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Database Programming with PL/SQL

3-4

Using Transaction Control Statements

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Objectives

- This lesson covers the following objectives:
 - Define a transaction and provide an example
 - Construct and execute a transaction control statement in PL/SQL
 - Since Oracle Application Express automatically commits changes, the following information will be presented as if you were issuing the commands in an installed/local environment with the ability to use COMMIT and ROLLBACK

Purpose

- In this lesson, you learn how to include transaction control statements such as COMMIT, ROLLBACK, and SAVEPOINT in PL/SQL
- Transactions often have multiple parts or steps
- If something happens to prevent, say, the third step from completing, database integrity is maintained because steps one and two didn't actually change the database because a COMMIT statement was never issued
- ROLLBACK and SAVEPOINT statements give you additional control in processing transactions

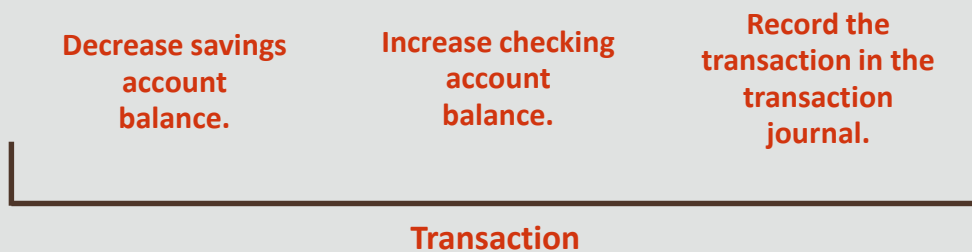
Database Transaction

- A transaction is an inseparable list of database operations that must be executed either in its entirety or not at all
- Transactions maintain data integrity and guarantee that the database is always in a consistent state



Example of a Transaction

- To illustrate the concept of a transaction, consider a banking database
- When a bank customer transfers money from a savings account to a checking account, the transaction can consist of three separate operations:



Example of a Transaction

- What would happen if there were insufficient funds in the savings account?
- Would the funds still be added to the checking account?
- Would an entry be logged in the transaction journal?

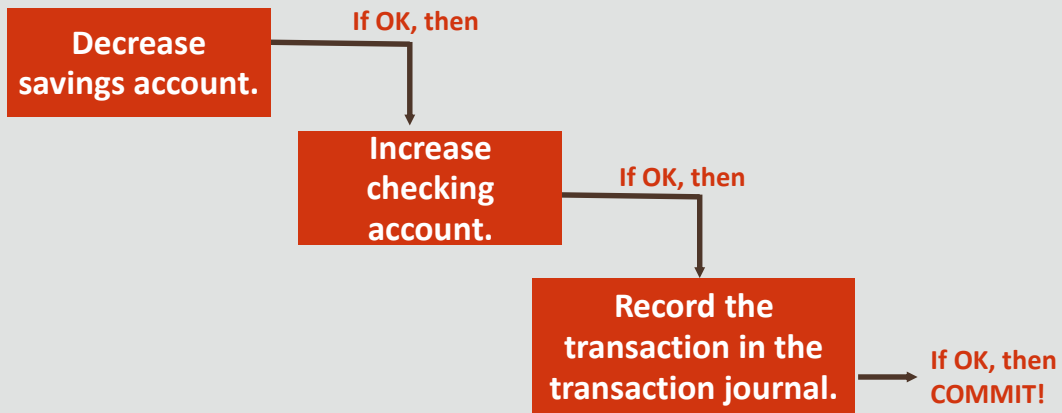
Example of a Transaction

- What do you think should happen?

