**TASK 1. Simple Tasks**

* 1. Write PL-SQL program, which prints multipliers of number 9 i.e., 9,18,27, …, up to 30\*9
  2. Prepare PL/SQL procedure which does the same as the task 1. Run that procedure.
  3. Write a function which returns the greatest common divisor (highest common factor) of two numbers.
  4. Prepare a function which displays n-th number in a Fibonacci sequence (1,1,2,3,5,8,13...) use recursion, then do it without using recursion.
  5. Create a table with the name »TEST« with columns »NAME« and »SURNAME« and write procedure, that inserts data to it. Parameters should be p\_name and p\_surname. Call procedure and check if data was added to the table.
  6. Change procedure from task 5. in a way that would not allow to insert the same person multiple times
  7. Add unique key to the table, so it will not be possible to insert one person more than one time
  8. Study which types are supported in oracle database. From now on use only the following:

NUMBER for all numeric columns,

VARCHAR2(size) for all character columns and

DATE for all date columns.

It is much easier if we don't over-complicate our lives.

**TASK 2. Meaningful names of tables and columns**

2.1 Use constants in task 1.1

2.2 Create table with the same columns as »TEST« but change a name to make it more meaningful. Add column id, which should be used as primary key, create sequence that you will insert when adding the data. Adapt procedure from task 1.6 in a way that it will insert name, surname, and sequence value. The data should be inserted in new table, of course.

2.3 Create table with the information of the presence in the job. Table should have meaningful name, the columns should include the data about: Date, Number of hours, Comment. The table from task 2.2 should be connected using the field id. Define foreign key between those two tables.

2.4 Add to the table from task 2.3 a column which hold information about regular hours/overtime hours. Create new table with this information (hour types) and create foreign key between them.

2.5 Create procedure, which inserts data to table from task 2.3. Parameters should be id of a person, number of hours and hour type.

* 1. Create procedure, which inserts data to table from task 2.3. Parameters should be id of a person, work start date, work end date (date columns in oracle include data about hours, minutes and seconds also). Your procedure should calculate number of hours from provided dates. If start date and end date are different (not in the same day) insert one record for each day (calculate and insert the appropriate number of hours). Use procedure from task 2.5 to insert one record. A person can for each day have 8 regular hours only, the rest should be overtime hours.
  2. Prepare database schema (Create tables, primary keys, foreign keys) to store information of employees and cars of a company. Include data about car manufacturer, car model, car manufacturing year, colour, equipment package, registration number, add a column for comment. Use master/detail as you find meaningful. It should be possible for one employee to have multiple cars. Schema should also include data about history of car registrations.

**TASK 3. Exceptions handling, indexes, execution time measurements**

* 1. Write a procedure, which inserts new person to table from task 2.7. Procedure should have parameters: p\_name, p\_surname and output parameters p\_status and p\_msg. Add exception handler to BEGIN-END block which executes ROLLBACK in case of error and returns p\_status='ERR' and p\_msg=…error message (use SQLERRM built in variable). If procedure finishes successfully execute COMMIT and return p\_status='OK'. Call this procedure from anonymous PL/SQL block and write returned status and message to Simple Tasks.
  2. Write a procedure that generates person names, surnames from sequence numbers (id=10, name=10, surname=10,…) – just to fill something to the table. Use sequence for id (using: Simple Tasks () ). Insert 1000 such persons.
  3. Add column status to persons table. Create procedure, which updates that table and set column status='A'. Use cursor, which loops through all persons in the table and update each of them. Calculate time to do that with the help of function DBMS\_UTILITY.GET\_TIME.
  4. Prepare procedure that does the same job as the procedure from task 3.3 but it updates all records in one SQL statement. Measure time needed to do that. Compare execution times of procedures from tasks 3.3 and 3.4.
  5. Add additional 1000000 with the help of procedure from task 3.2. Add column person\_group to the persons table. Update column with the numbers form 1 till 10 using folowing rules: person with id=1 person\_group=1, id=2 person\_group=2... id=10 person\_group=10, id=11 person\_group=1, id=12 person\_group=2,...
  6. Update column status='A' for persons with person\_group=1. Measure time.
  7. Create index on table persons on the column person\_group.
  8. Repeat task 3.6, measure time and compare it with the one from task 3.6

**TASK 4. Transactions**

* 1. Create table with money transactions to/from person's account (Persons from task 2.7). Create procedure that »transfers« money to their account. All transactions should be in this table. Balance on the account should be calculated as cumulative sum of all transactions fort he account. Prepare unique keys, primary keys, foreign keys… Define column names according to your judgement.
  2. Prepare procedure which subtracts (inserts negative transaction) to table from task 4.1
  3. Create procedure, which subtracts payment for car registration and inserts date and registration amount for a specific car. The transaction should be executed either all (all tables filled) or nothing (no tables filled). Procedure should return status and message (if successful 'OK' if error 'ERR' with error description)
  4. Prepare column in automobile table with a flag that some cars needs to be registered (yearly fee paid). Write a procedure, which subtracts registration amount, writes registration date and marks a record for a car that it does not need to be registered any more. If exception is thrown write error, time of error and car information to some new table where all the errors are logged.

**TASK 5. Dynamic SQL**

* 1. Create table with the steps that should be executed in a sequence. The table should have the following columns: ID, procedure name, process name, execution sequence, description and indication if the step is active. Create another table with parameters to run procedure. Connect both tables using foreign key. Use the name ADM\_LOAD\_STP.
  2. Create another table with the same structure and add columns: start\_date, end\_date, status and message. Use the name ADM\_LOAD\_RUN.
  3. Create package that dynamically executes procedure from task 5.1. When the procedure is called (with the ID of the appropriate step from task 5.1) the name of the procedure and parameters are prepared and stored to varchar2 field and executed using »EXECUTE IMMEDIATE«. The procedure which is called should include two parameters: p\_status and p\_msg.
  4. To the package from task 5.3 add procedure which calls all steps for selected process, but skips steps where status is not active.
  5. Add procedure which prepares script (text which itself is anonymous PL/SQL block) with commands that do the same job as in task 4.3. Prepare new table and make your procedure write that script into it.
  6. With the help of package DBMS\_JOB prepare a job that executes anonymous PL/SQL block from the table from task 5.5.

