

Advanced PLSQL 11g Index

Section	Title	Page
One	Advanced PL/SQL 11g Introduction	2
	- Introduction	3
Two	Loop Processing in PLSQL	4
	- Iterative Processing in PLSQL	5
	- Basic Looping in PLSQL	6
	- While Looping in PLSQL	10
	- For Looping in PLSQL	13
	- Using Dates in For Loops in PLSQL	17
	- Using Characters in For Loops in PLSQL	18
	- Implicit Cursor For Looping in PLSQL	19
	- Explicit Cursor For Looping in PLSQL	22
	- Using other Loops with Explicit Cursors	24
	- Loop Labels in PLSQL	27
	- Loop Continue and Continue When in PLSQL	29
	- <i>Exercise One</i>	33
Three	Advanced PLSQL 11g Techniques	37
	- Defining Sub-Blocks in PLSQL	38
	- Variables in PLSQL	44
	- Quoted Identifier Variables in PLSQL	45
	- Numeric Variables in PLSQL	48
	- Number Variables in PLSQL	49
	- Decimal Variables in PLSQL	52
	- Integer Variables in PLSQL	53
	- PLS_Integer Variables in PLSQL	54
	- Binary_Integer Variables in PLSQL	55
	- Natural Variables in PLSQL	56
	- Naturaln Variables in PLSQL	57
	- Positive Variables in PLSQL	58
	- Positiven Variables in PLSQL	59
	- Signtype Variables in PLSQL	60
	- Simple_Integer Variables in PLSQL	61
	- Defining Constants in PLSQL	62
	- Using %Rowtype in PLSQL	64
	- Declaring a Variable as a %Rowtype	65
	- Referencing a %Rowtype Variable	66
	- Populating a Variable which is a %Rowtype	67
	- Passing a %Rowtype between Processes	70
	- Declaring a Cursor %Rowtype	72
	- Using Sequences in PLSQL 11g	75
	- Using Savepoints in a PLSQL process	76
	- Example of Savepoints in a PLSQL process	77
	- Timestamps and Intervals in PLSQL	78
	- Timestamp Variables in PLSQL	79
	- Timestamp in PLSQL	81
	- Populating Timestamps in PLSQL	84

Advanced PLSQL 11g Index

Section	Title	Page
	- Using Extract in PLSQL	86
	- Timestamp with Time Zone	87
	- Timestamp Time Zone and Extract	90
	- Using sys_extract_utc to Normalise Timestamps	91
	- Using the To_Timestamp_TZ function	92
	- Using the From_TZ function	94
	- Timestamp with Local Time Zone	96
	- Intervals	98
	- Populating Year to Month Intervals	101
	- Populating Day to Second Intervals	102
	- Using Intervals in PLSQL	103
	- Using Intervals with Extract in PLSQL	108
	- Populating Intervals using Timestamps	109
Four	Case Statements and Case Expressions	110
	- Introduction	111
	- Using Searched Case in PLSQL	112
	- Using Case in PLSQL	113
	- Using Nested Case in PLSQL	114
	- Using Case Expressions in PLSQL	116
	- Using Nullif in PLSQL	120
	- Using Coalesce in PLSQL	121
	- <i>Exercise Two</i>	122
Five	Advanced Cursors in Oracle 11g	125
	- For Update with Explicit Cursors	126
	- Where Current Of Explicit Cursors	127
	- Example of Updating with Explicit Cursors	128
	- Using Nowait with Explicit Cursors	129
	- Using Skip Locked with Explicit Cursors	130
	- Using Wait with an Explicit Cursor	131
	- Using Rowid with Explicit Cursors	132
	- Using Returning Into in PLSQL	133
	- Ref Cursors in PLSQL	136
	- Strongly Typed Ref Cursors in PLSQL	137
	- Weakly Typed Ref Cursors in PLSQL	139
	- Sys_refcursor in PLSQL	140
	- Using Sys_Refcurors with SQL	142
	- Using Rowtype for DML	146
Six	Error Handling in PLSQL 11g	148
	- Exceptions in PLSQL	149
	- Testing for Exceptions in PLSQL	150
	- Informing the User of the Error	152
	- Raise_Application_Error Parameters	154
	- Oracle Defined Exceptions	155
	- Access_into_Null (ORA-06530)	156
	- Case_Not_Found (ORA-06592)	158

