Online Trading Platform and Database
Project 2

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Application Description:

Inspired by the self-directed investment service provided by commercial banks such as BMO investorline, the database application our group chose to develop serves for an online trading platform of financial products. The application stores information of available financial products on market and their quotes, and as well allows users to place ask and/or bid orders for their favorable financial products so that users would trade at an agreed price. In addition, this application stores data about its users. For each user, the database keeps records on the activities of one's accounts, including transactions, orders and current holding.

Question 1: Relations:

Company (CName, MarketValue, OutstandingShares)
Exchange (EName, open, close, headquarter, country)
FinancialProduct (FId, EName, CName, Type, Bid, Ask, Volume, Last, ExecutionDate, Dividend, StrikePrice, FuturesPrice, CouponRate, FaceValue)

- CName is the foreign key referencing Company. Since a financial product can be issued by exactly one company, we include the "Issues" relationship set in the table of FinancialProduct and imply the constraint.
- EName is the foreign key referencing Exchange. Since a financial product should list in at least one exchange, we make FId and EName to be primary keys to imply the relationship "Lists".
- Dividend only exists for type "Stock".
- StrikePrice only exists for type "Option".
- FuturesPrice only exists for type "Future".
- FaceValue and CouponRate only exist for type "Bond".

Holds (FId, EName, AId, Cost, HoldingQuantity)

- FId is the foreign key referencing FinancialProduct.
- AId is the foreign key referencing Account.

Watches (UId, FId, EName)

- FId is the foreign key referencing FinancialProduct.
- UId is the foreign key referencing User.

User (UId, Name, BillingAddress)
Consign (FromUId, ToUId, AId)

- FromUId is the foreign key referencing User(UId). (i.e. The consigner)
- ToUId is the foreign key referencing User(UId). (i.e. The consignee)
- AId is the foreign key referencing Account

Account (AId, Cash, PositionValue, UId)

- UId is the foreign key referencing User. Since an account can only owned by a user, we include the "Owns" relationship set in the table of Account and imply the constraint.

Transfer (TId, Amount, FromAId, ToAId)

- FromAId is the foreign key referencing Account(AId).
- ToAId is the foreign key referencing Account(AId).
- Since relationships "To" and "From" are one-to-one everywhere, we include them in the table of Transfer.

Order (OId, BidAsk, Price, Date, Time, Quantity, Status, Aid, FId, EName)

- AId is the foreign key referencing Account. Since every order can only be placed by one account, we include the "Places" relationship set in the table of Order and imply the constraint.
- FId is the foreign key referencing FinancialProduct.
- Status of order should be 1: pending 2: executed 3: cancelled

Question 2: Create Table

```
CREATE TABLE Company(
   CName VARCHAR(50) not null PRIMARY KEY,
   MarketValue INT NOT NULL,
   OutstandingShares INT NOT NULL);

CREATE TABLE Exchange(
   EName VARCHAR(50) not null PRIMARY KEY,
   Open TIME NOT NULL,
   Close TIME NOT NULL,
   Headquarter VARCHAR(30),
   Country VARCHAR(30));

CREATE TABLE FinancialProduct(
   FId INT not null,
   EName VARCHAR(50) not null,
   CName VARCHAR(50) NOT NULL,
   Type VARCHAR(20),
   Bid DECFLOAT(16),
   Ask DECFLOAT(16),
   Volume INT, Last DECFLOAT(16),
   ExecutionDate DATE,
   Dividend DECFLOAT(16),
   StrikePrice DECFLOAT(16),
   FuturesPrice DECFLOAT(16),
   CouponRate DECFLOAT(16),
   FaceValue DECFLOAT(16),
   PRIMARY KEY (FId, Ename),
   FOREIGN KEY (CName) REFERENCES Company,  FOREIGN KEY (EName)
REFERENCES Exchange);

CREATE TABLE User(
   UId INT not null PRIMARY KEY,
   Name VARCHAR(50) NOT NULL,
   BillingAddress VARCHAR(100) NOT NULL);

CREATE TABLE Consigns(
   FromUId INT not null,
   ToUId INT not null,
   AId INT NOT NULL,
   PRIMARY KEY (FromUId, AId),
   FOREIGN KEY (FromUId) REFERENCES User(UId),
   FOREIGN KEY (ToUId) REFERENCES User(UId),
   FOREIGN KEY (AId) REFERENCES Account);

CREATE TABLE Account(
   AId INT not null PRIMARY KEY,
   Cash DECFLOAT(16) DEFAULT 0,
   PositionValue DECFLOAT(16) DEFAULT 0,
   UId INT NOT NULL,
   FOREIGN KEY (UId) REFERENCES User);
```

```
CREATE TABLE Holds(
   FId INT not null,
   EName VARCHAR(50) not null,
   FOREIGN KEY (Fid,EName) REFERENCES FinancialProduct,
   AId INT not null,
   Cost DECFLOAT(16) NOT NULL,
   HoldingQuantity INT NOT NULL,
   PRIMARY KEY (FId, Ename, AId),
   FOREIGN KEY (AId) REFERENCES Account)

CREATE TABLE Watches(
   UId INT not null,
   FId INT not null,
   PRIMARY KEY (UId,FId),
   EName VARCHAR(50) NOT NULL,
   FOREIGN KEY (UId) REFERENCES User,
   FOREIGN KEY (Fid,EName) REFERENCES FinancialProduct);

CREATE TABLE Transfer(
   TId INT not null PRIMARY KEY,
   Amount DECFLOAT(16) DEFAULT 0,
   FromAId INT NOT NULL,
   ToAId INT NOT NULL,
   FOREIGN KEY (FromAId) REFERENCES Account(AId),
   FOREIGN KEY (ToAId) REFERENCES Account(AId));

CREATE TABLE Order(
   OId INT not null PRIMARY KEY,
   BidAsk CHAR(3) NOT NULL,
   Date DATE NOT NULL,
   Time TIME NOT NULL,
   Price DECFLOAT(16) NOT NULL,
   Quantity INT NOT NULL,
   Status INT NOT NULL,
   AId INT NOT NULL,
   FId INT NOT NULL,
   EName VARCHAR(50) NOT NULL,
   FOREIGN KEY (AId) REFERENCES Account,
   FOREIGN KEY (FId,EName) REFERENCES FinancialProduct);
```