**TASK 6. Star schemas: Fact tables, dimension tables, slowly changing dimensions**

Read some tutorial regarding star schemas (also check differences in modelling between transactional systems and analytical systems).

Basically, we divide data to

* tables with many rows and small number of columns (fact tables)
* tables with small number of rows and many columns (dimension tables)
  1. Using Star schema prepare a database model for sales of some items. Database model should include: item name, manufacturer, wholesaler, amount, price, sales date, name of the store, promotion, sales person, recommended price of the item,…
  2. Prepare procedure which randomly fills tables from task 6.1. Use package DBMS\_RANDOM.
  3. How to make queries as easy as possible: sales amounts per day, week, month, sales of the first Wednesday in the month, quarterly sales…?
  4. How to change the model if we would like to be able to know the price of an item when it was sold (we know that item prices change all the time and would like to store that information)?

**TASK 7. SQL tricks**

7.1 Create a table and insert 100.000 records from system view ALL\_OBJECTS – include columns object\_name, owner, rownum (this is system variable with row number). Use SQL statement: CREATE TABLE … AS SELECT … Create another table and insert 200.000 records using the same procedure. Delete every 3rd record (use function mod).

Prepare queries that return:

- Number of records that are in the first table and not in the second

- Number of records that are in the second table and not in the first

- Try to make a query that runs faster

7.2 Create table with 100.000 records with random sequence of 5 characters and random number from 0..1000. Use package dbms\_random and chr.

7.3 Prepare SQL statement that return first 20 records from task 3.5 (with the lowest values of column ID)

* 1. Prepare query which returns number of records for each group from task 3.5

7.5 Prepare a query which for each record from table 3.5 returns number of records that have the same group (use analytical functions)

**TASK 8. System Views**

* 1. Oracle objects can be queried using system views. Check which system views exist, you should check what it means if system views start with the name ALL\_, USER\_\_ and DBA\_
  2. Use system view USER\_TABLES to find all the tables that you created in your tasks.
  3. Check, which types did you use in your tables. Use system view USER\_TAB\_COLUMNS
  4. Find all appearances of COMMIT and ROLLBACK in your procedures and packages that you made. Use system view USER\_SOURCE.
  5. Find all objects that have errors. Use system view USER\_OBJECTS.

**Task 9. Questions**

* 1. I can see that you did not use COMMIT in all procedures to confirm transactions. What can happen if it is not used? What can go wrong?
  2. What happens if you open two connection to database and try to update the same records? Does it make sense?

**ANSWERS:**

**Task 1.**

* 1. **--** code that prints multiples of 9

DECLARE

i NUMBER := 1;

BEGIN

LOOP

EXIT WHEN i> 30 ;

DBMS\_OUTPUT.PUT\_LINE(9 \* i);

i := i+1;

END LOOP;

END;

* 1. **--** procedure that prints multiples of 9

CREATE OR REPLACE PROCEDURE PRINT\_MULTIPLES\_OF\_9 AS

i NUMBER := 1;

BEGIN

LOOP

EXIT WHEN i> 30 ;

DBMS\_OUTPUT.PUT\_LINE(9 \* i);

i := i+1;

END LOOP;

END PRINT\_MULTIPLES\_OF\_9;

* 1. **–** function that returns Highest Common Factor given two numbers

CREATE OR REPLACE FUNCTION HCF

(

p\_num1 IN number, p\_num2 IN number

) RETURN NUMBER AS

num1 NUMBER:=p\_num1;

num2 NUMBER:=p\_num2;

temp NUMBER;

BEGIN

WHILE MOD(num2, num1) != 0 LOOP

temp := MOD(num2, num1);

num2 := num1;

num1 := temp;

END LOOP;

RETURN num1;

END HCF;

**1.4** -- function that returns nth Fibonacci number

**Non-recursive**

CREATE OR REPLACE FUNCTION FIB\_NON\_RECURSIVE

(

p\_k IN NUMBER

) RETURN NUMBER AS

num1 NUMBER:= 0;

num2 NUMBER:= 1;

k NUMBER := p\_k;

temp NUMBER := 0;

nsum NUMBER := 0;

BEGIN

WHILE k > temp LOOP

nsum := nsum + num1;

num1 := num2;

num2 := nsum;

temp := temp+1;

END LOOP;

RETURN nsum;

END FIB\_NON\_RECURSIVE;

**Recursive**

create or replace FUNCTION FIB\_RECURSIVE

(

K IN NUMBER

) RETURN NUMBER AS

BEGIN

IF k= 1 THEN

RETURN 0;

ELSIF k = 2 THEN

RETURN 1;

ELSE

RETURN FIB\_RECURSIVE(K - 2) + FIB\_RECURSIVE(K - 1);

END IF;

END FIB\_RECURSIVE;

**1.5** -- create table test

CREATE TABLE test

(

NAME VARCHAR2(20),

SURNAME VARCHAR2(40)

);

-- procedure of adding records without any checks

create or replace PROCEDURE ADD\_DATA\_TO\_TABLE\_TEST

(

P\_NAME IN TEST.NAME%TYPE

, P\_SURNAME IN TEST.SURNAME%TYPE

) AS

BEGIN

INSERT INTO TEST ("NAME", "SURNAME")

VALUES (P\_NAME, P\_SURNAME);

COMMIT;

END ADD\_DATA\_TO\_TABLE\_TEST;

**1.6** -- procedure of adding records if they don’t exist

CREATE OR REPLACE PROCEDURE ADD\_TO\_TEST\_WITH\_CHECK

(

P\_NAME IN TEST.NAME%TYPE

, P\_SURNAME IN TEST.SURNAME%TYPE

) AS

BEGIN

INSERT INTO TEST ("NAME", "SURNAME")

SELECT p\_name, p\_surname

FROM TEST

WHERE NOT EXISTS

(

SELECT 1 FROM TEST

WHERE "NAME" = p\_name AND "SURNAME" = p\_surname

);

COMMIT;

END ADD\_TO\_TEST\_WITH\_CHECK;

**1.7 --** Alter table test by adding primary key

ALTER TABLE TEST

ADD CONSTRAINT pk\_1 PRIMARY KEY (NAME, SURNAME);