Advanced PLSQL 11g Index

Section	Title	Page
	- Collection_Is_Null (ORA-06531)	159
	- Cursor_Already_Open (ORA-06511)	161
	- Dup_Val_On_Index (ORA-00001)	162
	- Invalid_Cursor (ORA-01001)	163
	- Invalid_Number (ORA-01722)	164
	- Login_Denied (ORA-01017)	165
	- No_Data_Found (ORA-01403)	167
	- Not_Logged_On (ORA-01012)	168
	- Program_Error (ORA-06501)	169
	- Rowtype_Mismatch (ORA-06504)	170
	- Self_is_Null (ORA-30625)	172
	- Storage_Error (ORA-06500)	175
	- Subscript_Beyond_Count (ORA-06533)	176
	- Subscript_outside_limit (ORA-06532)	177
	- Sys_Invalid_Rowid (ORA-01410)	179
	- Timeout_On_Resource (ORA-00051)	180
	- Too_Many_Rows (ORA-01422)	181
	- Value_Error (ORA-06502)	182
	- Zero_Divide (ORA-01476)	183
	- Others	184
	- Raising User Defined Exceptions in PLSQL	185
	- Pragma Exceptions in PLSQL	188
	- Alternative Way to Handle SQL Errors in PLSQL	190
	- Handling SQL Errors in PLSQL	191
	- Advanced SQLerrm	193
	- Nesting Exceptions in PLSQL	194
	- Re-Raising Exceptions in PLSQL	197
	- Handling Exceptions in Sub-Processes in PLSQL	199
	- Using Nocopy When Declaring Processes	203
	- Using DBMS_UTILITY Functions	207
	- Using DBMS_UTILITY.FORMAT_ERROR_STACK	208
	- Using DBMS_UTILITY.FORMAT_BACKTRACE	209
Seven	PL/SQL Database Objects	212
	- PLSQL Objects	213
	- Compiling PLSQL Objects	214
	- Metadata For PLSQL Objects	215
	- Re-Compiling PLSQL Objects	216
	- Dropping PLSQL Objects	218
	- Passing Parameters in PLSQL	219
	- Passing Parameters using Positional Notation	220
	- Passing Parameters Using Named Notation	222
	- Using Mixed Notation in SQL	223
	- Metadata (User_Source)	225
	- Describing PLSQL Objects in SQL PLUS	226

Advanced PLSQL 11g Index

Section	Title	Page
Eight	Programmer Defined Functions	227
	- Syntax of Functions in Oracle	228
	- Suggested Naming Convention of Functions in Oracle	231
	- Function Example in PLSQL	232
	- Running Functions in Oracle	233
Nine	Programmer Defined Procedures	235
	- Syntax of Procedures in Oracle	236
	- Example of Procedures in Oracle	238
	- Executing Procedures in Oracle within SQLPLUS	239
	- Executing Procedures in Oracle within PLSQL	240
	- <i>Exercise Three</i>	241
Ten	Packaging Programmer Defined Programs	247
	- Syntax of Packages in Oracle	248
	- Compiling of Packages in Oracle	253
	- Private Processes in PLSQL Packages	254
	- Executing Packages in Oracle	256
	- Handling Exceptions in Packages in PLSQL	257
Eleven	DML Triggers in Oracle	259
	- Oracle Triggers Introduction	260
	- DML Triggers Introduction	261
	- DML Triggers Timing Points	264
	- DML Triggers When Conditions	265
	- DML Triggers When Conditions Examples	266
	- DML Triggers Suggested Naming Conventions	268
	- Syntax of DML Triggers in PLSQL	270
	- Referencing Values within Triggers	271
	- Checking the Event which fired the DML Trigger	275
	- Using the Follows syntax to dictate Trigger Firing	277
	- Using the Disable syntax when Compiling Triggers	282
	- Enabling/Disabling Triggers in an Oracle Database	283
	- Metadata for Triggers (User_Triggers)	285
- Mutating DML Triggers in Oracle	286	
Twelve	Instead Of Triggers	290
	- Introduction to Instead Of Triggers	291
	- Syntax of an Instead Of Trigger in Oracle	294
	- Example of an Instead Of Trigger	296
	- Deleting Records in Oracle using an Instead Of	304
	- Using Follows in an Instead Of Trigger	305
Thirteen	Compound Triggers	306
	- Introduction to Compound Triggers	307
	- Syntax for Table Compound Triggers	309
	- Declaration Section	310
	- Timing Points	311
	- BEFORE STATEMENT	312
	- BEFORE EACH ROW	313

