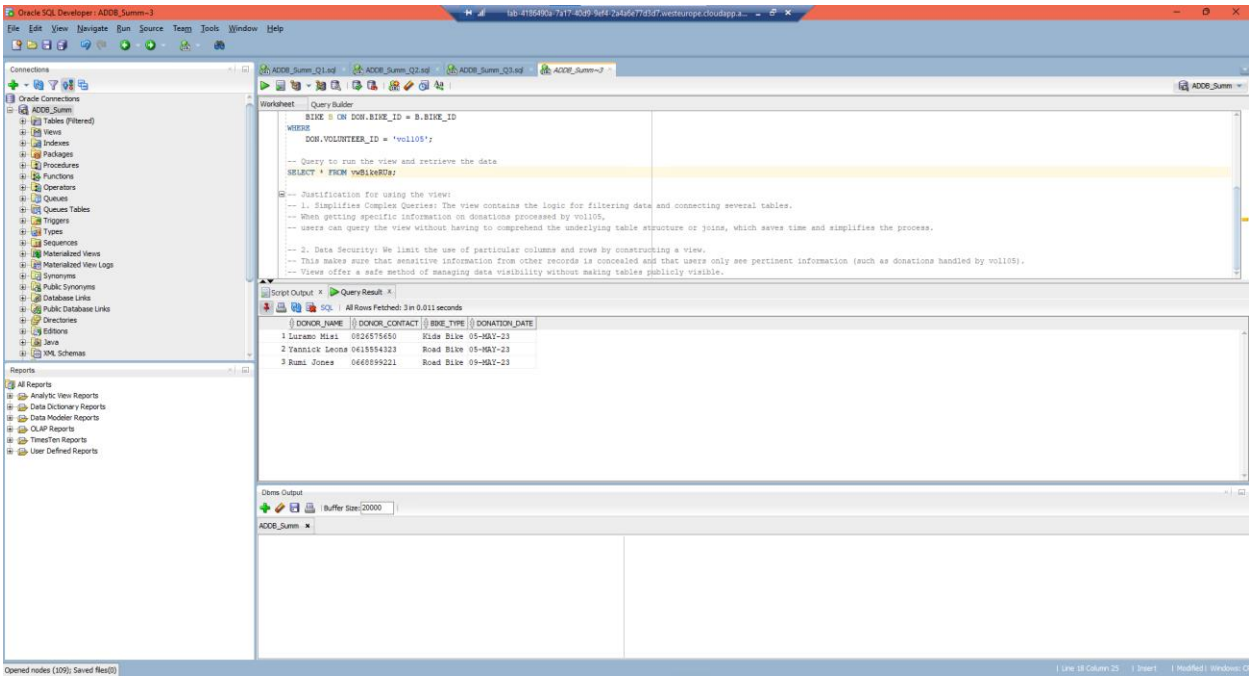
```
-- Create a view for donor's name, contact, bike type, and donation date for vol105

CREATE OR REPLACE VIEW vwBikeRUs AS

SELECT

   D.DONOR_FNAME || ' ' || D.DONOR_LNAME AS DONOR_NAME,

   D.CONTACT_NO AS DONOR_CONTACT,

   B.BIKE_TYPE,

   DON.DONATION_DATE

FROM

   DONATION DON

JOIN

   DONOR D ON DON.DONOR_ID = D.DONOR_ID

JOIN

   BIKE B ON DON.BIKE_ID = B.BIKE_ID

WHERE

   DON.VOLUNTEER_ID = 'vol105';


-- Query to run the view and retrieve the data

SELECT * FROM vwBikeRUs;


-- Justification for using the view:

-- 1. Simplifies Complex Queries: The view contains the logic for filtering data and connecting several tables.

-- When getting specific information on donations processed by vol105,

-- users can query the view without having to comprehend the underlying table structure or joins, which saves time and simplifies the process.
```

-- 2. Data Security: We limit the use of columns and rows by constructing a view.

-- This makes sure that sensitive information from other records is concealed and that users only see pertinent information (such as donations handled by vol105).

-- Views offer a safe method of managing data visibility without making tables publicly visible.

Proof of Question 4 (Please Zoom in to see image clearer)