**2.1** -- task 1.1 with the use of constant

DECLARE

i NUMBER := 1;

multiplier NUMBER := 9;

BEGIN

LOOP

EXIT WHEN i> 30 ;

DBMS\_OUTPUT.PUT\_LINE(multiplier \* i);

i := i+1;

END LOOP;

END;

**2.2** -- creating ID\_Generator

CREATE SEQUENCE ID\_GENERATOR\_2\_2

START WITH 1

INCREMENT BY 1;

-- creating table USERS

CREATE TABLE USERS

(

ID NUMBER NOT NULL,

NAME VARCHAR2(20),

SURNAME VARCHAR2(40),

CONSTRAINT PK\_ID PRIMARY KEY (ID)

);

-- creating “Add\_to\_users” procedure with “if doesn’t exist” check

create or replace PROCEDURE ADD\_TO\_USERS

(

P\_NAME IN USERS.NAME%TYPE,

P\_SURNAME IN USERS.SURNAME%TYPE

) AS

BEGIN

INSERT INTO USERS ("ID","NAME","SURNAME")

SELECT ID\_GENERATOR\_2\_2.NEXTVAL, P\_NAME,P\_SURNAME FROM dual

WHERE NOT EXISTS

(

SELECT NULL

FROM USERS

WHERE "NAME" = P\_NAME AND "SURNAME" = P\_SURNAME

);

END ADD\_TO\_USERS;

-- adding data using “Add\_to\_users” procedure

BEGIN

ADD\_TO\_USERS('Bob', 'Builder');

END;

**2.3** -- creating table “Job\_Presence” with foreign key reference to table “Users”

CREATE TABLE JOB\_PRESENCE

(

USER\_ID NUMBER NOT NULL,

"DATE" DATE,

HOURS\_OF\_WORK NUMBER,

"COMMENT" VARCHAR2(255),

CONSTRAINT FK\_USER\_ID

FOREIGN KEY (USER\_ID)

REFERENCES USERS(ID)

);

**2.4** -- creating table "Hours\_type"

CREATE TABLE HOURS\_TYPE

(

HOURS\_TYPE\_ID NUMBER NOT NULL,

HOURS\_TYPE VARCHAR2(30),

CONSTRAINT HOURS\_HOURS\_PK

PRIMARY KEY (HOURS\_TYPE\_ID)

);

-- adding a column to table “Job\_Presence” with hours type

-- adding foreign key reference to create a link between two tables

ALTER TABLE JOB\_PRESENCE

ADD

(

"HOURS\_TYPE\_ID" NUMBER,

CONSTRAINT HOURS\_JOB\_FK

FOREIGN KEY (HOURS\_TYPE\_ID)

REFERENCES HOURS\_TYPE(HOURS\_TYPE\_ID)

);

**2.5** --inserting data to selected columns of a table

create or replace PROCEDURE ADD\_TO\_JOB\_PRESENCE

(

P\_USER\_ID IN JOB\_PRESENCE.USER\_ID%TYPE,

P\_HOURS\_OF\_WORK IN JOB\_PRESENCE.HOURS\_OF\_WORK%TYPE,

P\_HOURS\_TYPE\_ID IN JOB\_PRESENCE.HOURS\_TYPE\_ID%TYPE

) AS

BEGIN

INSERT INTO JOB\_PRESENCE

("USER\_ID", "HOURS\_OF\_WORK", "HOURS\_TYPE\_ID")

VALUES (P\_USER\_ID, P\_HOURS\_OF\_WORK, P\_HOURS\_TYPE\_ID);

COMMIT;

END ADD\_TO\_JOB\_PRESENCE;

**2.6**

create or replace PROCEDURE PROCEDURE\_2\_6

(

USER\_ID IN NUMBER,

p\_work\_start IN DATE,

p\_work\_end IN DATE

) AS

p\_work\_start\_day NUMBER := EXTRACT(DAY FROM p\_work\_start);

p\_work\_end\_day NUMBER := EXTRACT(DAY FROM p\_work\_end);

p\_day\_hours NUMBER;

temp\_date DATE;

BEGIN

DBMS\_OUTPUT.PUT\_LINE('Starting day: '||p\_work\_start\_day);

DBMS\_OUTPUT.PUT\_LINE('Last day: '||p\_work\_end\_day);

p\_day\_hours := ROUND((p\_work\_end - p\_work\_start)\*24,1);

DBMS\_OUTPUT.PUT\_LINE('Hours of work: '||p\_day\_hours);

FOR number\_of\_days IN 0..(p\_work\_end\_day - p\_work\_start\_day) LOOP

DBMS\_OUTPUT.PUT\_LINE('Day no: '|| (number\_of\_days + 1));

IF number\_of\_days = 0

THEN

if (24 - ROUND((p\_work\_start-trunc(p\_work\_start))\*24,1)) < 8

then

INSERT INTO JOB\_PRESENCE("USER\_ID","DATE","HOURS\_OF\_WORK","COMMENT","HOURS\_TYPE\_ID")

VALUES(USER\_ID,p\_work\_start,24 - ROUND((p\_work\_start-trunc(p\_work\_start))\*24,1),'first day of work',1);

DBMS\_OUTPUT.PUT\_LINE('Hours of day'|| (number\_of\_days +1)|| ': '|| (24 - ROUND((p\_work\_start-trunc(p\_work\_start))\*24,1)));

else

INSERT INTO JOB\_PRESENCE("USER\_ID","DATE","HOURS\_OF\_WORK","COMMENT","HOURS\_TYPE\_ID")

VALUES(USER\_ID,p\_work\_start,8,'first day of work',1);

INSERT INTO JOB\_PRESENCE("USER\_ID","DATE","HOURS\_OF\_WORK","COMMENT","HOURS\_TYPE\_ID")

VALUES(USER\_ID,p\_work\_start + (8/24),(24 - ROUND((p\_work\_start-trunc(p\_work\_start))\*24,1))-8,'first day of work',2);

DBMS\_OUTPUT.PUT\_LINE('Hours of day'|| (number\_of\_days +1)|| ': '|| (24 - ROUND((p\_work\_start-trunc(p\_work\_start))\*24,1)));

end if;