Constraints cannot be expressed:

(All the key and participation constraints have been expressed when creating table.)

FinancialProduct:

Type must be one of 'Stock', 'Bond', 'Option', 'Future'.

Consigns:

FromUId must own the AId that is being consigned.

Order:

If Ask, order quantity must not exceed HoldingQuantity.

Company:

Amount of Outstanding shares must be the total amount of this product in holding (table).

Group 24 Table descriptions

```
db2 => list tables;

Table/View                      Schema          Type  Creation time
------------------------------- --------------- ----- --------------------------
ACCOUNT                         CS421G24        T     2016-02-22-15.59.03.601403
COMPANY                         CS421G24        T     2016-02-22-15.54.20.085688
CONSIGNS                        CS421G24        T     2016-02-22-16.42.57.137659
EXCHANGE                        CS421G24        T     2016-02-22-15.56.52.675665
FINANCIALPRODUCT                CS421G24        T     2016-02-22-15.57.08.955308
HOLDS                           CS421G24        T     2016-02-22-16.15.36.285214
ORDER                           CS421G24        T     2016-02-22-16.17.39.995163
TRANSFER                        CS421G24        T     2016-02-22-16.07.01.211930
USER                            CS421G24        T     2016-02-22-15.58.36.873741
WATCHES                         CS421G24        T     2016-02-22-16.16.48.299853

  10 record(s) selected.
```

```
db2 => describe table account;

                                Data type                     Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
AID                             SYSIBM    INTEGER                      4     0 No
CASH                            SYSIBM    DECFLOAT                     8     0 Yes
POSITIONVALUE                   SYSIBM    DECFLOAT                     8     0 Yes
UID                             SYSIBM    INTEGER                      4     0 No

  4 record(s) selected.

db2 => describe table company;

                                Data type                     Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
CNAME                           SYSIBM    VARCHAR                     50     0 No
MARKETVALUE                     SYSIBM    INTEGER                      4     0 No
OUTSTANDINGSHARES               SYSIBM    INTEGER                      4     0 No

  3 record(s) selected.
```

```
db2 => describe table consigns;

                                Data type                     Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
FROMUID                         SYSIBM    INTEGER                      4     0 No
TOUID                           SYSIBM    INTEGER                      4     0 No
AID                             SYSIBM    INTEGER                      4     0 No

  3 record(s) selected.

db2 => describe table exchange;

                                Data type                     Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
ENAME                           SYSIBM    VARCHAR                     50     0 No
OPEN                            SYSIBM    TIME                         3     0 No
CLOSE                           SYSIBM    TIME                         3     0 No
HEADQUARTER                     SYSIBM    VARCHAR                     30     0 Yes
COUNTRY                         SYSIBM    VARCHAR                     30     0 Yes

  5 record(s) selected.
```

Group 24 Table descriptions

```
db2 => describe table financialproduct;

                                Data type                       Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
FID                             SYSIBM    INTEGER                      4     0 No
ENAME                           SYSIBM    VARCHAR                     50     0 No
CNAME                           SYSIBM    VARCHAR                     50     0 No
TYPE                            SYSIBM    VARCHAR                     20     0 Yes
BID                             SYSIBM    DECFLOAT                     8     0 Yes
ASK                             SYSIBM    DECFLOAT                     8     0 Yes
VOLUME                          SYSIBM    INTEGER                      4     0 Yes
LAST                            SYSIBM    DECFLOAT                     8     0 Yes
EXECUTIONDATE                   SYSIBM    DATE                         4     0 Yes
DIVIDEND                        SYSIBM    DECFLOAT                     8     0 Yes
STRIKEPRICE                     SYSIBM    DECFLOAT                     8     0 Yes
FUTURESPRICE                    SYSIBM    DECFLOAT                     8     0 Yes
COUPONRATE                      SYSIBM    DECFLOAT                     8     0 Yes
FACEVALUE                       SYSIBM    DECFLOAT                     8     0 Yes

  14 record(s) selected.
```

```
db2 => describe table holds;

                                Data type                       Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
FID                             SYSIBM    INTEGER                      4     0 No
ENAME                           SYSIBM    VARCHAR                     50     0 No
AID                             SYSIBM    INTEGER                      4     0 No
COST                            SYSIBM    DECFLOAT                     8     0 No
HOLDINGQUANTITY                 SYSIBM    INTEGER                      4     0 No

  5 record(s) selected.

db2 => describe table transfer;

                                Data type                       Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
TID                             SYSIBM    INTEGER                      4     0 No
AMOUNT                          SYSIBM    DECFLOAT                     8     0 Yes
FROMAID                         SYSIBM    INTEGER                      4     0 No
TOAID                           SYSIBM    INTEGER                      4     0 No

  4 record(s) selected.
```

```
db2 => describe table order;

                                Data type                       Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
OID                             SYSIBM    INTEGER                      4     0 No
BIDASK                          SYSIBM    CHARACTER                    3     0 No
DATE                            SYSIBM    DATE                         4     0 No
TIME                            SYSIBM    TIME                         3     0 No
PRICE                           SYSIBM    DECFLOAT                     8     0 No
QUANTITY                        SYSIBM    INTEGER                      4     0 No
STATUS                          SYSIBM    INTEGER                      4     0 No
AID                             SYSIBM    INTEGER                      4     0 No
FID                             SYSIBM    INTEGER                      4     0 No
ENAME                           SYSIBM    VARCHAR                     50     0 No

  10 record(s) selected.
```

