

Contents

Preface	11
Introduction	11
Acknowledgment.....	11
Oracle Academy	12
Organization of the book	13
Lab 1 – Oracle Cloud Infrastructure (OCI)	15
SQL Developer connection specification	42
SQL*Plus command-line – SQL Client.....	45
Alternative 1 – full definition	46
Alternative 2 – connect identifiers.....	49
Capturing activities in SQL	54
Working with Help	54
Working with multiple commands.....	55
Comments.....	56
Working with procedures and functions	56
Connection and session termination	58
Syntax symbols.....	60
Lab 2 – Basics of data retrieval.....	61
Introduction	61
Projection, selection, column alias	62
Personal_id structure	65
Dual table.....	65
Using functions.....	66
Character string functions	66
ASCII function	66
CONCAT function	67
String character case management (LOWER, UPPER, INITCAP functions)....	67
LENGTH function.....	68
SUBSTR function	68
TRIM function	69
Numeric and Math functions	69
ABS function.....	69
CEIL function.....	70
ROUND function	70
FLOOR function	71
TRUNC function.....	71
MOD function	71
Date and Time functions.....	72
SYSDATE function.....	72
SYSTIMESTAMP function	73
ADD_MONTHS function	73
EXTRACT function	74
LAST_DAY function.....	74
MONTHS_BETWEEN function.....	75
NEXT_DAY function	75

TRUNC function	76
Conversion functions	77
TO_CHAR function	77
TO_DATE function.....	79
TO_NUMBER function	80
TO_TIMESTAMP function	80
Advanced functions	80
CASE conversion function.....	80
COALESCE function.....	82
DECODE function	82
NULLIF function	82
NVL function	83
NVL2 function	83
USER function	83
SYS_CONTEXT function.....	83
Managing NULL values	84
Comparing strings (equality, operator Like).....	86
Using Order By clause.....	88
Table joining.....	89
Cartesian product.....	93
Operations using SETs (IN, EXISTS).....	94
Managing duplicate values	98
Table alias.....	99
Practice	100
Lab 3 – Insert, Update, Delete statements and transactions.....	105
Introduction	105
Insert statement.....	105
Insert – Values type	106
Insert – Select type.....	107
Update statement	109
Delete statement	110
Direct joins for Update and Delete operations Oracle Database 23ai.....	111
The order of operations.....	113
Foreign key definition	113
Changing the primary key value.....	114
Transactions.....	115
Practice	117
Insert statements	117
Update statements.....	118
Delete statements	119
Lab 4 – Data modeling	121
Introduction	121
System analysis.....	121
System design.....	122
Technical design.....	122
Creating data model.....	122
Conceptual modeling.....	125

Entity-relational conceptual model	126
Identifying key	127
Conceptual schema notation in E-R model.....	127
Linear notation.....	127
Type diagram / Occurrence E-R diagram	127
Type diagram.....	128
Occurrence E-R diagram	128
Attributes	128
Non-atomic attributes	130
Group attributes	130
Multiple value attributes	130
Relationships and integrity constraints	131
Identifying and non-identifying relationship	131
Relationship cardinality	132
Cardinality 1:1	132
Cardinality 1:N	133
Cardinality M:N	133
Decomposition of the M:N relationship cardinality.....	134
Associative entity.....	136
Membership types.....	137
Multiple relationships between same tables.....	138
Recursive (self) relationships.....	139
Data modeling in Toad Modeler tool.....	139
Environment settings	140
Entity management	141
User-defined domain	146
Relationship management.....	150
Generating SQL script	151
Executing script on the server.....	154
Working with directories and files.....	155
Practice	157
Lab 5 – Create, Alter and Drop commands	161
Introduction	161
Data types	162
Introducing Boolean data type in Oracle Database 23ai.....	163
User management	163
Table management.....	166
Create command	166
Foreign key.....	169
Domain definition (check constraint).....	170
Default value	170
Constraint naming	171
Create table as Select.....	171
Alter command	173
Add option.....	173
Modify option.....	173
Drop option	174