ELSIF (number\_of\_days = (p\_work\_end\_day - p\_work\_start\_day))

THEN

select to\_char(cast(p\_work\_end as date),'DD-MM-YYYY') INTO temp\_date FROM dual;

if (ROUND((p\_work\_end - trunc(p\_work\_end))\*24,1)) < 8

then

INSERT INTO JOB\_PRESENCE("USER\_ID","DATE","HOURS\_OF\_WORK","COMMENT","HOURS\_TYPE\_ID")

VALUES(USER\_ID,temp\_date,ROUND((p\_work\_end - trunc(p\_work\_end))\*24,1),'last day of work',1);

DBMS\_OUTPUT.PUT\_LINE('Hours of day'|| (number\_of\_days +1)|| ': '|| (ROUND((p\_work\_end - trunc(p\_work\_end))\*24,1)));

else

INSERT INTO JOB\_PRESENCE("USER\_ID","DATE","HOURS\_OF\_WORK","COMMENT","HOURS\_TYPE\_ID")

VALUES(USER\_ID,temp\_date,8,'last day of work',1);

INSERT INTO JOB\_PRESENCE("USER\_ID","DATE","HOURS\_OF\_WORK","COMMENT","HOURS\_TYPE\_ID")

VALUES(USER\_ID,p\_work\_end - (8/24),ROUND((p\_work\_end - trunc(p\_work\_end))\*24,1)-8,'last day of work',2);

DBMS\_OUTPUT.PUT\_LINE('Hours of day'|| (number\_of\_days +1)|| ': '|| (ROUND((p\_work\_end - trunc(p\_work\_end))\*24,1)));

end if;

ELSE

select to\_char(cast(p\_work\_start as date),'DD-MM-YYYY') INTO temp\_date FROM dual;

INSERT INTO JOB\_PRESENCE("USER\_ID","DATE","HOURS\_OF\_WORK","COMMENT","HOURS\_TYPE\_ID")

VALUES(USER\_ID,temp\_date + number\_of\_days,8,'in between',1);

INSERT INTO JOB\_PRESENCE("USER\_ID","DATE","HOURS\_OF\_WORK","COMMENT","HOURS\_TYPE\_ID")

VALUES(USER\_ID,temp\_date + (8/24) + number\_of\_days,16,'in between',2);

DBMS\_OUTPUT.PUT\_LINE('Hours of day'|| (number\_of\_days +1)|| ': '|| 24);

END IF;

END LOOP;

END PROCEDURE\_2\_6;

**2.7**

CREATE TABLE CARS\_REG\_PLATES

(

REG\_PLATE VARCHAR2(10) NOT NULL ENABLE PRIMARY KEY,

"DATE" DATE,

REGISTRATION\_FEE NUMBER,

ADDITIONAL\_INFO VARCHAR2(255 BYTE)

);

CREATE TABLE VEHICLE\_EQUIPMENT

(

PACKAGE\_ID NUMBER(10) NOT NULL ENABLE PRIMARY KEY,

PACKAGE\_NAME VARCHAR2(50),

PACKAGE\_DETAILS VARCHAR2(50)

);

CREATE TABLE EMPLOYEES

(

EMPLOYEE\_ID NUMBER(10) NOT NULL ENABLE PRIMARY KEY,

"NAME" VARCHAR2(50),

SURNAME VARCHAR2(50),

CAR\_REG\_PLATE VARCHAR2(10),

CONSTRAINT EMPLOYEES\_FK

FOREIGN KEY (CAR\_REG\_PLATE)

REFERENCES CARS\_REG\_PLATES(REG\_PLATE)

);

CREATE TABLE CARS

(

REG\_PLATE VARCHAR2(10) NOT NULL ENABLE PRIMARY KEY,

CAR\_NAME VARCHAR2(50) NOT NULL,

CAR\_MANUFACTURER VARCHAR2(50),

CAR\_MODEL VARCHAR2(50),

CAR\_MANUFACTURING\_YEAR DATE,

CAR\_COLOUR VARCHAR2(50),

EQUIPMENT\_PACKAGE\_ID NUMBER(10),

CONSTRAINT CARS\_FK

FOREIGN KEY (REG\_PLATE)

REFERENCES CARS\_REG\_PLATES(REG\_PLATE),

FOREIGN KEY (EQUIPMENT\_PACKAGE\_ID)

REFERENCES VEHICLE\_EQUIPMENT(PACKAGE\_ID)

);

**3.1**

create or replace PROCEDURE PROCEDURE\_3\_1

(

P\_NAME IN EMPLOYEES.NAME%TYPE,

P\_SURNAME IN EMPLOYEES.SURNAME%TYPE,

P\_STATUS OUT VARCHAR2,

P\_MSG OUT VARCHAR2

) AS

BEGIN

INSERT INTO EMPLOYEES ("EMPLOYEE\_ID","NAME","SURNAME" )

SELECT ID\_GENERATOR\_3\_1.NEXTVAL, p\_name,p\_surname FROM dual

WHERE NOT EXISTS

(

SELECT NULL

FROM EMPLOYEES

WHERE "NAME" = P\_NAME AND "SURNAME" = P\_SURNAME

);

P\_STATUS := 'OK';

COMMIT;

EXCEPTION

WHEN OTHERS THEN

P\_STATUS := 'ERR';

P\_MSG := SQLERRM;

ROLLBACK;

END PROCEDURE\_3\_1;

**3.2**

CREATE SEQUENCE ID\_GENERATOR\_3\_2

START WITH 1

MAXVALUE 10000

INCREMENT BY 1;

DECLARE

i NUMBER;

temp Number;

BEGIN

FOR i in 1 .. 1000 LOOP

temp:=ID\_GENERATOR\_3\_2.NEXTVAL;

INSERT INTO EMPLOYEES("EMPLOYEE\_ID","NAME","SURNAME")

VALUES(temp,temp,temp);

END LOOP;

END;

**3.3**

create or replace PROCEDURE PROCEDURE\_3\_3 AS

proc\_start VARCHAR2(100);

proc\_end VARCHAR2(100);

proc\_total VARCHAR2(100);

