Connect to sys:

Sqlplus / as SYSDBA

Create a pluggable database:

CREATE PLUGGABLE DATABASE WEEK6PDB ADMIN USER lab IDENTIFIED BY userpass ROLES=(DBA) FILE\_NAME\_CONVERT=('PDBSEED','WEEK6PDB');

ALTER PLUGGABLE DATABASE WEEK6PDB OPEN;

--connect to system of week6pdb

CONNECT system/password@localhost/WEEK6PDB

CREATE USER week6 identified by userpass;

GRANT DBA TO week6;

Using sqldeveloper to connect to week6:

From Sqldeveloper, open two **independent** session (Ctrl + Shift + N), called session A and session B.

1. **Locks, blocks and deadlocks**
2. Blocked Inserts

|  |  |  |
| --- | --- | --- |
| **T** | **Session A** | **Session B** |
|  | CREATE TABLE TEST (ID NUMBER **PRIMARY KEY**, NAME VARCHAR2(50), NOTE VARCHAR2(1000)); |  |
|  | SELECT \* FROM TEST; | SELECT \* FROM TEST; |
|  | INSERT INTO TEST VALUES (1, 'HELLO', NULL); |  |
|  |  | INSERT INTO TEST VALUES (1, 'GOODBYE', NULL); |
|  | --See what session is blocking other session? | |
|  | COMMIT; | --See what’s happening in session B |
|  | SELECT \* FROM TEST; | SELECT \* FROM TEST; |

|  |  |  |
| --- | --- | --- |
| **T** | **Session A** | **Session B** |
|  | INSERT INTO TEST VALUES (2, 'HELLO SESSION A', NULL); |  |
|  |  | INSERT INTO TEST VALUES (2, 'HELLO SESSION B', NULL); |
|  | --See what session is blocking other session? | |
|  | ROLLBACK; | --See what’s happening in session B |
|  |  | COMMIT; |
|  | SELECT \* FROM TEST; | SELECT \* FROM TEST; |

1. Blocked Updates, Deletes

|  |  |  |
| --- | --- | --- |
| **T** | **Session A** | **Session B** |
|  | INSERT INTO TEST VALUES (3, 'JOHN', NULL);  COMMIT; |  |
|  | UPDATE TEST SET NOTE='UPDATED BY SESSION A' WHERE ID=3; |  |
|  |  | UPDATE TEST SET NOTE='UPDATED BY SESSION B' WHERE ID=3; |
|  | --See what session is blocking other session? | |
|  | COMMIT; | --See what’s happening in session B |
|  |  | COMMIT; |
|  | SELECT \* FROM TEST; | SELECT \* FROM TEST; |

|  |  |  |
| --- | --- | --- |
| **T** | **SESSION A** | **SESSION B** |
|  | INSERT INTO TEST VALUES (4, 'SAMSUNG', NULL);  COMMIT; |  |
|  | SELECT \* FROM TEST; | SELECT \* FROM TEST; |
|  | UPDATE TEST SET NAME='APPLE' WHERE ID=4; |  |
|  |  | DELETE FROM TEST WHERE ID=4; |
|  | --See what session is blocking other session? | |
|  | COMMIT; | --See what’s happening in session B |
|  |  | COMMIT; |
|  | SELECT \* FROM TEST; | SELECT \* FROM TEST; |

|  |  |  |
| --- | --- | --- |
| **T** | **SESSION A** | **SESSION B** |
|  | INSERT INTO TEST VALUES (5, 'TIKI', NULL);  COMMIT; |  |
|  | SELECT \* FROM TEST; | SELECT \* FROM TEST; |
|  | DELETE FROM TEST WHERE ID=5; |  |
|  |  | UPDATE TEST SET NAME='LAZADA' WHERE ID=5; |
|  | --See what session is blocking other session? | |
|  | ROLLBACK; | --See what’s happening in session B |
|  |  | COMMIT; |
|  | SELECT \* FROM TEST; | SELECT \* FROM TEST; |

1. **SELECT FOR UPDATE**

|  |  |  |
| --- | --- | --- |
| **T** | **SESSION A** | **SESSION B** |
|  | DELETE FROM TEST;  INSERT INTO TEST VALUES (6, 'FAHASA', NULL);  COMMIT; |  |
|  | SELECT \* FROM TEST; | SELECT \* FROM TEST; |
|  | UPDATE TEST SET NOTE='HELLO FAHASA' WHERE ID=6; |  |
|  |  | SELECT \* FROM TEST WHERE ID=6 **FOR UPDATE**; |
|  |  | --See what’s happening in session B. |
|  | COMMIT; |  |
|  |  | --See what’s happening in session B. |
|  | UPDATE TEST SET NOTE='UPDATED BY SESSION A' WHERE ID=6; |  |
|  |  | COMMIT; |
|  | COMMIT; |  |