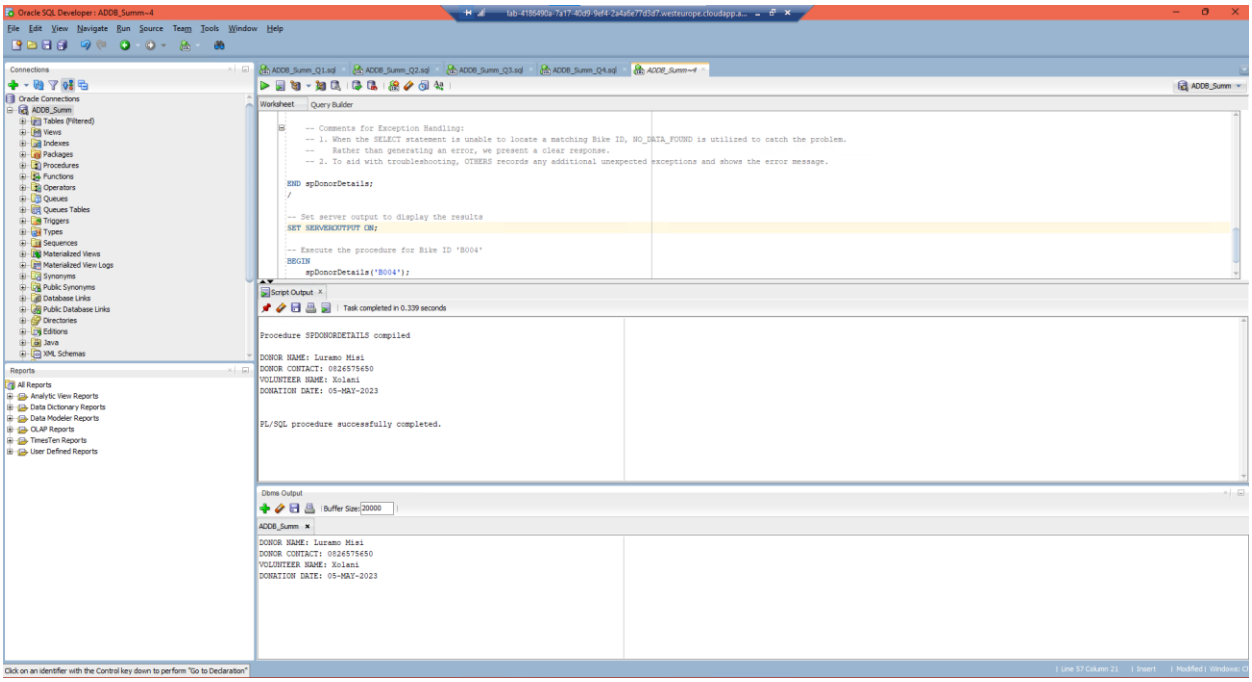
Question 5

```
-- Create procedure to fetch donor details based on the provided Bike ID
CREATE OR REPLACE PROCEDURE spDonorDetails (
    p_bike_id IN BIKE.BIKE_ID%TYPE
)
IS
    -- Declare variables to store fetched data
    v_donor_name VARCHAR2(100);
    v_donor_contact VARCHAR2(15);
    v_volunteer_fname VARCHAR2(50);
    v_donation_date DATE;

    -- Custom exception
    no_data_found EXCEPTION;

BEGIN
    -- Fetch the donor, volunteer, and donation details for the provided Bike ID
    SELECT
        D.DONOR_FNAME || ' ' || D.DONOR_LNAME AS donor_name,
        D.CONTACT_NO,
        V.VOL_FNAME,
        DON.DONATION_DATE
    INTO
        v_donor_name, v_donor_contact, v_volunteer_fname, v_donation_date
    FROM
        DONATION DON
    JOIN
```

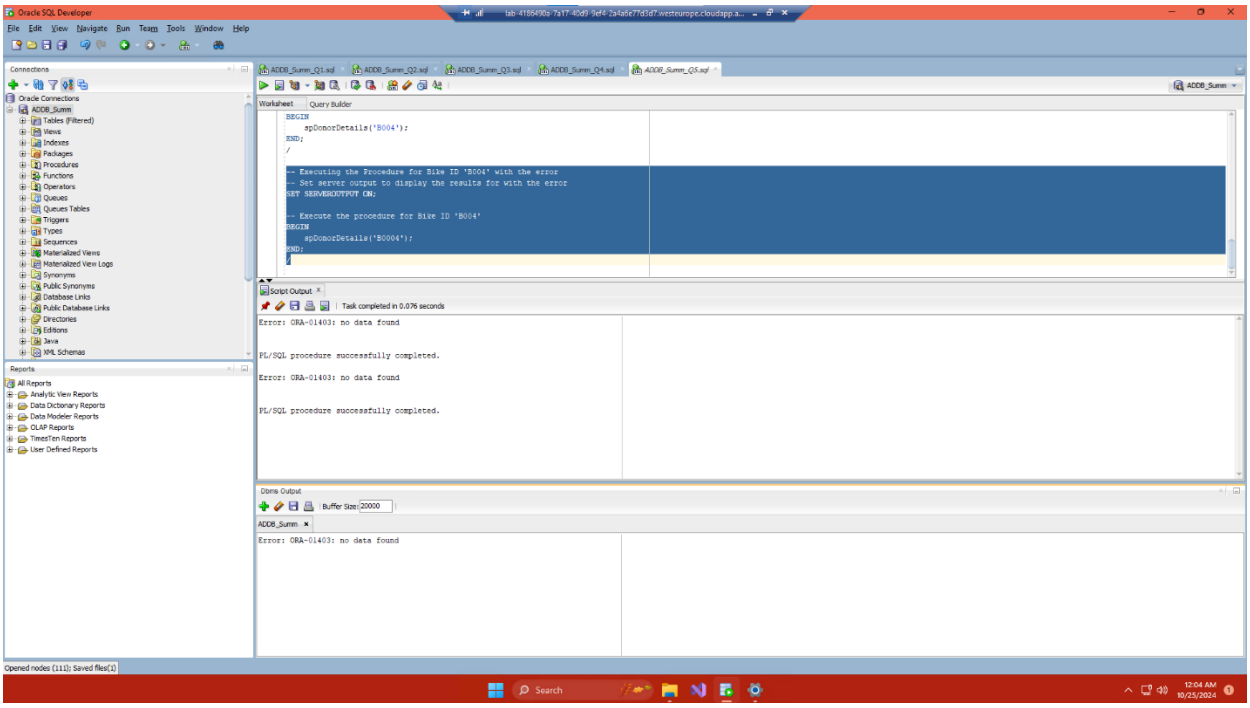
```
    DONOR D ON DON.DONOR_ID = D.DONOR_ID
  JOIN
    VOLUNTEER V ON DON.VOLUNTEER_ID = V.VOL_ID
  WHERE
    DON.BIKE_ID = p_bike_id;

  -- Output the fetched data
  DBMS_OUTPUT.PUT_LINE('DONOR NAME: ' || v_donor_name);
  DBMS_OUTPUT.PUT_LINE('DONOR CONTACT: ' || v_donor_contact);
  DBMS_OUTPUT.PUT_LINE('VOLUNTEER NAME: ' || v_volunteer_fname);
  DBMS_OUTPUT.PUT_LINE('DONATION DATE: ' || TO_CHAR(v_donation_date, 'DD-MON-
YYYY'));

EXCEPTION
  -- Handle case where no data is found
  WHEN NO_DATA_FOUND THEN
    DBMS_OUTPUT.PUT_LINE('Error: No data found for the provided Bike ID.');

  -- Handle any other errors
  WHEN OTHERS THEN
    DBMS_OUTPUT.PUT_LINE('Error: ' || SQLERRM);

  -- Comments for Exception Handling:
  -- 1. When the SELECT statement is unable to locate a matching Bike ID, NO_DATA_FOUND is
utilized to catch the problem.
  --    Rather than generating an error, we present a clear response.
  -- 2. To aid with troubleshooting, OTHERS records any additional unexpected exceptions and
shows the error message.
```

```
END spDonorDetails;
/

-- Executing the Procedure for Bike ID 'B004' without a error
-- Set server output to display the results for without error
SET SERVEROUTPUT ON;

-- Execute the procedure for Bike ID 'B004'
BEGIN
   spDonorDetails('B004');
END;
/

-- Executing the Procedure for Bike ID 'B0004' with the error
-- Set server output to display the results for with the error
SET SERVEROUTPUT ON;

-- Execute the procedure for Bike ID 'B0004'
BEGIN
   spDonorDetails('B0004');
END;
/
```