Advanced PLSQL 11g Index

Section	Title	Page
	- AFTER EACH ROW	314
	- AFTER STATEMENT	315
	- Compound Triggers for Views	316
Fourteen	System Triggers	317
	- Introduction to System Triggers	318
	- Syntax for System Triggers in Oracle	319
	- System Event Triggers	320
	- User Event Triggers	321
	- Schema Event Triggers	325
	- Database Level Attributes for System Triggers	331
	- <i>Exercise Four</i>	332
Fifteen	Using Contexts	341
	- Introduction	342
	- Attributes	343
	- User Defined	351
	- Creating Contexts	352
	- Creating a Package for a Context	353
	- Creating a Context	354
	- Populating a Context	355
	- Accessing a Context	356
	- Listing Contents of a Context	357
	- Deleting Contents of a Context	359
	- Changing Context Behaviour	361
Sixteen	Subprogram Inlining	362
	- Introduction	363
	- Pragma Inline	364
	- Example of Inlining	365
	- Inlining Usage	370
	- Conclusion	372
Seventeen	PLSQL Compiler	373
	- Introduction	374
	- Warning Levels	375
	- Enabling/Disabling Warning Levels	376
	- Using the Alter Session	377
	- Using the Error option	380
	- Using DBMS_WARNING Package	382
	- Using DBMS_WARNING.GET_CATEGORY	383
	- Severe Category Errors	384
	- Informational Category Errors	386
	- Performance Category Errors	388
	- Oracle Error Messages	389
	- Using dbms_warning.set_warning_setting_string	390
	- Using dbms_warning.set_warning_setting_num	391
	- Using dbms_warning.set_warning_setting_cat	392
	- USER_PLSQL_OBJECT_SETTINGS	393

Advanced PLSQL 11g Index

Section	Title	Page
	- Re-Compiling with same Warning settings	395
	- PLSQL_OPTIMIZE_LEVEL	396
	- Optimize Levels	397
	- Timing Optimization with dbms_utility.get_cpu_time	398
	- Optimize Levels in user_plsql_object_settings	404
	- Re-Compiling with same Optimize settings	405
	- High Level Optimization without Pragma Inline	406
Eighteen	Conditional Compilation in PLSQL	408
	- Introduction	409
	- Dbms_preprocessor	411
	- Compiling using PLSQL_CCFLAGS	412
	- PLSQL_CCFLAGS in PLSQL	414
	- Using \$error Directive	422
	- Using Constants with CCFlags	424
	- \$\$PLSQL_CODE_TYPE	425
	- Oracle Compilation Modes	426
	- \$\$PLSQL_OPTIMIZE_LEVEL	427
	- \$\$PLSQL_LINE	428
	- \$\$PLSQL_UNIT	429
	- DBMS_DB_VERSION	430
	- Setting Session CCFlags	432
	- Plsql_ccflags in user_plsql_object_settings	433
	- Plsql_ccflags in Triggers	434
Nineteen	Regular Expressions in PLSQL (Regex)	436
	- Introduction	437
	- Using REGEXP_LIKE in Where Clauses	439
	- Case Sensitivity	441
	- Line Anchors	442
	- Using the Dot (Any Character)	444
	- Counting Characters {Intervals}	447
	- Character Lists	451
	- Excluding Character Lists	455
	- Alternatives to Character Lists	456
	- Class Shorthands	459
	- Or Patterns (Alternatives)	460
	- Or Patterns with Character Lists	461
	- Using the Question Mark (Optional)	462
	- Using the Plus sign (Mandatory)	465
	- Using the Star sign (Optional)	467
	- Backreferencing	468
	- POSIX	470
	- Using POSIX in Oracle - [:upper] example	472
	- Using POSIX in Oracle - [:digit] example	473
	- Using POSIX in Oracle – Character equivalents	474
	- Using Regexp_like in PLSQL	475