1. **SELECT FOR UPDATE NOWAIT**

|  |  |  |
| --- | --- | --- |
| **T** | **SESSION A** | **SESSION B** |
|  | INSERT INTO TEST VALUES (7, 'LENOVO', NULL);  COMMIT; |  |
|  | UPDATE TEST SET NOTE='HELLO LENOVO' WHERE ID=7; |  |
|  |  | SELECT \* FROM TEST WHERE ID=7 FOR UPDATE NOWAIT; |
|  |  | --See what’s happening in session B. |
|  | COMMIT; |  |

1. TX Lock, TM Locks

|  |  |  |
| --- | --- | --- |
| **T** | **SESSION A** | **SESSION B** |
|  | INSERT INTO TEST VALUES (8, 'FORD', NULL);  COMMIT; |  |
|  | SELECT \* FROM TEST; | SELECT \* FROM TEST; |
|  | UPDATE TEST SET NOTE='HELLO FORD' WHERE ID=8;  --(WHICH LOCK HERE: TX? TM LOCK?) |  |
|  |  | ALTER TABLE TEST ALTER COLUMN NOTE VARCHAR2(200);  --See what’s happening in session B. |
|  | COMMIT; | --See what’s happening in session B. |
|  | UPDATE TEST SET NOTE='HELLO FORD' WHERE ID=8; |  |
|  |  | DELETE FROM TEST WHERE ID=8;  --See what’s happening in session B. |
|  | COMMIT; | --See what’s happening in session B. |
|  |  | COMMIT; |

1. DEADLOCK

|  |  |  |
| --- | --- | --- |
| **T** | **SESSION A** | **SESSION B** |
|  | DELETE FROM TEST;  INSERT INTO TEST VALUES (90, 'RESOURCE 1', NULL);  INSERT INTO TEST VALUES (91, 'RESOURCE 2', NULL);  COMMIT; |  |
|  | SELECT \* FROM TEST; | SELECT \* FROM TEST; |
|  | UPDATE TEST SET NOTE='HELLO RESOURCE 1' WHERE ID=90; | UPDATE TEST SET NOTE='HELLO RESOURCE 2' WHERE ID=91; |
|  | DELETE FROM TEST WHERE ID=91; | DELETE FROM TEST WHERE ID=90; |
|  | --SEE WHAT’S HAPPENING? | |

1. Working with pl/sql

Account script:

DROP TABLE accounts;

CREATE TABLE accounts (accid NUMBER(6) primary key,

balance NUMBER (10,2),

check (balance>=0));

INSERT INTO accounts VALUES (7715, 7000);

INSERT INTO accounts VALUES (7720, 5100);

INSERT INTO accounts VALUES (7725, 20);

INSERT INTO accounts VALUES (7730, 49);

COMMIT;

|  |  |
| --- | --- |
| accid | balance |
| 7715 | 7000 |
| 7720 | 5100 |
| 7725 | 20 |
| 7730 | 49 |

Open two session (Ctrl + Shift + N) and do the following things.

SESSION 1: Transfer money ($500) from account 7715 to 7720

SESSION 2: Transfer money ($800) from account 7715 to 7725

|  |  |
| --- | --- |
| acc 7715: -500$ |  |
|  | Acc 7715: -800$ |
| Acc 7720: +500$ | Acc 7725: +800$ |

|  |  |  |
| --- | --- | --- |
| **T** | **Session 1** | **Session 2** |
|  | select \* from accounts; | select \* from accounts; |
|  | begin  update accounts  set balance=balance-500  where accid=7715;  **dbms\_lock.sleep(15);**  update accounts  set balance=balance+500  where accid=7720;  commit;  end; | begin  update accounts  set balance=balance-800  where accid=7715;    update accounts  set balance=balance+800  where accid=7725;  commit;  end; |
|  | select \* from accounts; | select \* from accounts; |
|  | Explain the results | |

1. Rerun the Account script:

|  |  |
| --- | --- |
| accid | balance |
| 7715 | 7000 |
| 7720 | 5100 |
| 7725 | 20 |
| 7730 | 49 |

Open two session (Ctrl + Shift + N) and do the following things.

SESSION 1: Transfer money ($5000) from account 7715 to 7720

SESSION 2: Transfer money ($5000) from account 7715 to 7725

|  |  |
| --- | --- |
| acc 7715: -5000$ |  |
|  | Acc 7715: -5000$ |
| Acc 7720: +5000$ | Acc 7725: +5000$ |

|  |  |  |
| --- | --- | --- |
| **T** | **Session 1** | **Session 2** |
|  | select \* from accounts; | select \* from accounts; |
|  | begin  update accounts  set balance=balance-5000  where accid=7715;  **dbms\_lock.sleep(15);**  update accounts  set balance=balance+5000  where accid=7720;  commit;  end; | begin  update accounts  set balance=balance-5000  where accid=7715;    update accounts  set balance=balance+5000  where accid=7725;  commit;  end; |
|  | select \* from accounts; | select \* from accounts; |
|  | Explain the results | |

1. Rerun the Account script:

|  |  |
| --- | --- |
| accid | balance |
| 7715 | 7000 |
| 7720 | 5100 |
| 7725 | 20 |
| 7730 | 49 |

Open two session (Ctrl + Shift + N) and do the following things.