Decrease savings account balance.	<pre>UPDATE savings_accounts SET balance = balance - 500 WHERE account = 3209;</pre>
Increase checking account balance.	<pre>UPDATE checking_accounts SET balance = balance + 500 WHERE account = 3208;</pre>
Record the transaction in the transaction journal.	<pre>INSERT INTO journal VALUES (journal_seq.NEXTVAL, '1B' 3209, 3208, 500);</pre>

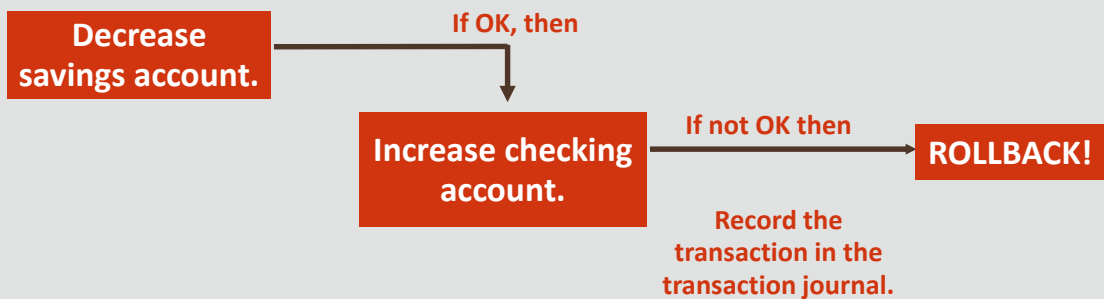
Example of a Transaction

- If all three SQL statements can be performed to maintain the accounts in proper balance, the effects of the transaction can be committed, or applied to the database tables



Example of a Transaction

- However, if a problem, such as insufficient funds, invalid account number, or a hardware failure prevents one or two of the statements in the transaction from completing, the entire transaction must be rolled back (reversed out) so that the balance of all accounts is correct.



Transaction Control Statements

- You use transaction control statements to make the changes to the database permanent or to discard them
- The three main transaction control statements are:
 - COMMIT
 - ROLLBACK
 - SAVEPOINT
- The transaction control commands are valid in PL/SQL and therefore can be used directly in the executable or exception section of a PL/SQL block

Remember, in the online, iAcademy Application Express environment, all statements are automatically committed. This will not be the case with databases in a production environment.

COMMIT

- COMMIT is used to make the database changes permanent
- If a transaction ends with a COMMIT statement, all the changes made to the database during that transaction are made permanent

```
BEGIN
  INSERT INTO pairtable VALUES (1, 2);
  COMMIT;
END;
```

- The keyword END signals the end of a PL/SQL block, not the end of a transaction
- A transaction may include multiple PL/SQL blocks and nested PL/SQL blocks

ROLLBACK

- ROLLBACK is for discarding any changes that were made to the database after the last COMMIT
- If the transaction fails, or ends with a ROLLBACK, then none of the statements take effect
- In the example, only the second INSERT statement adds a row of data

```
BEGIN
  INSERT INTO pairtable VALUES (3, 4);
  ROLLBACK;
  INSERT INTO pairtable VALUES (5, 6);
  COMMIT;
END;
```

ROLLBACK and SAVEPOINT are useful commands, and a major component of real-world database programming. They are used to restore the data to its original values, when and if, the transaction cannot complete all of its steps.

SAVEPOINT

- SAVEPOINT is used to mark an intermediate point in transaction processing
- ROLLBACK is used to return the data values to the point of a SAVEPOINT

```
BEGIN
  INSERT INTO pairtable VALUES (7, 8);
  SAVEPOINT my_sp_1;
  INSERT INTO pairtable VALUES (9, 10);
  SAVEPOINT my_sp_2;
  INSERT INTO pairtable VALUES (11, 12);
  ROLLBACK to my_sp_1;
  INSERT INTO pairtable VALUES (13, 14);
  COMMIT;
END;
```

SAVEPOINTS are useful in application programs. If a procedure contains several functions, then you can create a SAVEPOINT before each function begins. Then, if a function fails, it is easy to return the data to its state before the function began and re-run the function with revised parameters or perform a recovery action.

Terminology

- Key terms used in this lesson included:
 - COMMIT
 - END
 - ROLLBACK
 - SAVEPOINT
 - Transaction

- COMMIT – Statement used to make database changes permanent.
- END – Keyword used to signal the end of a PL/SQL block, not the end of a transaction.
- ROLLBACK – Used for discarding any changes that were made to the database after the last COMMIT.
- SAVEPOINT – Used to mark an intermediate point in transaction processing.
- Transaction – An inseparable list of database operations, which must be executed either in its entirety or not at all.

Summary

- In this lesson, you should have learned how to:
 - Define a transaction and provide an example
 - Construct and execute a transaction control statement in PL/SQL

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