Group 24 Table descriptions

```
db2 => describe table user;

                                Data type                     Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
UID                             SYSIBM    INTEGER                      4     0 No
NAME                            SYSIBM    VARCHAR                     50     0 No
BILLINGADDRESS                  SYSIBM    VARCHAR                    100     0 No

  3 record(s) selected.

db2 => describe table watches;

                                Data type                     Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
UID                             SYSIBM    INTEGER                      4     0 No
FID                             SYSIBM    INTEGER                      4     0 No
ENAME                           SYSIBM    VARCHAR                     50     0 No

  3 record(s) selected.
```

Question 3:

```
db2 => INSERT INTO HOLDS VALUES(600005,'NYSE',100001,10,5000)
DB20000I  The SQL command completed successfully.
db2 => INSERT INTO HOLDS VALUES (600005,'NYSE',100002,9,2000)
DB20000I  The SQL command completed successfully.
db2 => INSERT INTO HOLDS VALUES (600005,'NYSE',100021,10,3000)
DB20000I  The SQL command completed successfully.
db2 => INSERT INTO HOLDS VALUES (600005,'NYSE',100031,11.5,2200)
DB20000I  The SQL command completed successfully.
db2 => INSERT INTO HOLDS VALUES (600005,'NYSE',100041,10.2,7800)
DB20000I  The SQL command completed successfully.

db2 => select * from holds
FID         ENAME                                                AID
COST                  HOLDINGQUANTITY
----------- -------------------------------------------------- ---
-------- ----------------------- ---------------
    600001 NASDAQ                                               100001
200          30000
    600002 NASDAQ                                               100001
30           5666
    600003 NYSE                                                 100001
30          25000
    600002 NASDAQ                                               100011
10           1000
    600001 NASDAQ                                               100021
190          10000
    600003 NYSE                                                 100021
30          20000
    600001 NASDAQ                                               100031
30          10000
    600004 NYSE                                                 100031
28          18200
    600005 NYSE                                                 100011
10           3450
    600005 NYSE                                                 100001
10           5000
    600005 NYSE                                                 100002
9           2000
    600005 NYSE                                                 100021
10           3000
    600005 NYSE                                                 100031
11.5           2200
```

```
    600005 NYSE                                                  100041
10.2          7800
  14 record(s) selected.
```

Question 4:

```
db2 => select * from company

CNAME                                                       MARKETVALUE
OUTSTANDINGSHARES
-------------------------------------------------- ----------- ---
--------------
Macrosoft                                                      10000000
50000
Pineapple                                                        666666
6666
NukaOola                                                        1245000
45000
McKFC                                                            555000
18200
Moonbuck                                                         234500
23450

  5 record(s) selected.

db2 => select * from user

UID                                                                NAME
BILLINGADDRESS
----------- -------------------------------------------------- ---
-------------------------------------------------------------------
-------------------------------
     10000 Rich                                                     250
University Montreal
     10001 Poor                                                3213 Hum
Montreal
     10002 Bob                                                 343 Yolo
Quebec
     10003 Smith                                            222 Bimundo
Quebec
     10004 John                                                    5191
NorthPole Quebec
```

```
  5 record(s) selected.

db2 => select * from holds

FID         ENAME                                                AID
COST                 HOLDINGQUANTITY
----------- -------------------------------------------------- ---
-------- ---------------------- --------------
    600001 NASDAQ                                             100001
200          30000
    600002 NASDAQ                                             100001
30           5666
    600003 NYSE                                               100001
30          25000
    600002 NASDAQ                                             100011
10           1000
    600001 NASDAQ                                             100021
190          10000
    600003 NYSE                                               100021
30          20000
    600001 NASDAQ                                             100031
30          10000
    600004 NYSE                                               100031
28          18200
    600005 NYSE                                               100011
10           3450

db2 => select * from financialproduct

FID         ENAME                                                CNAME
TYPE                        BID                                   ASK
VOLUME       LAST                          EXECUTIONDATE  DIVIDEND
STRIKEPRICE                 FUTURESPRICE                COUPONRATE
FACEVALUE
----------- -------------------------------------------------- ---
-------------------------------------------- ------------------
-- ---------------------- ---------------------- ----------- -
-------------------- ------------ ---------------------- ---
-------------------- ---------------------- ------------------
----- ------------------------
    600001 NASDAQ                                          Macrosoft
Stock                                199                    201
10000                    200 -                                  -
-                    -                    -                   -
```

```
    600002 NASDAQ                                          Pineapple
Stock                                    10                    10.02
100000                  10.01 -                                    -
-                     -                    -                     -
    600003 NYSE                                           NukaOola
Stock                                 27.50                    27.70
44000                   27.67 -                                    -
-                     -                    -                     -
    600004 NYSE                                              McKFC
Stock                                    30                       31
2000                  30.49 -                                    -
-                     -                    -                     -
    600005 NYSE                                           Moonbuck
Stock                                   9.9                     10.1
10000                     10 -                                    -
-                     -                    -                     -
  5 record(s) selected.
db2 => select * from transfer

TID        AMOUNT                 FROMAID    TOAID
---------- ---------------------- ---------- ----------
  10000121                 10000     100001     100002

  1 record(s) selected.

db2 => select * from watches

UID        FID        ENAME
---------- ---------- ----------------------------------------
--------
     10000     600003 NYSE

  1 record(s) selected.

db2 => select * from consigns

FROMUID    TOUID      AID
---------- ---------- ----------
     10002      10000     100021

  1 record(s) selected.
db2 => select * from order

OID        BIDASK DATE      TIME     PRICE                  QUANTITY
```

```
STATUS      AID         FID         ENAME                          --
---------- ------ ---------- -------- ------------------------ --
--------- ----------- ----------- ----------- --------------------
------------------------------
         1 Bid     02/02/2016 10:00:00                            200
2000          1     100001     600001 NASDAQ
         2 Ask     02/03/2016 10:21:00                             30
1000          1     100031     600003 NYSE
         3 bid     02/02/2016 09:40:00                             10
100           2     100031     600005 NYSE
         4 ask     02/02/2016 09:45:00                             10
100           2     100041     600005 NYSE
         5 bid     02/03/2016 13:30:00                            199
1000          1     100001     600001 NASDAQ

  5 record(s) selected.

db2 => select * from exchange

ENAME                                                 OPEN     CLOSE
HEADQUARTER                   COUNTRY
-------------------------------------------------- -------- ------
-- ------------------------------ ------------------------------
NASDAQ                                             09:30:00 16:00:00 New
York                          US
NYSE                                               09:30:00 16:00:00 New
York                          US

  2 record(s) selected.

db2 => select * from account

AID         CASH                    POSITIONVALUE           UID
----------- ----------------------- ----------------------- ----
-------
    100001                   5000            6799216.66      10000
    100002                5000000                 20000      10000
    100011                    320                 44510      10001
    100021                 100000               2583400      10002
    100031                 500000               2576918      10003
    100041                  10000                 78000      10004

  6 record(s) selected.
```