Advanced PLSQL 11g Index

Section	Title	Page
	- Using Regexp_count in PLSQL	478
	- Using Regexp_replace in PLSQL	482
	- Using Regexp_instr in PLSQL	484
	- Using Regexp_substr in PLSQL	486
	- Using Regular Expressions in Oracle	488
Twenty	Using Alternative Quoting Mechanism in PLSQL	489
	- Introduction	490
	- Using Alternative Quoting Mechanism	491
	- <i>Exercise Five</i>	492
Twenty One	File I/O	497
	- Reading and Writing from the Operating System in PLSQL	498
	- Accessing the File System using Directories	499
	- Creating Directories	500
	- Simple Write using UTL_FILE.PUT_LINE	502
	- Simple Read using UTL_FILE.GET_LINE	503
	- Additional Functions in the UTL_FILE Package	504
	- Using UTL_FILE.PUTF in PLSQL	505
	- UTL_FILE Exceptions	507
	- Using UTL_FILE to perform Operating System Commands	509
	- Using UTL_FILE.Fcopy in PLSQL	510
	- Using UTL_FILE.Fgetattr in PLSQL	511
	- Using UTL_FILE.Fremove in PLSQL	512
	- Using UTL_FILE.Frename in PLSQL	513
Twenty Two	Working with Clobs and Blobs in PLSQL	514
	- Introduction	515
	- Creation of Clobs in Tables	516
	- Using Clobs in PLSQL	517
	- Inserting Clobs into the Database using PLSQL	518
	- Writing Clobs to the Filesystem using PLSQL	522
	- Introduction to Blobs	523
	- Inserting Blobs into the Database using PLSQL	524
	- Writing Blobs into the Filesystem using PLSQL	525
	- DBMS_LOB exceptions	528
Twenty Three	DBMS_Metadata	530
	- Generating Database Object Scripts	531
	- List of Object Types	532
	- Example of Using DBMS_Metadata	533
Twenty Four	Sub-programming Techniques	535
	- Introduction	536
	- Example	537

Advanced PLSQL 11g Index

Section	Title	Page
Twenty Five	Encrypting Code	539
	- Introduction	540
	- Using Wrap.exe to encrypt processes in Oracle	541
	- Example of using Wrap.exe to encrypt processes	544
	- Using DBMS_DDL.CREATE_WRAPPED Function	546
Twenty Six	Object Orientated Programming	550
	- Introduction	551
	- Definition of Objects	552
Twenty Seven	Row Objects	556
	- Introduction	557
	- Creating	558
	- Metadata	559
	- Data	560
	- Indexes	561
	- Views	563
	- Removing	564
	- OIDs	566
Twenty Eight	Column Objects	573
	- Introduction	574
	- Describing	575
	- Inserting into	578
	- Selecting from	580
	- Updating	585
	- Object Views	586
Twenty Nine	Defining Processes within Objects	588
	- Introduction	589
	- Defining Methods	590
	- Member Methods	592
	- Map Methods	599
	- Order Methods	601
	- Constructor Methods	607
Thirty	PLSQL Data Structures and Collections	611
	- Programmer Defined Records	612
	- Nested Programmer Defined Records	616
	- Varrays in PLSQL	618
	- Using Varrays in Loops	621
	- Populating Varrays	622
	- Extending Varrays	623
	- Deleting from Varrays	625
	- Varrays and Tables	626
	- Multilevel Varrays	629