CURSOR cursor1 IS

SELECT EMPLOYEE\_ID FROM EMPLOYEES;

c\_row cursor1%ROWTYPE;

BEGIN

OPEN cursor1;

proc\_start := DBMS\_UTILITY.GET\_TIME;

LOOP

FETCH cursor1 INTO c\_row;

EXIT WHEN cursor1%NOTFOUND;

UPDATE EMPLOYEES

SET "STATUS" = 'A';

DBMS\_OUTPUT.PUT\_LINE

('Employee ID: '||c\_row.EMPLOYEE\_ID ||'Operation no:

'||cursor1%ROWCOUNT ||', STATUS column updated.');

END LOOP;

proc\_end := DBMS\_UTILITY.GET\_TIME;

CLOSE cursor1;

proc\_total := proc\_end - proc\_start;

DBMS\_OUTPUT.PUT\_LINE('Procedure running time: '||proc\_total/100 || ' sec.');

END PROCEDURE\_3\_3;

**3.4**

create or replace PROCEDURE PROCEDURE\_3\_4 AS

proc\_start NUMBER;

proc\_end NUMBER;

proc\_total NUMBER;

BEGIN

proc\_start := DBMS\_UTILITY.GET\_TIME;

UPDATE EMPLOYEES

SET "STATUS" = 'A';

proc\_end := DBMS\_UTILITY.GET\_TIME;

proc\_total := proc\_end - proc\_start;

DBMS\_OUTPUT.PUT\_LINE('Procedure running time: '||proc\_total/100 || ' sec.');

END PROCEDURE\_3\_4;

**3.5**

create or replace PROCEDURE PROCEDURE\_3\_5 AS

i NUMBER;

temp Number;

BEGIN

FOR i in 1 .. 1000000 LOOP

temp:=ID\_GENERATOR\_3\_2.NEXTVAL;

INSERT INTO EMPLOYEES("EMPLOYEE\_ID","NAME","SURNAME")

VALUES(temp,temp,temp);

END LOOP;

END PROCEDURE\_3\_5;

**3.6**

DECLARE

proc\_start VARCHAR2(100);

proc\_end VARCHAR2(100);

proc\_total VARCHAR2(100);

BEGIN

proc\_start := DBMS\_UTILITY.GET\_TIME;

UPDATE EMPLOYEES

SET STATUS = 'A'

WHERE "PERSON\_GROUP" = 1;

proc\_end := DBMS\_UTILITY.GET\_TIME;

proc\_total := proc\_end - proc\_start;

DBMS\_OUTPUT.PUT\_LINE('Procedure running time: '||proc\_total/100 || ' sec.');

END;

-- PROCEDURE TIME 1.36 sec.

**3.7** -- Create index on table persons on the column person\_group.

CREATE INDEX person\_group\_index

ON EMPLOYEES ("PERSON\_GROUP");

3.8 -- Repeat task 3.6, measure time and compare it with the one from task 3.6

DECLARE

proc\_start VARCHAR2(100);

proc\_end VARCHAR2(100);

proc\_total VARCHAR2(100);

BEGIN

proc\_start := DBMS\_UTILITY.GET\_TIME;

UPDATE EMPLOYEES

SET STATUS = 'A'

WHERE "PERSON\_GROUP" = 1;

proc\_end := DBMS\_UTILITY.GET\_TIME;

proc\_total := proc\_end - proc\_start;

DBMS\_OUTPUT.PUT\_LINE('Procedure running time: '||proc\_total/100 || ' sec.');

END;

-- PROCEDURE TIME 1.03 sec.

4.1

create or replace PROCEDURE transfer (

p\_transaction\_id IN NUMBER,

p\_transfer\_to IN NUMBER,

p\_amount IN NUMBER,

p\_comment IN VARCHAR2

) AS

sum\_temp NUMBER;

BEGIN

-- insert transaction "to" into transactions table

INSERT

INTO transactions (

"ID",

ACCOUNT\_ID,

TRANSACTION\_ID,

"DATE",

AMOUNT,

"COMMENT"

)

VALUES (

transaction\_id\_number.nextval,

p\_transfer\_to,

p\_transaction\_id,

to\_char(sysdate, 'dd.mm.yyyy hh24:mi:ss'),

p\_amount,

p\_comment );

-- insert receiver if doesn't exist

INSERT INTO ACCOUNTS ("employee\_id")

SELECT p\_transfer\_to

FROM dual

WHERE NOT EXISTS

(

SELECT 1 FROM ACCOUNTS WHERE "employee\_id" = p\_transfer\_to

);

-- SUM TRANSACTIONS for RECEIVER

SELECT

SUM(p\_amount)

INTO sum\_temp

FROM

transactions

GROUP BY

"ACCOUNT\_ID"

HAVING

"ACCOUNT\_ID" = p\_transfer\_to;

UPDATE accounts

SET

"ACCOUNT\_BALANCE" = sum\_temp

WHERE

"employee\_id" = p\_transfer\_to;

COMMIT;

EXCEPTION

WHEN OTHERS THEN

dbms\_output.put\_line('error');

ROLLBACK;

END transfer;

**4.2**

CREATE OR REPLACE PROCEDURE transfer\_4\_2 (

p\_transaction\_id IN NUMBER,

p\_transfer\_from IN NUMBER,

p\_transfer\_to IN NUMBER,

p\_amount IN NUMBER,

p\_comment IN VARCHAR2

) AS

neg\_amount NUMBER := ( -1 ) \* p\_amount;

sum\_temp NUMBER;

BEGIN

-- INSERT TRANSACTION "FROM" INTO TRANSACTIONS TABLE

INSERT INTO transactions (

"ID",

"ACCOUNT\_ID",

"TRANSACTION\_ID",

"DATE",

"AMOUNT",

"COMMENT"

) VALUES (

transaction\_id\_number.NEXTVAL,

p\_transfer\_from,

p\_transaction\_id,

to\_char(sysdate, 'DD.MM.YYYY HH24:MI:SS'),

neg\_amount,

p\_comment

);

-- INSERT TRANSACTION "TO" INTO TRANSACTIONS TABLE

INSERT INTO transactions (

"ID",

"ACCOUNT\_ID",

"TRANSACTION\_ID",

"DATE",

"AMOUNT",

"COMMENT"