Q5:

1) transaction history:

select *
from order
where AID = ‘100001’ AND status = 2

Description: This query is used to get the transaction history of a particular account (orders that has been executed in this particular account).

script:

```
OID         BIDASK DATE       TIME     PRICE                  QUANTITY    STATUS      AID         FID         ENAME
----------- ------ ---------- -------- ---------------------- ----------- ----------- ----------- ----------- --------------------------------
          1 Bid    02/02/2016 10:00:00                   200        2000           1      100001      600001 NASDAQ
          7 Bid    02/15/2016 15:00:00                    20        5000           1      100061      700001 SH
          8 Bid    02/16/2016 12:00:00                   200       23333           2      100001      600001 NASDAQ
          5 bid    02/02/2016 13:30:00                   199        1000           1      100001      600001 NASDAQ
          9 Ask    02/16/2016 13:00:00                   200       23333           2      100073      600001 NASDAQ

  5 record(s) selected.

db2 => select *
db2 (cont.) => from order
db2 (cont.) => where aid='100001' and status='2';

OID         BIDASK DATE       TIME     PRICE                  QUANTITY    STATUS      AID         FID         ENAME
----------- ------ ---------- -------- ---------------------- ----------- ----------- ----------- ----------- --------------------------------
          8 Bid    02/16/2016 12:00:00                   200       23333           2      100001      600001 NASDAQ

  1 record(s) selected.
```

relation:

```
db2 => describe table order
db2 (cont.) => ;

                                Data type                     Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
OID                             SYSIBM    INTEGER                      4     0 No
BIDASK                          SYSIBM    CHARACTER                    3     0 No
DATE                            SYSIBM    DATE                         4     0 No
TIME                            SYSIBM    TIME                         3     0 No
PRICE                           SYSIBM    DECFLOAT                     8     0 No
QUANTITY                        SYSIBM    INTEGER                      4     0 No
STATUS                          SYSIBM    INTEGER                      4     0 No
AID                             SYSIBM    INTEGER                      4     0 No
FID                             SYSIBM    INTEGER                      4     0 No
ENAME                           SYSIBM    VARCHAR                     50     0 No

  10 record(s) selected.
```

2）account summary:

select sum(cash) as TOTALCASH, sum(positionvalue) as TOTALVALUE,
from account where UID=‘10001

script:

```
db2 => select sum(cash) as TOTALCASH,sum(positionvalue) as TOTALVALUE
db2 (cont.) => from account
db2 (cont.) => where uid='10001';

TOTALCASH                                TOTALVALUE
---------------------------------------- ----------------------------------------
                                     320                                    44510

  1 record(s) selected.
```

Description: This query sums up the cash and position value in all accounts that the user owns.

relation:

```
db2 => describe table account
db2 (cont.) => ;

                                Data type                       Column
Column name                     schema    Data type name        Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
AID                             SYSIBM    INTEGER                      4     0 No
CASH                            SYSIBM    DECFLOAT                     8     0 Yes
POSITIONVALUE                   SYSIBM    DECFLOAT                     8     0 Yes
UID                             SYSIBM    INTEGER                      4     0 No

  4 record(s) selected.
```

```
AID         CASH                    POSITIONVALUE           UID
----------- ----------------------- ----------------------- -----------
     100001                    5000              6799216.66       10000
     100002                 5000000                   20000       10000
     100011                     320                   44510       10001
     100021                  100000                 2583400       10002
     100031                  500000                 2576918       10003
     100041                   10000                   78000       10004
     100051                   10000                       0       10005
     100052                       0                 1000000       10005
     100061                    5000                 1200000       10006
     100071                       0                       0       10007
     100072                  100000                 3010000       10007
     100073                    1000                    9500       10007
     100081                   53421                  603000       10008

  13 record(s) selected.
```