Proof of Question 5 Without Error Message Handled (Please Zoom in to see image clearer)



Proof of Question 5 With Error Message Handled (Please Zoom in to see image clearer)



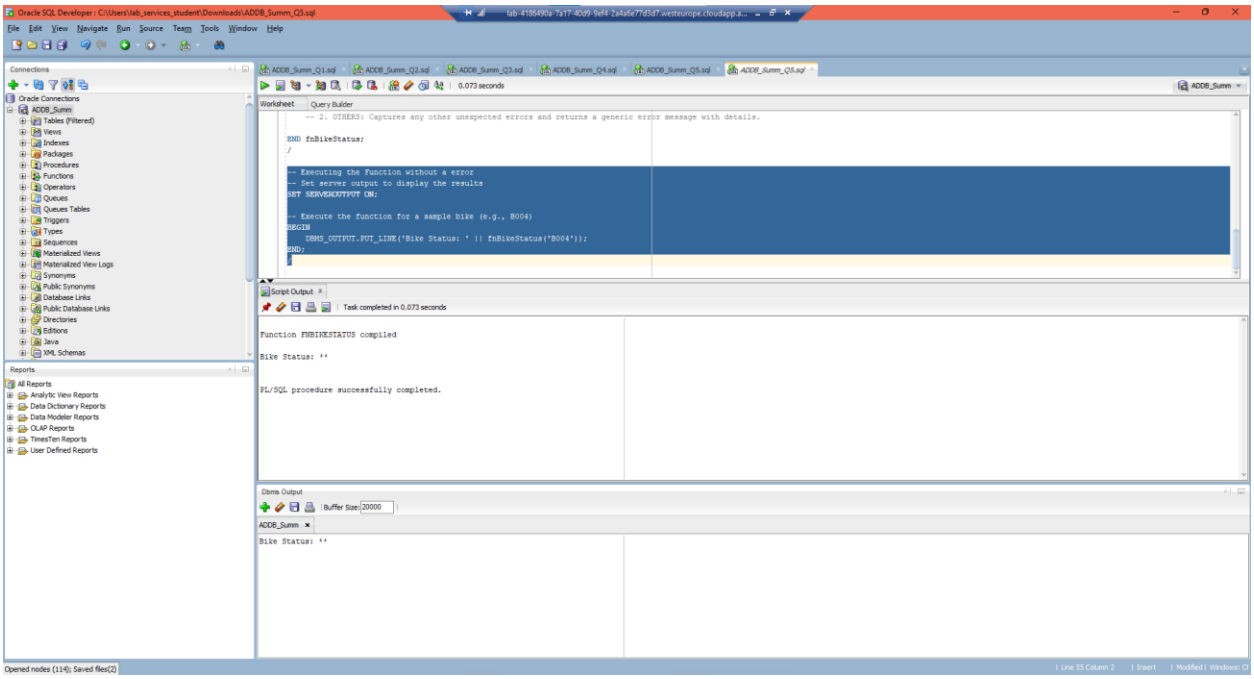
Question 6

```
-- Create function to calculate bike status based on value
CREATE FUNCTION fnBikeStatus (
    p_bike_id IN BIKE.BIKE_ID%TYPE
)
RETURN VARCHAR2
IS
    -- Declare a variable to store the bike's value
    v_bike_value DONATION.VALUE%TYPE;
    -- Declare a variable to store the bike's status (1-star, 2-star, 3-star)
    v_bike_status VARCHAR2(10);

BEGIN
    -- Fetch the bike value for the provided Bike ID
    SELECT DON.VALUE
    INTO v_bike_value
    FROM DONATION DON
    WHERE DON.BIKE_ID = p_bike_id;

    -- Determine the status based on the bike's value
    IF v_bike_value BETWEEN 0 AND 1500 THEN
        v_bike_status := '*';  -- 1-star status
    ELSIF v_bike_value > 1500 AND v_bike_value <= 3000 THEN
        v_bike_status := '**';  -- 2-star status
    ELSIF v_bike_value > 3000 THEN
        v_bike_status := '***'; -- 3-star status
    END IF;
```