Table renaming.....	175
Drop command	175
Recycle bin.....	176
Index.....	177
ROWID.....	178
Index management.....	179
Types of indexes.....	179
B+ tree index type	179
Bitmap index	181
Index organized table	182
Access methods	183
Practice	183
Lab 6 – Data loading	185
Introduction	185
SQL Loader	185
EXP / IMP utility.....	194
Creating import/export using dump files	195
Import using data pump	195
Object storage.....	196
Bucket	196
Create_credentials procedure	199
Authentication token	200
Data Pump Import Wizard	205
Bucket	215
Object	215
ExpDp	217
Useful notes	226
Lab 7 – Managing privileges	227
Introduction	227
Grant command	227
System privilege management	227
Object privilege management	229
Accessing another schema object	231
Revoke command	231
Grouping privileges to roles	234
Practice	234
Lab 8 – Advanced techniques of data retrieval.....	237
Introduction	237
Aggregate functions.....	237
Fundamentals for Group By clause management	239
Working with aggregate function Count and Group By clause	239
Having clause	244
Using aliases in Group By and Having clauses (Oracle Database 23ai).....	247
Extended versions of table joining.....	248
INNER JOIN type.....	249
ON / USING CLAUSE.....	250
LEFT OUTER JOIN type	250

RIGHT OUTER JOIN type	251
FULL OUTER JOIN type.....	251
SEMI JOIN type	252
ANTI JOIN type	252
NATURAL JOIN type.....	253
Relational algebra operations	253
Union operation	254
Difference operation	257
Intersection operation	259
Recursive relationships.....	260
Referencing one table multiple times in the Select statement.....	263
Practice	264
Lab 9 – Procedures, functions and packages	267
Introduction	267
Code preliminaries.....	268
Variable definition	268
Assignment, NULL.....	268
Conditional processing	269
IF condition	269
Condition CASE.....	273
CASE statement and expression enhancements in Oracle Database 23ai	277
LOOPs	279
Infinite loop, EXIT condition.....	279
WHILE loop type	280
FOR loop type	280
PL/SQL anonymous block.....	281
Procedure, function.....	282
Procedure syntax.....	282
Function syntax.....	283
Executing stored method	284
EXECUTE command	284
Calling method from PL/SQL block.....	285
DBMS_OUTPUT package	286
Disable procedure	286
Enable procedure	286
Get_line procedure.....	286
Get_lines procedure	287
New_line procedure	287
Put procedure	287
Put_line procedure	288
Calling function from the Select statement.....	289
Exception handling	290
Ways of passing parameters	298
Position way of passing parameters.....	298
Passing parameters using names	299
Hybrid passing	300
Differences between anonymous and stored (named) PL/SQL block	300

Removing procedures and functions.....	300
Select statement in PL/SQL.....	301
SELECT INTO type	301
CURSOR	302
Increasing control – access rights.....	308
Packages	312
Package specification syntax	313
Package body syntax.....	314
Overloading	317
Initialization block	318
Practice	321
Lab 10 – Triggers	323
Introduction	323
Syntax	324
Restrictions for trigger definition	327
Triggers turning on and off.....	327
Changes monitoring.....	327
Default values.....	330
Conditions for trigger firing.....	331
One trigger – multiple operations	334
Referential integrity management.....	336
Changing the value of the primary key.....	338
Sequences and triggers	339
Sequence syntax.....	339
Sequence and transaction correlation.....	342
Mutating table.....	343
DDL triggers.....	346
Event triggers.....	348
Practice	349
Lab 11 – Relational integrity	351
Introduction	351
Integrity constraints classification	351
Entity integrity.....	352
Primary key candidate	352
Primary key.....	352
Alternative key.....	353
Superkey	353
Referential integrity	353
Referential integrity rule	353
Referential integrity consequences	354
Cascade option example	354
Restricted option example	356
Nullified option example	357
User integrity	358
Column integrity.....	358
Domain integrity.....	359
Integrity constraints controlling and processing	359