Advanced PLSQL 11g Index

Section	Title	Page	
Thirty One	Associate Arrays (Index by Tables)	632	
	-	Introducing Associate Arrays in PLSQL	633
	-	Declaring PLSQL Tables	635
	-	Populating PLSQL Tables	636
	-	Using Count with PLSQL Tables	638
	-	Using Delete with PLSQL Tables	639
	-	Using Exists with PLSQL Tables	640
	-	Using First/Last with PLSQL Tables	641
	-	Using Next/Prior with PLSQL Tables	642
	-	Using Varchar2 as an index with a PLSQL Table	643
	-	Multi-Level PLSQL Table	647
	-	Nested PLSQL Table	648
	-	Cardinality with Nested Table	651
	-	Tidying Nested PLSQL Tables using Set	652
	-	Nested PLSQL Tables using Set	653
	-	Trimming Nested PLSQL Tables	655
	-	Multi-Level Nested PLSQL Tables	657
Thirty Two	Collection Comparisons	658	
	-	Introduction	659
	-	Check for Equality	660
	-	Using IN with a Nested Table	663
	-	Using Member Of with a Nested Table	664
	-	Using Is Empty with a Nested Table	665
	-	Multiset Union	666
	-	Multiset Union Distinct	668
	-	Multiset Intersect	669
	-	Multiset Except	670
	-	Submultiset	671
	-	Not Submultiset	672
-	Not Submultiset Alternative	673	
-	<i>Exercise Six</i>	674	
Thirty Three	Bulk SQL in PLSQL	677	
	-	Introduction to Bulk Processing	678
	-	Bulk Binding in PLSQL	679
	-	Bulk Binding in PLSQL Using Associate Arrays	680
	-	Bulk Binding in PLSQL Using Varrays	681
	-	Bulk Binding in PLSQL Using Nested Tables	682
	-	Forall with Save Exceptions	683
	-	Forall with SQL%BULKEXCEPTIONS	685
	-	Forall with Indices Of	688
	-	Forall with Values Of	690
	-	Bulk Collect with Implicit Cursors (Varray)	691
	-	Bulk Collect with Implicit Cursors (Associative Array)	692

Advanced PLSQL 11g Index

Section	Title	Page
	- Bulk Collect with Implicit Cursors (Nested Table)	693
	- Bulk Collect with Explicit Cursors	694
	- Bulk Collect and Returning in PLSQL	695
	- Problems with Bulk Processing in PLSQL	698
	- Bulk Processing and Limit in PLSQL	699
Thirty Four	Invoker Rights in PLSQL	700
	- The need to use Invoker Rights	701
	- Example of Invoker Rights	702
	- Using AUTHID in PLSQL	705
Thirty Five	Overloading Modules in PLSQL	708
	- Introduction	709
	- Example	710
	- User_Procedures	714
Thirty Six	Forward Declaration	715
Thirty Seven	Autonomous Transactions in PLSQL	718
	- Introduction	719
	- Example of an Autonomous Transaction	721
	- Rollback in Autonomous Transactions	728
	- Using Autonomous Transactions in Triggers	729
Thirty Eight	Advanced Use of Packages	731
	- Introduction	732
	- Defining Explicit Cursors in Packages	733
	- Flexible Explicit Cursors in Packages	737
	- Passing Parameters Using Packages	740
	- Using PLSQL Tables as Parameters	743
	- Global Variables using Packages	747
	- Public and Private Variables in Packages	753
Thirty Nine	Dynamic SQL	755
	- Introduction to Dynamic SQL	756
	- Native Dynamic SQL (NDS) with Execute Immediate	757
	- NDS Error Handling	760
	- NDS with Inputs	761
	- NDS with Output	763
	- Dynamic Cursors and Sys_Refcursor	764
	- NDS with Outputs	766
	- Introduction to DBMS_SQL	767
	- DBMS_SQL.Example	768
	- <i>Exercise Seven</i>	769