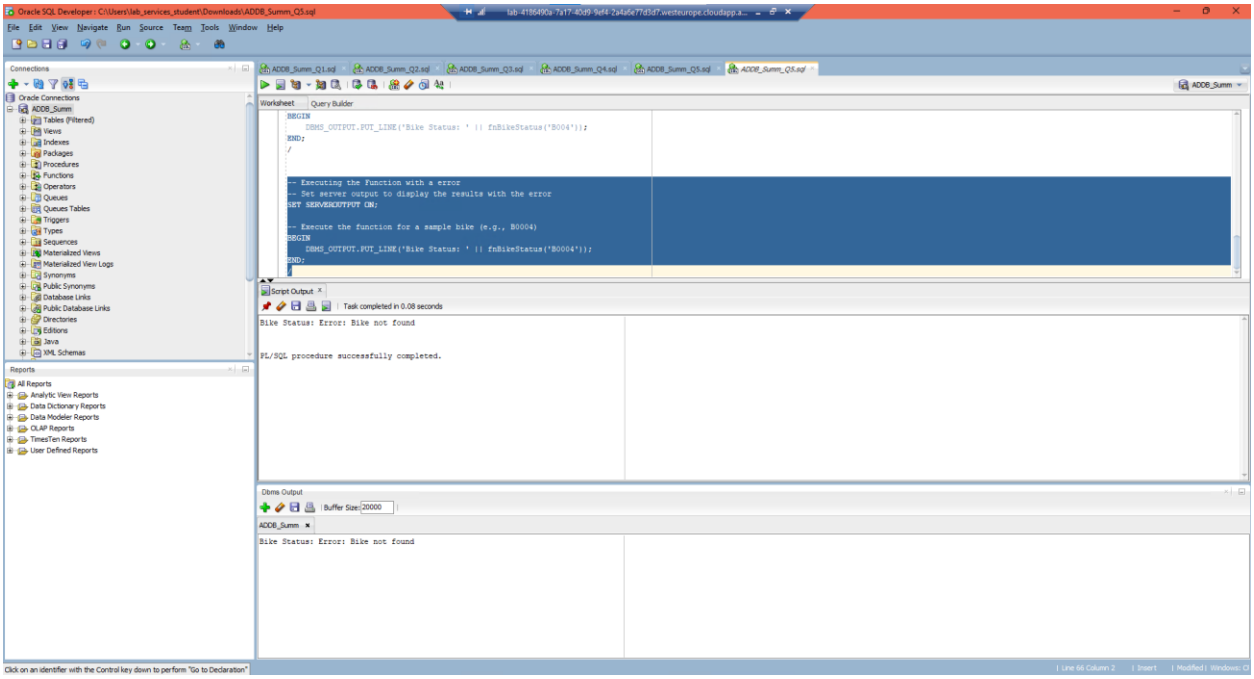
```
    -- Return the bike's status
    RETURN v_bike_status;

EXCEPTION
    -- Handle the case where the bike ID is not found
    WHEN NO_DATA_FOUND THEN
        RETURN 'Error: Bike not found';

    -- Handle any other unexpected errors
    WHEN OTHERS THEN
        RETURN 'Error: ' || SQLERRM;

  -- Comments for Exception Handling:
  -- 1. NO_DATA_FOUND: Prevents an unhandled error by catching instances in which the input
    Bike ID is not present in the database.
    -- 2. OTHERS:  Records any other unexpected errors and provides a detailed generic error
    notice.
END fnBikeStatus;
/
```

```
-- Executing the Function without an error
-- Set server output to display the results
SET SERVEROUTPUT ON;

-- Execute the function for a sample bike (e.g., B004)
BEGIN
   DBMS_OUTPUT.PUT_LINE('Bike Status: ' || fnBikeStatus('B004'));
END;
/

-- Executing the Function with an error
-- Set server output to display the results with the error
SET SERVEROUTPUT ON;

-- Execute the function for a sample bike (e.g., B0004)
BEGIN
   DBMS_OUTPUT.PUT_LINE('Bike Status: ' || fnBikeStatus('B0004'));
END;
/
```

Proof of Question 6 Without Error Message Handled (Please Zoom in to see image clearer)



Proof of Question 6 With Error Message Handled (Please Zoom in to see image clearer)