Practice	359
Lab 12 – Views.....	361
Introduction	361
Syntax.....	361
Exceptions	362
Managing data in views	364
Attribute name redefinition in views	367
Check option clause.....	367
Nesting views	369
Option 1 – Using With check option clause on the lower level	370
Option 2 – Using With check option clause on the upper level.....	370
Read only view	371
View based on multiple tables and triggers	371
Triggers associated with views	372
Summary.....	373
Practice	373
Lab 13 – Date and Time value management.....	375
NLS parameters & session format	380
NLS_Language.....	381
NLS_Territory	382
NLS_Date_Language	382
NLS_Date_format.....	383
Transformation of the personal_id into the date of birth	383
Get the list of persons who celebrate a birthday today	384
Get the list of students who passed the exam this month.....	385
Get the list of students who passed the exam previous last month	386
Get the list of the persons, who will celebrate their birthday next Sunday	388
Get the Date of the second Sunday of the month.....	390
Get the list of the persons, who will celebrate their birthday next week	391
Get the difference between Date values	392
Get the difference between Date values – a sophisticated solution	392
YY vs. RR	394
Current employees.....	395
Period models and Allen relationships	396
Unlimited validity definition	399
Data type Interval management	400
Interval Year to Month data type	400
Interval Day to Second data type.....	401
Examples – Interval data types	402
Update validity definition based on Interval data value.....	402
Developing Robust Date and Time Oriented Applications in Oracle Cloud: A comprehensive guide to efficient date and time management in Oracle Cloud	405
Lab 14 – Data dictionary views	407
Introduction	407
Data dictionary – structure.....	408
Querying data dictionary	411
List of tables owned actual user.....	411

List of table attributes	411
Get attribute data type and characteristics	411
Get system identifier and definition of the primary key	413
Get system identifier and definition of the foreign key	414
Listing triggers for a particular table	415
Listing developed methods (procedures, functions)	416
Managing sequences	419
Practice	421
Lab 15 – Reports	423
Overview	423
Environment settings, background	424
Filtering, sorting	430
Hidden columns	437
Binding multiple reports – Master – Child	438
Chart reports	446
Pie chart type reports	450
Line type reports	453
Three-dimensional (3D) chart types	459
Binding multiple reports of various types	461
Exports	462
CSV format	463
Delimited format	465
Text format	466
Excel format	467
XML format	469
JSON format	470
HTML format	472
Script format (Insert)	476
Summary	479
References	481
Abbreviations	485
Index	489
Appendix A – Model Student	497
Table PERSONAL_DATA	497
Table STUDENT	500
Table STUDY SUBJECTS	503
Table ST_FIELD	506
Table SUBJECT	508
Table TEACHER	510
Table SUBJECT_YEAR	512
Table ST_PROGRAM	514
Table CONTACT	517
Appendix B – Model Flight	519
Table L_PERSON	519
Table L_FLIGHT TICKET	521
Table L_CLASS	524
Table L_FLIGHT	526

Table L_PLANE.....	529
Table L_EMPLOYEE	531
Table L_AIRPORT.....	534
Table L_PLANE_TYPE.....	536
Table L_COUNTRY	538
Table L_TOWN.....	539
Table L_AIR_COMPANY	541
Appendix C – Model Library.....	543
Table K_PERSON.....	543
Table K_READER	546
Table K_RENT_BOOKS	548
Table K_BOOK.....	550
Table K_TITLE	552
Table K_AUTHOR.....	554
Table K_AUTHORS_OF_BOOK	556
Appendix D – Syntax.....	559
Appendix E – File management	567

For the memories of professor *Karol Matiaško*, who took care of deepening students' knowledge in the field of database technologies at the Faculty of Management Science and Informatics (University of Žilina). He always paid attention to the quality and availability of study literature and technological innovations. He initiated the creation of this book.