) VALUES (

transaction\_id\_number.NEXTVAL,

p\_transfer\_to,

p\_transaction\_id,

to\_char(sysdate, 'DD.MM.YYYY HH24:MI:SS'),

p\_amount,

p\_comment

);

-- SUM TRANSACTIONS for sender

SELECT

SUM("AMOUNT")

INTO sum\_temp

FROM

transactions

GROUP BY

"ACCOUNT\_ID"

HAVING

"ACCOUNT\_ID" = p\_transfer\_from;

INSERT INTO accounts ( "employee\_id" )

SELECT

p\_transfer\_from

FROM

dual

WHERE

NOT EXISTS (

SELECT

1

FROM

accounts

WHERE

"employee\_id" = p\_transfer\_from

);

UPDATE accounts

SET

"ACCOUNT\_BALANCE" = sum\_temp

WHERE

"employee\_id" = p\_transfer\_from;

-- SUM TRANSACTIONS for receiver

SELECT

SUM("AMOUNT")

INTO sum\_temp

FROM

transactions

GROUP BY

"ACCOUNT\_ID"

HAVING

"ACCOUNT\_ID" = p\_transfer\_to;

INSERT INTO accounts ( "employee\_id" )

SELECT

p\_transfer\_to

FROM

dual

WHERE

NOT EXISTS (

SELECT

1

FROM

accounts

WHERE

"employee\_id" = p\_transfer\_to

);

UPDATE accounts

SET

"ACCOUNT\_BALANCE" = sum\_temp

WHERE

"employee\_id" = p\_transfer\_to;

COMMIT;

EXCEPTION

WHEN OTHERS THEN

dbms\_output.put\_line('Error');

ROLLBACK;

END transfer\_4\_2;

**4.3**

create or replace PROCEDURE procedure\_4\_3

( p\_reg\_plate IN VARCHAR2,

p\_registration\_fee IN NUMBER,

p\_status OUT VARCHAR2,

p\_msg OUT VARCHAR2 ) AS

employee\_id\_number number;

BEGIN

-- insert registration into cars\_reg\_plates

insert into cars\_reg\_plates (REG\_PLATE,"REGISTRATION\_DATE",REGISTRATION\_FEE)

values(p\_reg\_plate,to\_char(sysdate, 'dd.mm.yyyy hh24:mi:ss'),p\_registration\_fee);

-- get employee id for the reg\_plate

select employee\_id

into employee\_id\_number

from employees

where car\_reg\_plate = p\_reg\_plate;

-- insert employee if doesn't exist

INSERT INTO ACCOUNTS ("employee\_id")

SELECT employee\_id\_number

FROM dual

WHERE NOT EXISTS

(

SELECT 1 FROM ACCOUNTS WHERE "employee\_id" = employee\_id\_number

);

-- take registration fee from the account

UPDATE accounts

SET

"ACCOUNT\_BALANCE" = ACCOUNT\_BALANCE - p\_registration\_fee

WHERE

"employee\_id" = employee\_id\_number;

p\_status := 'OK';

COMMIT;

EXCEPTION

WHEN OTHERS THEN

p\_status := 'ERR';

p\_msg := sqlerrm;

ROLLBACK;

END procedure\_4\_3;

**4.4**

create or replace PROCEDURE PROCEDURE\_4\_4

( p\_reg\_plate IN VARCHAR2,

p\_registration\_fee IN NUMBER,

p\_status OUT VARCHAR2,

p\_msg OUT VARCHAR2 ) AS

employee\_id\_number number;

error\_message varchar(255);

BEGIN

-- same as 4.3

-- insert registration into cars\_reg\_plates

insert into cars\_reg\_plates (REG\_PLATE,"DATE",REGISTRATION\_FEE)

values(p\_reg\_plate,to\_char(sysdate, 'dd.mm.yyyy hh24:mi:ss'),p\_registration\_fee);

-- get employee id for the reg\_plate

select employee\_id

into employee\_id\_number

from employees

where car\_reg\_plate = p\_reg\_plate;

-- insert employee if doesn't exist

INSERT INTO ACCOUNTS ("employee\_id")

SELECT employee\_id\_number

FROM dual

WHERE NOT EXISTS

(

SELECT 1 FROM ACCOUNTS WHERE "employee\_id" = employee\_id\_number

);

-- take registration fee from the account

UPDATE accounts

SET

"ACCOUNT\_BALANCE" = ACCOUNT\_BALANCE - p\_registration\_fee

WHERE

"employee\_id" = employee\_id\_number;

-- now part 4.4

-- add date to car\_reg\_plates and change "needs\_registration" to 0

UPDATE cars\_reg\_plates

SET

REGISTRATION\_DATE = to\_char(sysdate, 'dd.mm.yyyy hh24:mi:ss'),

NEEDS\_REGISTRATION = 0

WHERE

"REG\_PLATE" = p\_reg\_plate;

p\_status := 'OK';

COMMIT;

-- get error type, error time

EXCEPTION

WHEN OTHERS THEN

p\_status := 'ERR';

p\_msg := sqlerrm;

error\_message := to\_char(p\_msg);

-- write error info into "error table"

INSERT INTO ERROR\_LOGS(ERROR\_DATE, REG\_PLATE, ERROR\_MESSAGE)

VALUES (to\_char(sysdate, 'dd.mm.yyyy hh24:mi:ss'),p\_reg\_plate,error\_message);

DBMS\_OUTPUT.PUT\_LINE('Error...: '||error\_message||' Date: '||to\_char(sysdate, 'dd.mm.yyyy hh24:mi:ss') ||' Reg: '|| p\_reg\_plate);

COMMIT;

--RAISE;

ROLLBACK;

END PROCEDURE\_4\_4;

**5.1**

--------------------------------------------

-- drop everything to restart

---------------------------------------------

DROP TABLE AAA\_procedures\_names;

DROP TABLE AAA\_procedures\_parametrs;

DROP SEQUENCE process\_sequence;