3) holding:

select *

from holds
where AID in (select AID from account where uid = ‘10001’)

Description: show all financial product that a user holds (a user might have several accounts)

script:

```
db2 => select * from holds where aid in(select aid from account
db2 (cont.) => where uid='10001');

FID         ENAME                                              AID         COST                   HOLDINGQUANTITY
----------- -------------------------------------------------- ----------- ---------------------- ---------------
     600002 NASDAQ                                              100011                      10            1000
     600005 NYSE                                                100011                      10            1000

  2 record(s) selected.
```

relation:

```
db2 => describe table holds
db2 (cont.) => ;

                                Data type                       Column
Column name                     schema    Data type name        Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
FID                             SYSIBM    INTEGER                      4     0 No
ENAME                           SYSIBM    VARCHAR                     50     0 No
AID                             SYSIBM    INTEGER                      4     0 No
COST                            SYSIBM    DECFLOAT                     8     0 No
HOLDINGQUANTITY                 SYSIBM    INTEGER                      4     0 No

  5 record(s) selected.

db2 => describe table account
db2 (cont.) => ;

                                Data type                       Column
Column name                     schema    Data type name        Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
AID                             SYSIBM    INTEGER                      4     0 No
CASH                            SYSIBM    DECFLOAT                     8     0 Yes
POSITIONVALUE                   SYSIBM    DECFLOAT                     8     0 Yes
UID                             SYSIBM    INTEGER                      4     0 No

  4 record(s) selected.

db2 =>
```

4) top return rate stock ranking:

select h.fid, h.cost, f.last, (f.last-h.cost)/h.cost as returnrate
from holds h
inner join financialProduct f
on h.fid = f.fid
where AID in (select AID from account where uid = ‘10001’) AND f.type=‘Stock’
order by returnRate desc

Description: calculate the return rate of all the stocks that a particular user holds and order the stocks in a descending order with respect to the return rate

script:

```
db2 => select h.fid,h.cost,f.last,(f.last-h.cost)/h.cost as returnrate
db2 (cont.) => from holds h
db2 (cont.) => inner join financialProduct f
db2 (cont.) => on h.fid=f.fid
db2 (cont.) => where aid in (select aid from account where uid ='10001')and f.type='Stock'
db2 (cont.) => order by returnRate desc;

FID         COST                     LAST                     RETURNRATE
----------- ------------------------ ------------------------ ------------------------
     600002                       10                    10.01                    0.001
     600005                       10                       10                        0

  2 record(s) selected.
```

relation:

```
db2 => describe table holds
db2 (cont.) => ;

                                Data type                     Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
FID                             SYSIBM    INTEGER                      4     0 No
ENAME                           SYSIBM    VARCHAR                     50     0 No
AID                             SYSIBM    INTEGER                      4     0 No
COST                            SYSIBM    DECFLOAT                     8     0 No
HOLDINGQUANTITY                 SYSIBM    INTEGER                      4     0 No

  5 record(s) selected.

db2 => describe table financialproduct;

                                Data type                     Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
FID                             SYSIBM    INTEGER                      4     0 No
ENAME                           SYSIBM    VARCHAR                     50     0 No
CNAME                           SYSIBM    VARCHAR                     50     0 No
TYPE                            SYSIBM    VARCHAR                     20     0 Yes
BID                             SYSIBM    DECFLOAT                     8     0 Yes
ASK                             SYSIBM    DECFLOAT                     8     0 Yes
VOLUME                          SYSIBM    INTEGER                      4     0 Yes
LAST                            SYSIBM    DECFLOAT                     8     0 Yes
EXECUTIONDATE                   SYSIBM    DATE                         4     0 Yes
DIVIDEND                        SYSIBM    DECFLOAT                     8     0 Yes
STRIKEPRICE                     SYSIBM    DECFLOAT                     8     0 Yes
FUTURESPRICE                    SYSIBM    DECFLOAT                     8     0 Yes
COUPONRATE                      SYSIBM    DECFLOAT                     8     0 Yes
FACEVALUE                       SYSIBM    DECFLOAT                     8     0 Yes

  14 record(s) selected.

db2 => describe table account
db2 (cont.) => ;

                                Data type                     Column
Column name                     schema    Data type name      Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
AID                             SYSIBM    INTEGER                      4     0 No
CASH                            SYSIBM    DECFLOAT                     8     0 Yes
POSITIONVALUE                   SYSIBM    DECFLOAT                     8     0 Yes
UID                             SYSIBM    INTEGER                      4     0 No

  4 record(s) selected.
```