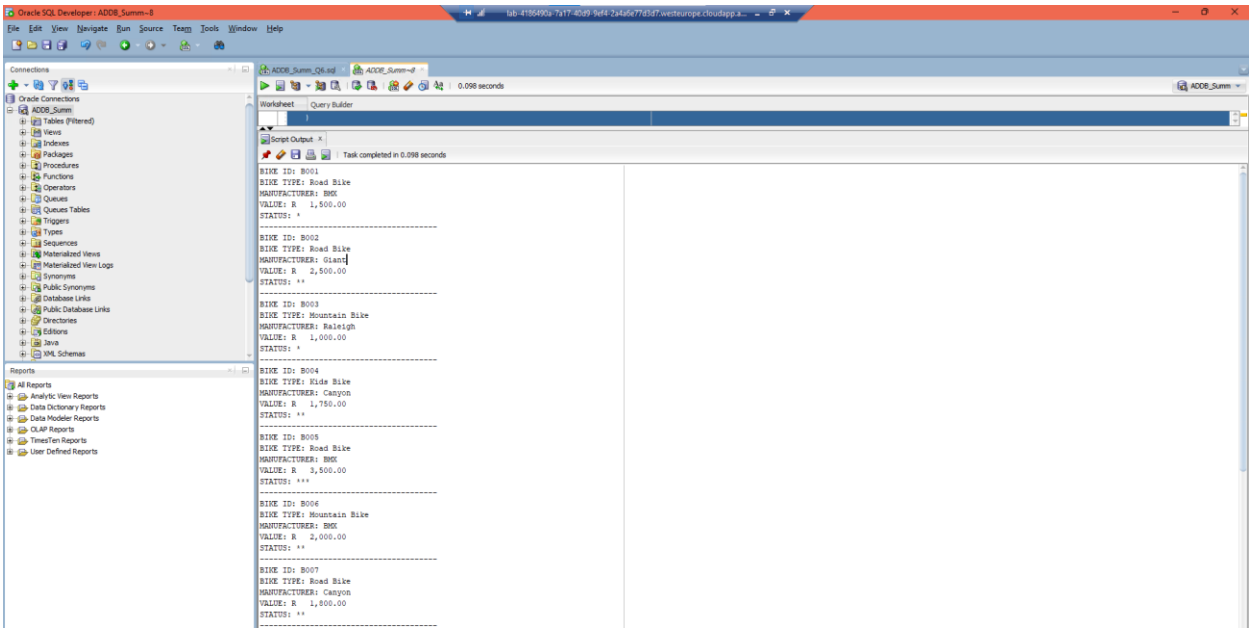


Question 7

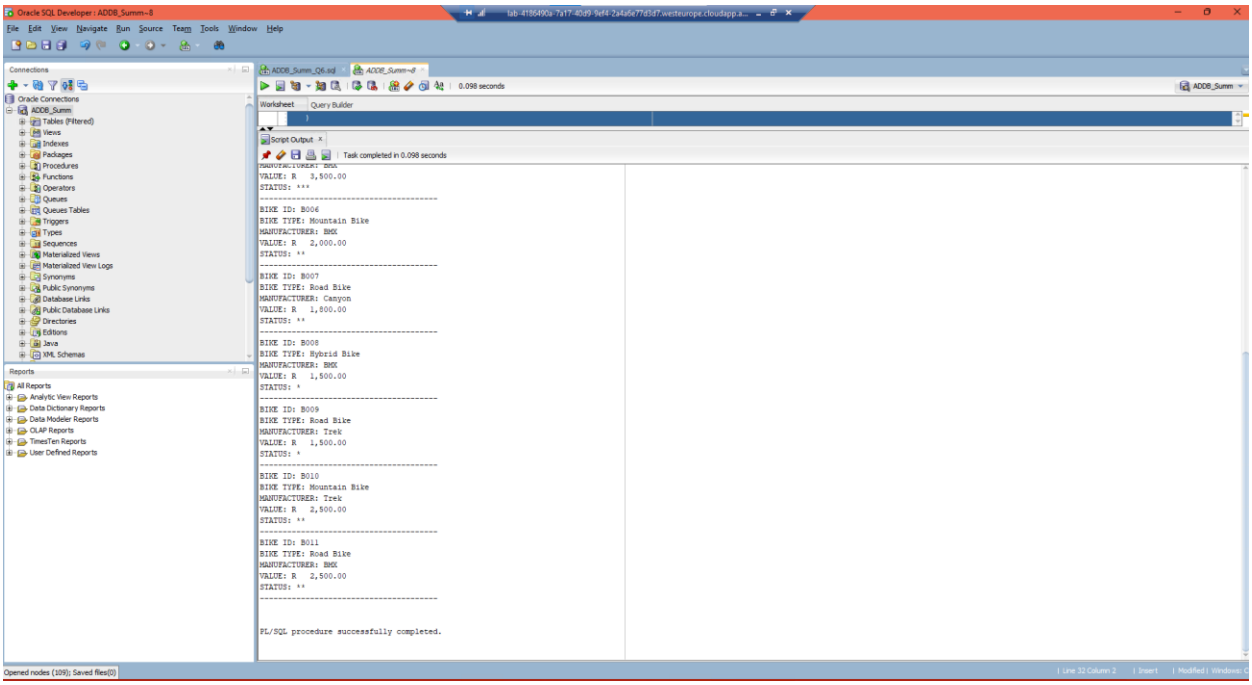
```
-- Enable output to display the results
SET SERVEROUTPUT ON;


-- PL/SQL block to generate the bike report using IF statements for status
BEGIN
   -- Loop through all the bikes and print details along with their status
   FOR rec IN (
      SELECT B.BIKE_ID, B.BIKE_TYPE, B.MANUFACTURER, DON.VALUE
      FROM DONATION DON
      JOIN BIKE B ON DON.BIKE_ID = B.BIKE_ID
   )
   LOOP
      -- Display bike details
      DBMS_OUTPUT.PUT_LINE('BIKE ID: ' || rec.BIKE_ID);
      DBMS_OUTPUT.PUT_LINE('BIKE TYPE: ' || rec.BIKE_TYPE);
      DBMS_OUTPUT.PUT_LINE('MANUFACTURER: ' || rec.MANUFACTURER);
      DBMS_OUTPUT.PUT_LINE('VALUE: R' || TO_CHAR(rec.VALUE, '999G999D00'));

      -- Determine bike status using IF...ELSIF
      IF rec.VALUE BETWEEN 0 AND 1500 THEN
         DBMS_OUTPUT.PUT_LINE('STATUS: *'); -- 1-star
      ELSIF rec.VALUE > 1500 AND rec.VALUE <= 3000 THEN
         DBMS_OUTPUT.PUT_LINE('STATUS: **'); -- 2-stars
      ELSIF rec.VALUE > 3000 THEN
         DBMS_OUTPUT.PUT_LINE('STATUS: ***'); -- 3-stars
      END IF;
```

```
    -- Add a separator for clarity
    DBMS_OUTPUT.PUT_LINE('----------------------------------------');
  END LOOP;
END;
/
```

Proof of Question 7 Part 1 (Please Zoom in to see image clearer)