--------------------------------------------------------------

-- create a table with procedures names

--------------------------------------------------------------

create table AAA\_procedures\_names

(

PROCESS\_ID number not null primary key,

PROCEDURE\_NAME varchar2(100) unique,

PROCESS\_NAME varchar2(100),

EXECUTION\_SEQUENCE number,

PROCESS\_DESCRIPTION varchar2(4000)

);

---------------------------------------------------

-- creating a table of parameters

---------------------------------------------------

create table AAA\_procedures\_parametrs

(

PROCESS\_ID number not null primary key,

PROCEDURE\_NAME VARCHAR2(50),

PARAMETER\_1\_NAME varchar2(20) not null,

PARAMETER\_2\_NAME varchar2(20) not null

);

-------------------------------------------

-- create sample procedures

-------------------------------------------

create or replace PROCEDURE sample\_p1(

arg1 IN NUMBER,

arg2 IN NUMBER

) AS

BEGIN

DBMS\_OUTPUT.PUT\_LINE('Procedure P1 executed with arguments: '||arg1||','||arg2);

end sample\_p1;

/

create or replace PROCEDURE sample\_p2(

arg1 IN NUMBER,

arg2 IN NUMBER

) AS

BEGIN

DBMS\_OUTPUT.PUT\_LINE('Procedure P2 executed with arguments: '||arg1||','||arg2);

end sample\_p2;

/

create or replace PROCEDURE sample\_p3(

arg1 IN NUMBER,

arg2 IN NUMBER

) AS

BEGIN

DBMS\_OUTPUT.PUT\_LINE('Procedure P3 executed with arguments: '||arg1||','||arg2);

end sample\_p3;

/

-------------------------------------------------------

-- add values to procedures\_names

-------------------------------------------------------

INSERT INTO AAA\_procedures\_names

(PROCESS\_ID,PROCEDURE\_NAME,PROCESS\_NAME,EXECUTION\_SEQUENCE,PROCESS\_DESCRIPTION)

VALUES

(1,'sample\_p1','learning\_process',100,'Process inactive');

--------------------------------------------------------------------------------

INSERT INTO AAA\_procedures\_names

VALUES

(2,'sample\_p2','learning\_process',200,'Process inactive');

--------------------------------------------------------------------------------

INSERT INTO AAA\_procedures\_names

(PROCESS\_ID,PROCEDURE\_NAME,PROCESS\_NAME,EXECUTION\_SEQUENCE,PROCESS\_DESCRIPTION)

VALUES

(3,'sample\_p3','learning\_process',300,'Process inactive');

--------------------------------------------------------------

-- add values to procedures\_parameters

--------------------------------------------------------------

INSERT INTO AAA\_procedures\_parametrs("PROCESS\_ID", "PROCEDURE\_NAME","PARAMETER\_1\_NAME","PARAMETER\_2\_NAME")

VALUES(1,'p1',2,4);

-----------------------------------------------------------------------------------------

INSERT INTO AAA\_procedures\_parametrs("PROCESS\_ID", "PROCEDURE\_NAME","PARAMETER\_1\_NAME","PARAMETER\_2\_NAME")

VALUES(2,'p2',6,13);

------------------------------------------------------------------------------------------

INSERT INTO AAA\_procedures\_parametrs("PROCESS\_ID", "PROCEDURE\_NAME","PARAMETER\_1\_NAME","PARAMETER\_2\_NAME")

VALUES(3,'p3',1,10);

commit;

----------------------------------------------------------

-- add foreign key to parameters table

-----------------------------------------------------------

ALTER TABLE AAA\_procedures\_parametrs

ADD CONSTRAINT AAA\_procedures\_parametrs\_FK

FOREIGN KEY (PROCESS\_ID)

REFERENCES AAA\_procedures\_names (PROCESS\_ID);

----------------------------------------------------------------------------------------

-- create dynamic procedure with cursor

to run each sample procedure with its parameters

----------------------------------------------------------------------------------------

create or replace procedure run\_procedure(p\_process\_name varchar2) AS

cursor cursor\_5\_1 is

SELECT

a.PROCESS\_ID,a.PROCEDURE\_NAME,PROCESS\_NAME,EXECUTION\_SEQUENCE,PROCESS\_DESCRIPTION, a.PROCEDURE\_NAME||'('||parameter\_1\_name||','||parameter\_2\_name||')' script

FROM AAA\_procedures\_names a, aaa\_procedures\_parametrs b

where a.PROCESS\_ID = b.PROCESS\_ID

and a.PROCESS\_NAME = p\_process\_name

order by execution\_sequence;

BEGIN

FOR r\_step in cursor\_5\_1 LOOP

dbms\_output.put\_line('Calling '||r\_step.script);

END LOOP;

END run\_procedure;

/

BEGIN

RUN\_PROCEDURE('learning\_process');

END;

**5.2**

**-------------------------------------------------------------------**

**-- creating a table with the same structure**

**-------------------------------------------------------------------**

create table ADM\_LOAD\_RUN as select \* from AAA\_PROCEDURES\_NAMES where 1=0;

/\* Limitations

The following things will not be copied to the new table:

sequences

triggers

indexes

some constraints may not be copied

materialized view logs

This also does not handle partitions

\*/

**----------------------------------------------**

**-- adding additional columns**

**----------------------------------------------**

alter table ADM\_LOAD\_RUN

add (

start\_date date,

end\_date date,

status\_message varchar(255)

);

**5.3**

**/\* 5.3 Create package that dynamically executes procedure from task 5.1.**

**When the procedure is called (with the ID of the appropriate step from task 5.1)**

**the name of the procedure and parameters are prepared and stored to varchar2 field and executed using »EXECUTE IMMEDIATE«.**

**The procedure which is called should include two parameters: p\_status and p\_msg.**

**\*/**

-----------------------

DROP TABLE ADM\_LOAD\_STP;

DROP TABLE ADM\_LOAD\_RUN;

**-----------------------**

**-- create tables needed**

**-----------------------**

CREATE TABLE ADM\_LOAD\_RUN

(

procedure\_id NUMBER NOT NULL PRIMARY KEY,

procedure\_name VARCHAR2(100) UNIQUE,

process\_name VARCHAR2(100),

execution\_sequence NUMBER,

process\_description VARCHAR2(4000),

status NUMBER DEFAULT 0,

message VARCHAR2(255) DEFAULT 'no additional info');

create table ADM\_LOAD\_STP

(

PROCEDURE\_ID number not null primary key,

PROCEDURE\_NAME VARCHAR2(50),

PARAMETER\_1\_NAME varchar2(20) not null,

PARAMETER\_2\_NAME varchar2(20) not null

);