SESSION 1: Transfer money ($500) from account 7715 to 7720

SESSION 2: Transfer money ($300) from account 7720 to 7725

|  |  |
| --- | --- |
| acc 7715: -500$ |  |
|  | Acc 7720: -300$ |
| Acc 7720: +500$ | Acc 7725: +300$ |

|  |  |  |
| --- | --- | --- |
| **T** | **Session 1** | **Session 2** |
|  | select \* from accounts; | select \* from accounts; |
|  | begin  update accounts  set balance=balance-500  where accid=7715;  **dbms\_lock.sleep(10);**  update accounts  set balance=balance+500  where accid=7720;  commit;  end; | begin  update accounts  set balance=balance-300  where accid=7720;  update accounts  set balance=balance+300  where accid=7725;  commit;  end; |
|  | select \* from accounts; | select \* from accounts; |
|  | Explain the results | |

1. Rerun the Account script

|  |  |
| --- | --- |
| Accid | balance |
| 7715 | 7000 |
| 7720 | 5100 |
| 7725 | 20 |
| 7730 | 49 |

Open two session (Ctrl + Shift + N) and do the following things.

Transfer money ($2000) from account 7715 to 7720

Transfer money ($1000) from account 7720 to 7715

|  |  |
| --- | --- |
| acc 7715: -2000$ |  |
|  | Acc 7720: -1000$ |
| Acc 7720: +2000$ | Acc 7715: +1000$ |

|  |  |  |
| --- | --- | --- |
| **T** | **Session 1** | **Session 2** |
|  | select \* from accounts; | select \* from accounts; |
|  | begin  update accounts  set balance=balance-2000  where accid=7715;  **dbms\_lock.sleep(10);**  update accounts  set balance=balance+2000  where accid=7720;  commit;  end; | begin  update accounts  set balance=balance-1000  where accid=7720;  update accounts  set balance=balance+1000  where accid=7715;  commit;  end; |
|  | select \* from accounts; | select \* from accounts; |
|  | Explain the results | |

1. [Isolation levels](https://stackoverflow.com/questions/13647604/isolation-levels-in-oracle)

|  |  |  |  |
| --- | --- | --- | --- |
| **Isolation Level** | **Dirty Read** | **Non-repeatable Read** | **Phantom Read** |
| Read uncommitted | Possible | Possible | Possible |
| Read committed | Not possible | Possible | Possible |
| Repeatable read | Not possible | Not possible | Possible |
| Serializable | Not possible | Not possible | Not possible |

1. Read committed: **Non-repeatable Read**

Rerun the Account script and delete two account 7725 and 7730:

Delete from accounts where accid=7725 or accid=7730

|  |  |
| --- | --- |
| Accid | balance |
| 7715 | 7000 |
| 7720 | 5100 |

|  |  |  |
| --- | --- | --- |
| **T** | **Session 1** | **Session 2** |
|  | select \* from accounts; | select \* from accounts; |
|  | update accounts  set balance=balance-2000  where accid=7715; |  |
|  |  | select \* from accounts; |
|  | Commit; |  |
|  | select \* from accounts; | select \* from accounts; |

1. Read committed: **Phantom Read**

|  |  |  |
| --- | --- | --- |
| **T** | **Session 1** | **Session 2** |
|  | select \* from accounts  where balance>100; | select \* from accounts  where balance>100; |
|  | INSERT INTO accounts VALUES (7740, 3000);  Commit; |  |
|  |  | select \* from accounts  where balance>100; |

Rerun the Account script and delete two account 7725 and 7730:

Delete from accounts where accid=7725 or accid=7730

|  |  |
| --- | --- |
| Accid | balance |
| 7715 | 7000 |
| 7720 | 5100 |

1. Serializable Isolation Level: **repeatable Read**

|  |  |  |
| --- | --- | --- |
| **T** | **Session 1** | **Session 2** |
|  | COMMIT;  select \* from accounts; | COMMIT;  select \* from accounts; |
|  | update accounts set balance=8000  where accid=7720; | SET TRANSACTION ISOLATION LEVEL SERIALIZABLE;  select \* from accounts; |
|  | COMMIT; |  |
|  |  | select \* from accounts; |
|  |  | update accounts set balance=40  where accid=7720; |
|  | select \* from accounts | select \* from accounts |
|  |  | ROLLBACK; |

1. Serializable Isolation Level**: non-Phantom Read**

|  |  |  |
| --- | --- | --- |
| **T** | **Session 1** | **Session 2** |
|  | select \* from accounts; |  |
|  | INSERT INTO accounts VALUES (7750, 3000); |  |
|  |  | SET TRANSACTION ISOLATION LEVEL SERIALIZABLE;  select \* from accounts; |
|  |  |  |
|  | COMMIT; |  |
|  | select \* from accounts; | select \* from accounts; |
|  |  | update accounts set balance=1111 where accid=**7750**; |
|  |  | INSERT INTO accounts VALUES (**7750**, 8000); |
|  |  | COMMIT; |