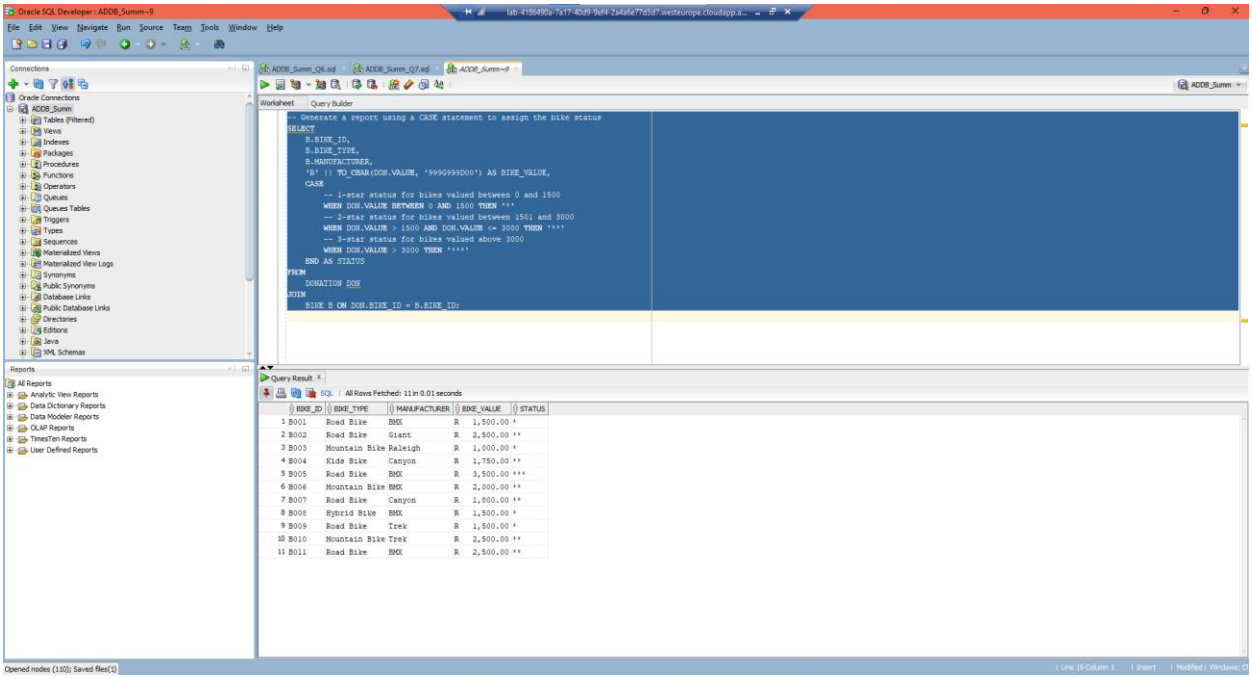
Proof of Question 7 Part 2 (Please Zoom in to see image clearer)



Question 8

```
-- Generate a report using a CASE statement to assign the bike status
SELECT
   B.BIKE_ID,
   B.BIKE_TYPE,
   B.MANUFACTURER,
   'R' || TO_CHAR(DON.VALUE, '999G999D00') AS BIKE_VALUE,
   CASE
      -- 1-star status for bikes valued between 0 and 1500
      WHEN DON.VALUE BETWEEN 0 AND 1500 THEN '*'
      -- 2-star status for bikes valued between 1501 and 3000
      WHEN DON.VALUE > 1500 AND DON.VALUE <= 3000 THEN '**'
      -- 3-star status for bikes valued above 3000
      WHEN DON.VALUE > 3000 THEN '***'
   END AS STATUS
FROM
   DONATION DON
JOIN
   BIKE B ON DON.BIKE_ID = B.BIKE_ID;
```

Proof of Question 8 (Please Zoom in to see image clearer)