**---------------------**

**-- fill in the tables**

**---------------------**

INSERT INTO ADM\_LOAD\_RUN

(PROCEDURE\_ID,PROCEDURE\_NAME,PROCESS\_NAME,EXECUTION\_SEQUENCE,PROCESS\_DESCRIPTION)

VALUES

(1,'sample\_p1','learning\_process',100,'Process does p1 procedure');

--------------------------------------------------------------------------------

INSERT INTO ADM\_LOAD\_RUN

(PROCEDURE\_ID,PROCEDURE\_NAME,PROCESS\_NAME,EXECUTION\_SEQUENCE,PROCESS\_DESCRIPTION)

VALUES

(2,'sample\_p2','learning\_process',200,'Process does p2 procedure');

--------------------------------------------------------------------------------

INSERT INTO ADM\_LOAD\_RUN

(PROCEDURE\_ID,PROCEDURE\_NAME,PROCESS\_NAME,EXECUTION\_SEQUENCE,PROCESS\_DESCRIPTION)

VALUES

(3,'sample\_p3','learning\_process',300,'Process does p3 procedure');

commit;

----------------------------------------

INSERT INTO ADM\_LOAD\_STP("PROCEDURE\_ID", "PROCEDURE\_NAME","PARAMETER\_1\_NAME","PARAMETER\_2\_NAME")

VALUES(1,'sample\_p1',2,4);

-----------------------------------------------------------------------------------------

INSERT INTO ADM\_LOAD\_STP("PROCEDURE\_ID", "PROCEDURE\_NAME","PARAMETER\_1\_NAME","PARAMETER\_2\_NAME")

VALUES(2,'sample\_p2',6,13);

------------------------------------------------------------------------------------------

INSERT INTO ADM\_LOAD\_STP("PROCEDURE\_ID", "PROCEDURE\_NAME","PARAMETER\_1\_NAME","PARAMETER\_2\_NAME")

VALUES(3,'sample\_p3',1,10);

commit;

**--------------------------**

**-- viewing cursor selection --- HOW TO DEAL WITH DIFFERENT NUMBER OF PARAMETERS, is the script column temporary?**

**---------------------------**

SELECT

a.PROCEDURE\_ID,

a.PROCEDURE\_NAME,

PROCESS\_NAME,

EXECUTION\_SEQUENCE,

PROCESS\_DESCRIPTION,

a.PROCEDURE\_NAME||'('||parameter\_1\_name||','||parameter\_2\_name||')' script

FROM ADM\_LOAD\_RUN a, ADM\_LOAD\_STP b

where a.PROCEDURE\_ID = b.PROCEDURE\_ID

order by execution\_sequence;

**-----------------------------------------------**

**-- assigning single row selection into variable**

**-----------------------------------------------**

DECLARE

temp\_rec adm\_load\_stp%rowtype;

BEGIN

SELECT

procedure\_id,

procedure\_name,

parameter\_1\_name,

parameter\_2\_name

INTO temp\_rec

FROM

adm\_load\_stp

WHERE

procedure\_id = 1;

dbms\_output.put\_line(temp\_rec.procedure\_name

|| '('

|| temp\_rec.parameter\_1\_name

|| ','

|| temp\_rec.parameter\_2\_name

|| ')');

END;

**-------------------------------------------**

**-- preparing dynamic PLSQL for a single row**

**-------------------------------------------**

DECLARE

temp\_rec adm\_load\_stp%rowtype;

stmt VARCHAR2(500);

BEGIN

SELECT

procedure\_id,

procedure\_name,

parameter\_1\_name,

parameter\_2\_name

INTO temp\_rec

FROM

adm\_load\_stp

WHERE

procedure\_id = 1;

stmt := temp\_rec.procedure\_name

|| ' ('

|| temp\_rec.parameter\_1\_name

|| ','

|| temp\_rec.parameter\_2\_name

|| ')';

dbms\_output.put\_line(stmt);

EXECUTE IMMEDIATE ( 'begin '

|| stmt

|| ' ; end;' );

END;

**----------------------------**

**-- inside of the package\_5\_3**

**----------------------------**

create or replace PACKAGE PACKAGE\_5\_3 AS

procedure run\_one(p\_procedure\_id in number, p\_status out varchar2, p\_msg out varchar2);

END PACKAGE\_5\_3;

**---------------------------------**

**-- inside of the package\_5\_3 body**

**---------------------------------**

CREATE OR REPLACE PACKAGE BODY package\_5\_3 AS

procedure run\_one(p\_procedure\_id in number, p\_status out varchar2, p\_msg out varchar2

) AS

temp\_rec adm\_load\_stp%rowtype;

stmt VARCHAR2(500);

BEGIN

-- procedure execution

SELECT

procedure\_id,

procedure\_name,

parameter\_1\_name,

parameter\_2\_name

INTO temp\_rec

FROM

adm\_load\_stp

WHERE

procedure\_id = p\_procedure\_id;

stmt := temp\_rec.procedure\_name

|| ' ('

|| temp\_rec.parameter\_1\_name

|| ','

|| temp\_rec.parameter\_2\_name

|| ')';

dbms\_output.put\_line(stmt);

EXECUTE IMMEDIATE ( 'begin '

|| stmt

|| ' ; end;' );

-- status update

p\_status := 'STATUS: OK';

dbms\_output.put\_line(p\_status);

exception

WHEN OTHERS THEN

p\_status := 'STATUS: ERR';

p\_msg := sqlerrm;

ROLLBACK;

dbms\_output.put\_line(p\_status);

dbms\_output.put\_line(p\_msg);

END run\_one;

END package\_5\_3;

**----------------------**

**-- execute package\_5\_3**

**----------------------**

DECLARE

out1 varchar2(500);

out2 varchar2(500);

begin

PACKAGE\_5\_3.run\_one(4,out1,out2);

end;