5) all bond coupon rate>5:

select *
from financialProduct
where type = ‘Bond’ AND couponRate <2

Description: find all the bond whose coupon rate is greater than 5

script:

```
db2 => select * from financialproduct where type='Bond' and couponrate<2;

FID         ENAME                                              CNAME                                              TYPE                BID                     ASK                     VOLUME
    LAST                  EXECUTIONDATE DIVIDEND                STRIKEPRICE             FUTURESPRICE             COUPONRATE          FACEVALUE
----------- -------------------------------------------------- -------------------------------------------------- ------------------- ----------------------- ----------------------- --------
--- ---------------------- ------------ ---------- ---------------------- ---------------------- ---------- ---------- ---------- ----------
     200001 NYSE                                               Macrosoft                                          Bond                            900                     960
100                    950 10/10/2016                                0                      0                   0                 1.5                    1000
     200004 NYSE                                               McKFC                                              Bond                            800                     860        2
000                    850 10/10/2020                                0                      0                   0                 1.3                    1000

  2 record(s) selected.
```

table of all financial products (prove the correctness of the result of the query)

```
db2 => select * from financialproduct
db2 (cont.) => ;

FID         ENAME                                              CNAME                                              TYPE                BID                     ASK                     VOLUME
    LAST                  EXECUTIONDATE DIVIDEND                STRIKEPRICE             FUTURESPRICE             COUPONRATE          FACEVALUE
----------- -------------------------------------------------- -------------------------------------------------- ------------------- ----------------------- ----------------------- --------
--- ---------------------- ------------ ---------- ---------------------- ---------------------- ---------- ---------- ---------- ----------
     600001 NASDAQ                                             Macrosoft                                          Stock                           199                     201       10
000                    200 -                                         1.00                   -                   -                 -                      -
     600002 NASDAQ                                             Pineapple                                          Stock                            10                   10.02      100
000                  10.01 -                                         0.59                   -                   -                 -                      -
     600003 NYSE                                               NukaOola                                           Stock                         27.50                   27.70       44
000                  27.67 -                                            0                   -                   -                 -                      -
     600004 NYSE                                               McKFC                                              Stock                            30                      31        2
000                  30.49 -                                         0.29                   -                   -                 -                      -
     600005 NYSE                                               Moonbuck                                           Stock                           9.9                    10.1       10
000                     10 -                                            0                   -                   -                 -                      -
     200001 NYSE                                               Macrosoft                                          Bond                            900                     960
100                    950 10/10/2016                                0                      0                   0                 1.5                    1000
     200002 NYSE                                               Pineapple                                          Bond                            999                    1001
100                   1000 08/08/2018                                0                      0                   0                   2                    1000
     200003 NYSE                                               NukaOola                                           Bond                           1500                    1520        1
000                   1510 05/03/2016                                0                      0                   0                   4                    1000
     200004 NYSE                                               McKFC                                              Bond                            800                     860        2
000                    850 10/10/2020                                0                      0                   0                 1.3                    1000
     200005 NYSE                                               Moonbuck                                           Bond                           1000                    1001
400                   1000 01/01/2018                                0                      0                   0                   2                   10000
     300001 NASDAQ                                             Macrosoft                                          Option                         0.50                    0.60
100                    0.50 03/26/2016                               0                    200                   0                   0                       0
     300002 NASDAQ                                             Pineapple                                          Option                            1                    1.05
 50                    1.05 04/21/2016                               0                     10                   0                   0                       0
     300003 NYSE                                               McKFC                                              Option                            0                    0.10
100                    0.05 03/19/2016                               0                     40                   0                   0                       0
     300004 NASDAQ                                             Macrosoft                                          Option                          100                     130        1
000                    120 04/21/2016                                0                    100                   0                   0                       0
     700001 SH                                                 McKFC                                              Stock                            20                    20.5        1
000                   20.10 -                                         0.20                   -                   -                 -                      -

  15 record(s) selected.
```

relation:

```
db2 => describe table financialproduct
db2 (cont.) => ;

                                Data type                       Column
Column name                     schema    Data type name        Length     Scale Nulls
------------------------------- --------- ------------------- ---------- ----- ------
FID                             SYSIBM    INTEGER                      4     0 No
ENAME                           SYSIBM    VARCHAR                     50     0 No
CNAME                           SYSIBM    VARCHAR                     50     0 No
TYPE                            SYSIBM    VARCHAR                     20     0 Yes
BID                             SYSIBM    DECFLOAT                     8     0 Yes
ASK                             SYSIBM    DECFLOAT                     8     0 Yes
VOLUME                          SYSIBM    INTEGER                      4     0 Yes
LAST                            SYSIBM    DECFLOAT                     8     0 Yes
EXECUTIONDATE                   SYSIBM    DATE                         4     0 Yes
DIVIDEND                        SYSIBM    DECFLOAT                     8     0 Yes
STRIKEPRICE                     SYSIBM    DECFLOAT                     8     0 Yes
FUTURESPRICE                    SYSIBM    DECFLOAT                     8     0 Yes
COUPONRATE                      SYSIBM    DECFLOAT                     8     0 Yes
FACEVALUE                       SYSIBM    DECFLOAT                     8     0 Yes

  14 record(s) selected.
```

Question 6:

1.
Purpose: add a birthday column to the user relation.
Relation: User.
SQL Statement: `ALTER TABLE USER ADD BIRTHDAY DATE;`

```
db2 => ALTER TABLE USER ADD BIRTHDAY DATE;
DB20000I  The SQL command completed successfully.
db2 => DESCRIBE TABLE USER;

                              Data type                  Column
Column name                     schema    Data type name     Length
Scale Nulls
------------------------------- --------- ------------------ ----
------ ----- ------
UID                           SYSIBM    INTEGER                 4
0 No
NAME                          SYSIBM    VARCHAR                50
0 No
BILLINGADDRESS                 SYSIBM    VARCHAR                100
0 No
BIRTHDAY                      SYSIBM    DATE                    4
0 Yes

  4 record(s) selected.

db2 => ALTER TABLE USER DROP COLUMN BIRTHDAY;
DB20000I  The SQL command completed successfully.
db2 => DESCRIBE TABLE USER;

                              Data type                  Column
Column name                     schema    Data type name     Length
Scale Nulls
------------------------------- --------- ------------------ ----
------ ----- ------
UID                           SYSIBM    INTEGER                 4
0 No
NAME                          SYSIBM    VARCHAR                50
0 No
BILLINGADDRESS                 SYSIBM    VARCHAR                100
0 No
```

```
  3 record(s) selected.

**********************************************************************
**********************************
```

2.