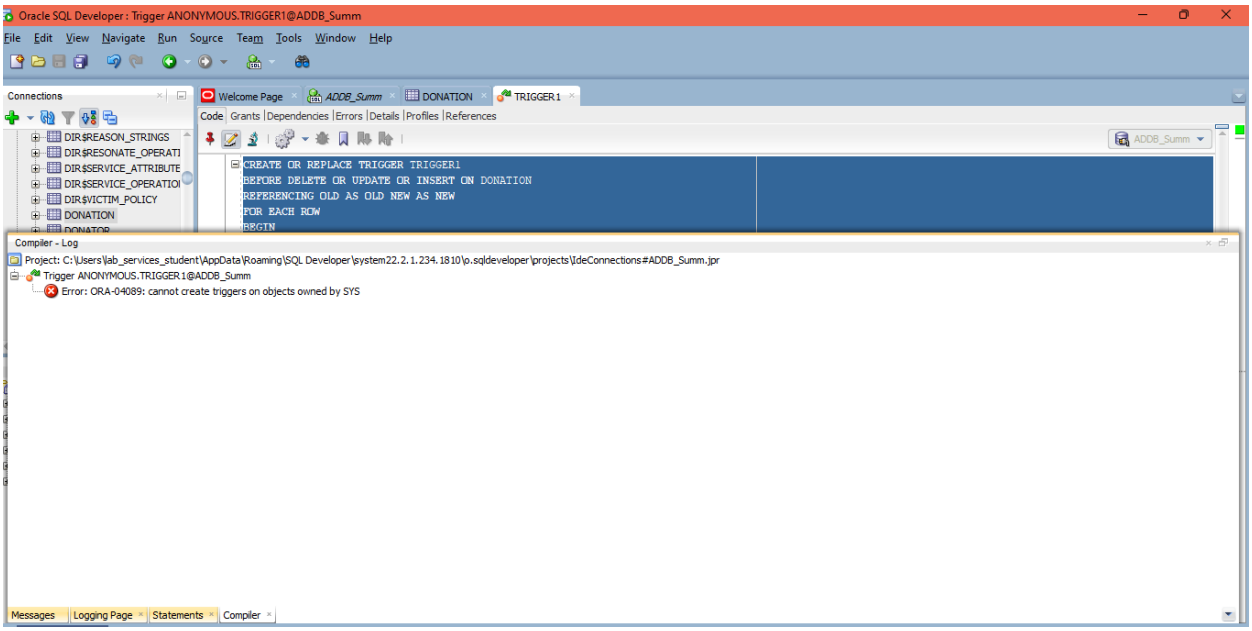


Question 9

```
-- Task 9.1: Trigger to prevent deletions from the DONATION table
CREATE OR REPLACE TRIGGER trg_prevent_donation_delete
BEFORE DELETE ON DONATION
FOR EACH ROW
BEGIN
   -- Raise an error if there is an attempt to delete a record from the DONATION table
   RAISE_APPLICATION_ERROR(-20001, 'Deletion from the DONATION table is not allowed.');
END trg_prevent_donation_delete;
/

-- Test for Trigger trg_prevent_donation_delete
-- This DELETE statement should fail and raise an error.
BEGIN
   DELETE FROM DONATION WHERE DONATION_ID = 1;
END;
/

-- Task 9.2: Trigger to ensure a valid bike value on update in the DONATION table
CREATE OR REPLACE TRIGGER trg_validate_donation_value
BEFORE UPDATE OF VALUE ON DONATION
FOR EACH ROW
BEGIN
   -- Check if the new bike value is greater than 0
   IF :NEW.VALUE <= 0 THEN
      -- Raise an error if the new value is invalid (0 or negative)
      RAISE_APPLICATION_ERROR(-20002, 'Bike value must be greater than 0.');
```

```
    END IF;
END trg_validate_donation_value;
/

-- Test for Trigger trg_validate_donation_value
-- This UPDATE statement should fail and raise an error if the new value is 0 or negative.
BEGIN
    UPDATE DONATION SET VALUE = -100 WHERE DONATION_ID = 1;
END;
/
```

Proof of Error I am getting with regards to Question 9 (Please Zoom in to see image clearer)



Reason for this error:

Oracle prevents users from creating triggers on tables that belong to the SYS schema, which is why I'm getting the problem ORA-04089: cannot construct triggers on objects owned by SYS. Oracle's default administration schema, known as the SYS schema, includes system-related tables and objects that are necessary for the database to function. So therefore, I am receiving this error as I cant create triggers that belong to a SYS Schema.

Question 10

1. Confidentiality

Only those with permission can access sensitive data thanks to confidentiality. The BikesRUs database can be secured as follows:

a. Roles and Privileges of Users

- Limit access to only the information required for each user's function in accordance with the principle of least privilege (PoLP). Volunteers should, for example, only view the tables pertaining to donations and not financial information.

- **Example SQL Code:**

  -- Grant specific privileges to volunteers

  GRANT SELECT, INSERT ON Donation TO volunteer_role;

  REVOKE UPDATE, DELETE ON Donation FROM volunteer_role;

b. Encryption of Data

- Encryption in Transit: Use SSL/TLS to encrypt all network communications to guard against illegal parties intercepting them. Oracle Advanced Security offers configuration options for these.
- Resting Encryption: For sensitive data columns like donor contact details, enable Transparent Data Encryption (TDE).

- Example Command for TDE:
  -- Encrypt sensitive column
  ALTER TABLE Donation MODIFY (Value ENCRYPT USING 'AES256');

c. Masking Data

- When working in non-production settings, apply data masking techniques. This guarantees that development personnel and volunteers will not have access to actual donor data in test databases.
- Tool: For testing or development, the Oracle Data Masking and Subsetting tool can create masked duplicates of production data.

2. Integrity

reserving correct and precise data throughout its existence is the core goal of integrity.

a. Constraints and Triggers

- To preserve referential integrity, apply primary and foreign key constraints to every relational table. For instance, there should be a foreign key constraint connecting Donor_ID in the Donation field to the Donor table.
- As seen in Question 9, when we enforce a positive value for donations, use triggers to evaluate data on update or insert.

b. Audit Trails

- Allow auditing to document activities on sensitive tables, such Volunteer and Donation. This guarantees responsibility and makes it possible to track improvements.

- Example SQL Code:
  -- Enable auditing on the Donation table for INSERT and DELETE operations
  AUDIT INSERT, DELETE ON Donation;

- Tool: Database Firewall and Oracle Audit Vault offer centralized audits and can notify administrators of anomalous activity.

c. Data Validation and Checks

- To avoid SQL injection and other types of corruption, make sure that all user input is verified.
- For instance, use a trigger in Question 9 to enforce checks on the bike value column to make sure it is positive.

3. Accessibility

Availability guarantees that authorized users may access data as needed.

a. Recovery and Backup

- Safeguarding against data loss requires routinely planned backups and recovery processes.
- Tool: To automate backups and guarantee quick recovery, use Oracle Recovery Manager (RMAN).

b. Failover and Redundancy

- Oracle Data Guard can be used to replicate the database to a standby server and create a high-availability environment. In the event of a hardware breakdown, this permits a smooth failover.
- ***Example:***

```
-- Configure Data Guard environment
ALTER SYSTEM SET LOG_ARCHIVE_DEST_2='SERVICE=standby_db';
```

c. Management of Resources

- To avoid resource monopolization by any one user, restrict resource consumption per user.
- Tool: Oracle Resource Manager can assist in efficiently allocating CPU resources so that lower-priority workloads do not impact high-priority operations.

4. Additional Measures for Security and Performance

a. Use of Views

- Implement views to restrict users from accessing entire tables. A view can provide only the necessary columns without exposing sensitive data.

- Example View:

```
CREATE VIEW volunteer_view AS
SELECT DONATION_ID, BIKE_ID, DONATION_DATE
FROM Donation
WHERE VOLUNTEER_ID = 'vol105';
```

b. Frequent updates and patching

- Updating the database software is essential for preventing risks. Plan to update frequently and keep an eye on Oracle Security Alerts.

In conclusion, a mix of user access control, encryption, data integrity procedures, frequent backups, and availability measures is needed to safeguard BikesRUs's data. We can guarantee that the database is safe, dependable, and accessible by utilizing Oracle's built-in tools and security procedures, which will support BikesRUs's purpose while protecting its data assets.