Purpose: for a particular transaction record (tid = 10000121), we update the two accounts associated with this transaction accordingly (subtract the transfer account from the "from account" and deposit money into the other account), and delete this transfer (i.e. this transaction is done).

Relation: Account, Transfer.

SQL Statement:

```
update account set cash = (select cash from account, transfer
where aid = transfer.fromaid) - (select amount from transfer where
tid = 10000121) where aid = (select fromaid from transfer where
tid = 10000121);
update account set cash = (select cash from account, transfer
where aid = transfer.toaid) + (select amount from transfer where
tid = 10000121) where aid = (select toaid from transfer where tid
= 10000121);
delete from transfer where tid = 10000121;
```

```
db2 => select * from transfer;

TID         AMOUNT                 FROMAID     TOAID
----------- ---------------------- ----------- -----------
   10000121                    100      100001      100002

  1 record(s) selected.

db2 => select * from account;

AID         CASH                   POSITIONVALUE          UID
----------- ---------------------- ---------------------- ----
-------
    100001                   4900             6799216.66       10000
    100002                5000000                  20000       10000
    100011                    320                  44510       10001
    100021                 100000                2583400       10002
    100031                 500000                2576918       10003
    100041                  10000                  78000       10004
    100051                  10000                      0       10005
    100052                      0                1000000       10005
    100061                   5000                1200000       10006
```

```
    100071                   0                    0      10007
    100072              100000              3010000       10007
    100073                1000                 9500      10007
    100081               53421               603000       10008

  13 record(s) selected.

db2 => update account set cash = (select cash from account,
transfer where aid = transfer.fromaid) - (select amount from
transfer where tid = 10000121) where aid = (select fromaid from
transfer where tid = 10000121);
DB20000I  The SQL command completed successfully.

db2 => update account set cash = (select cash from account,
transfer where aid = transfer.toaid) + (select amount from
transfer where tid = 10000121) where aid = (select toaid from
transfer where tid = 10000121);
DB20000I  The SQL command completed successfully.

db2 => delete from transfer where tid = 10000121;
DB20000I  The SQL command completed successfully.

db2 => select * from account;

AID         CASH                    POSITIONVALUE           UID
----------- ----------------------- ----------------------- ----
-------
    100001                   4800             6799216.66      10000
    100002                5000100                20000       10000
    100011                   320                 44510       10001
    100021                 100000              2583400       10002
    100031                 500000              2576918       10003
    100041                  10000                78000       10004
    100051                  10000                   0       10005
    100052                      0              1000000       10005
    100061                   5000              1200000       10006
    100071                      0                    0      10007
    100072                 100000              3010000       10007
    100073                   1000                 9500      10007
    100081                  53421               603000       10008

  13 record(s) selected.

db2 => select * from transfer;
```

```
TID         AMOUNT                  FROMAID     TOAID
----------- ----------------------- ----------- -----------

  0 record(s) selected.
```

****

3.

Purpose: update holding quantity to 1000 for those holds with cost no bigger than 10.
Relation: Holds.
SQL Statement: `update holds set HOLDINGQUANTITY=1000 where cost <=10;`

```
db2 => select * from holds;

FID         ENAME                                              AID
COST                  HOLDINGQUANTITY
----------- -------------------------------------------------- ---
-------- ----------------------- ---------------
     600001 NASDAQ                                              100001
200           30000
     600002 NASDAQ                                              100001
30            5666
     600003 NYSE                                               100001
30           25000
     600002 NASDAQ                                              100011
10            1000
     600001 NASDAQ                                              100021
190           10000
     600003 NYSE                                               100021
30           20000
     600001 NASDAQ                                              100031
30           10000
     600004 NYSE                                               100031
28           18200
     600005 NYSE                                               100011
10            3450
     600005 NYSE                                               100001
10            5000
     600005 NYSE                                               100002
9            2000
```

```
    600005 NYSE                                              100021
10          3000
    600005 NYSE                                              100031
11.5          2200
    600005 NYSE                                              100041
10.2          7800

  14 record(s) selected.

db2 => update holds set HOLDINGQUANTITY=1000 where cost <=10;
DB20000I  The SQL command completed successfully.
```

****

4.

Purpose: update Rich's billing address.
Relation: User.
SQL Statement: `update user set BILLINGADDRESS = '555 University Montreal' where NAME = 'Rich';`

```
db2 => select * from user;

UID        NAME
BILLINGADDRESS
----------- -------------------------------------------------- ---
--------------------------------------------------------------------
-------------------------------
     10000 Rich                                            250
University Montreal
     10001 Poor                                            3213 Hum
Montreal
     10002 Bob                                             343 Yolo
Quebec
     10003 Smith                                           222 Bimundo
Quebec
     10004 John                                            5191
NorthPole Quebec

  5 record(s) selected.

db2 => update user set BILLINGADDRESS = '555 University Montreal'
where NAME = 'Rich';
```

```
DB20000I  The SQL command completed successfully.
db2 => select * from user;

UID        NAME
BILLINGADDRESS
---------- -------------------------------------------------- ---
------------------------------------------------------------------
------------------------------
     10000 Rich                                               555
University Montreal
     10001 Poor                                               3213 Hum
Montreal
     10002 Bob                                                343 Yolo
Quebec
     10003 Smith                                               222 Bimundo
Quebec
     10004 John                                               5191
NorthPole Quebec

  5 record(s) selected.
```

Question7:

1.