References Used in this Summative Assessment

(Feuerstein, 2020) (GeekforGeek, 2023) (MSFT, et al., 2024) (W3Schools, n.d.) (To, et al., 2024) (Programiz, n.d.) (Wolhuter, 2024) (Wolhuter, 2024) (Wolhuter, 2024) (Wolhuter, 2024) (Wolhuter, 2024) (Wolhuter, 2024) (Wolhuter, 2024) (Wolhuter, 2024) (Wolhuter, 2024) (Wolhuter, 2024) (Wolhuter, 2024) (Wolhuter, 2024) (Wolhuter, 2024) (Wolhuter, 2024) (Wolhuter, 2024) (ChatGPT, 2024) (ChatGPT, 2024) (ChatGPT, 2024) (satori, n.d.) (Loshin, 2022) (Charles Sturt University, n.d.) (Secoda, 2024) (IBM, 2023) (Microsoft, n.d.) (Microsoft, n.d.)

References

Charles Sturt University, n.d. *ASC202 Research Skills Guide: Use Journal Databases*. [Online]
Available at: https://libguides.csu.edu.au/c.php?g=220102&p=6596671#:~:text=A%20journal%20database%20is%20an,of%20publication%2C%20title%2C%20etc)
[Accessed 28 October 2024].

ChatGPT, 2024. *BikeRUs donation table error*. [Online]
Available at: https://chatgpt.com/c/671ad018-e334-8012-8fe4-4f84a5d2018b5
[Accessed 29 October 2024].

ChatGPT, 2024. *How to drop Tables/ View Tables/ Table insert error*. [Online]
Available at: https://chatgpt.com/c/671839c0-30e8-8012-b2dd-a4203a3fa07e
[Accessed 29 October 2024].

ChatGPT, 2024. *Oracle Trigger Creation Error*. [Online]
Available at: https://chatgpt.com/c/6720c626-11c0-8012-839f-5f5f2c4b6244
[Accessed 29 October 2024].

Feuerstein, S., 2020. *Building with blocks in PL/SQL*. [Online]
Available at: https://blogs.oracle.com/connect/post/building-with-blocks
[Accessed 29 October 2024].

GeekforGeek, 2023. *Blocks in PL/SQL*. [Online]
Available at: https://www.geeksforgeeks.org/blocks-in-pl-sql/
[Accessed 29 October 2024].

IBM, 2023. *12 Data Integrity Examples: Types, Industry Usage, and Risks*. [Online]
Available at: https://www.ibm.com/think/topics/data-integrity#:~:text=The%20main%20types%20of%20data,across%20data%20relationships%20in%20databases.
[Accessed 29 October 2024].

Loshin, P., 2022. *Open Web Application Security Project (OWASP)*. [Online]
Available at: https://www.techtarget.com/searchsoftwarequality/definition/OWASP
[Accessed 28 October 2024].

Microsoft, n.d. *Learn the structure of an Access database.* [Online]
Available at: https://support.microsoft.com/en-us/office/learn-the-structure-of-an-access-database-001a5c05-3fea-48f1-90a0-cccaa57ba4af
[Accessed 29 October 2024].

Microsoft, n.d. *What is database security?.* [Online]
Available at: https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-database-security
[Accessed 29 October 2024].

MSFT, R. W., Buck, A. & Roth, J., 2024. *BEGIN...END (Transact-SQL).* [Online]
Available at: https://learn.microsoft.com/en-us/sql/t-sql/language-elements/begin-end-transact-sql?view=sql-server-ver16
[Accessed 29 October 2024].

Programiz, n.d. *Getting Started with SQL.* [Online]
Available at: https://www.programiz.com/sql/getting-started
[Accessed 29 October 2024].

satori, n.d. *Top 10 Database Security Best Practices.* [Online]
Available at: https://satoricyber.com/database-security/top-10-database-security-best-practices/
[Accessed 28 October 2024].

Secoda, 2024. *What is Data Confidentiality?.* [Online]
Available at: https://www.secoda.co/glossary/data-confidentiality#:~:text=Data%20confidentiality%20typically%20refers%20to,driver's%20license%20numbers%20and%20addresses.
[Accessed 29 October 2024].

To, V., MSFT, R. W. & Millsap, R., 2024. *SELECT (Transact-SQL).* [Online]
Available at: https://learn.microsoft.com/en-us/sql/t-sql/queries/select-transact-sql?view=sql-server-ver16
[Accessed 29 October 2024].

W3Schools, n.d. *SQL SELECT Statement.* [Online]
Available at: https://www.w3schools.com/sql/sql_select.asp
[Accessed 29 October 2024].

Wolhuter, R., 2024. *ADDB_7311_Intro&LU1_Theme1And2 (Introduction),* Cape Town: Wolhuter, Riko.

Wolhuter, R., 2024. *ADDB_7311_Theme11&12 (PL/SQL blocks) ,* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *ADDB_7311_Theme3&4 (SQL Developer + SQL Plus),* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *ADDB_7311_Theme5&6 (SQL basics, TCL + Exercise),* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *ADDB_7311_Theme7&8 (DBCA + Database Memory + TableSpace Management + Terminating a Session),* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *Control Structures + Cursors,* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *Database security,* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *Exception handling PL/SQL,* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *Exception handling PL/SQL #2,* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *Exception handling PL/SQL #3 + Subprograms,* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *External Procedures - Java/C,* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *Indexes, sequences, views, and synonyms,* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *PL/SQL blocks practical introduction,* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *PL/SQL Lexical Units,* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *PL/SQL Triggers,* Cape Town: Riko Wolhuter.

Wolhuter, R., 2024. *Procedures and Functions - PL/SQL,* Cape Town: Riko Wolhuter.