Description: a view of users and watches: user id, financial product id, exchange name, user name, user's billing address (joined by user id).

CREATE VIEW Statement: `create view USER_AND_WATCHES as select watches.uid, fid, ename, name, billingaddress from watches, user;`

UPDATE Statement: `update user_and_watches set billingaddress = '666 Montreal' where name = 'Oz';`

```
db2 => create view USER_AND_WATCHES as select watches.uid, fid,
ename, name, billingaddress from watches, user;
DB20000I  The SQL command completed successfully.

db2 => select * from user_and_watches;

UID        FID        ENAME
NAME                                               BILLINGADDRESS
---------- ---------- -------------------------------------------
-------- -------------------------------------------------- ------
------------------------------------------------------------------
```

```
----------------------------
     10000     600003 NYSE
Rich                                          555 University
Montreal
     10000     600003 NYSE
Poor                                          3213 Hum Montreal
     10000     600003 NYSE
Bob                                           343 Yolo Quebec
     10000     600003 NYSE
Smith                                         222 Bimundo Quebec
     10000     600003 NYSE
John                                          5191 NorthPole Quebec
     10000     600003 NYSE
Oz                                            222 somewhere NewYork
     10000     600003 NYSE
Salsa                                         83219 HAHAHA NewYork
     10000     600003 NYSE
DarkLord                                       1 DarkPath Washington
     10000     600003 NYSE
Koslos                                        312 Gesh Shanghai

  9 record(s) selected.

db2 => update user_and_watches set billingaddress = '666 Montreal'
where name = 'Oz';

DB21034E  The command was processed as an SQL statement because it
was not a valid Command Line Processor command.  During SQL
processing it returned:
SQL0150N  The target fullselect, view, typed table, materialized
query table, range-clustered table, or staging table in the
INSERT, DELETE, UPDATE, MERGE, or TRUNCATE statement is a target
for which the requested operation is not permitted.
SQLSTATE=42807
```

2.

Description: a view of financial products with bid >= 30.

CREATE VIEW Statement: `CREATE VIEW BID_BIGGER_THAN_30 AS SELECT FID, ENAME, CNAME, BID FROM financialproduct where BID>=30;`

UPDATE Statement: `update BID_BIGGER_THAN_30 set bid = 5 where cname = 'Moonbuck';`

```
db2 => CREATE VIEW BID_BIGGER_THAN_30 AS SELECT FID, ENAME, CNAME,
BID FROM financialproduct where BID>=30;
```

```
DB20000I  The SQL command completed successfully.

db2 => SELECT * FROM BID_BIGGER_THAN_30;

FID        ENAME                                              CNAME
BID
---------- -------------------------------------------------- ---
---------------------------------------- ------------------
------
    600001 NASDAQ                                              Macrosoft
199
    200001 NYSE                                               Macrosoft
900
    200002 NYSE                                               Pineapple
999
    200003 NYSE                                               NukaOola
1500
    200005 NYSE                                               Moonbuck
1000
    300004 NASDAQ                                              Macrosoft
100

  6 record(s) selected.

db2 => update BID_BIGGER_THAN_30 set bid = 5 where cname =
'Moonbuck';
DB20000I  The SQL command completed successfully.

db2 => SELECT * FROM BID_BIGGER_THAN_30;

FID        ENAME                                              CNAME
BID
---------- -------------------------------------------------- ---
---------------------------------------- ------------------
------
    600001 NASDAQ                                              Macrosoft
199
    200001 NYSE                                               Macrosoft
900
    200002 NYSE                                               Pineapple
999
    200003 NYSE                                               NukaOola
1500
    300004 NASDAQ                                              Macrosoft
```

```
100
  5 record(s) selected.
```

For a view to be updatable, the rows in the view and the rows in the base table must be a one-to-one relationship.
In our cases, user_and_watches cannot be updated because it refers to two relations: user and watches.
BID_BIGGER_THAN_30 is updatable because it has a one-to-one relationship with the relation financialproduct.

Question 8:

Check Constraint 1: Type of Financial Product can only be Stock, Option, Bond or Futures

```
db2 => alter table financialproduct add constraint Typecheck
CHECK(Type='Stock' or Type='Option' or Type='Bond' or
Type='Futures')
DB20000I  The SQL command completed successfully.
```

If violated:

```
db2 => insert into financialproduct(Fid,EName,CName,Type)
values(000001,'NASDAQ','Macrosoft','Something')
DB21034E  The command was processed as an SQL statement because it
was not a valid Command Line Processor command.  During SQL
processing it returned:
SQL0545N  The requested operation is not allowed because a row does
not satisfy the check constraint
"CS421G24.FINANCIALPRODUCT.TYPECHECK".
SQLSTATE=23513
```

Check Constraint 2: Status of Order can only be 1, 2 or 3

```
db2 => alter table order add constraint StatusCheck CHECK(Status=1
or Status=2 or Status=3)
DB20000I  The SQL command completed successfully.
```

If violated:

```
db2 => insert into order values(10,'Bid','2012-12-
12','10:00:00',10,10,99,100001,600001,'NASDAQ')
DB21034E  The command was processed as an SQL statement because it
was not a valid Command Line Processor command.  During SQL
processing it returned:
SQL0545N  The requested operation is not allowed because a row does
not
satisfy the check constraint "CS421G24.ORDER.STATUSCHECK".
SQLSTATE=23513
```