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Definition of the situation

Develop an e-banking database for a variety of web services and applications to the web users including the most popular e-banking system. The requirements are as follow:

1**) Account management;** registered users must be able to manage the following banking products of banking accounts, credit-debit cards and loans in addition to a login system, the capability to deactivate accounts also it should allow the bankers to communicate with registered users with a messaging system.

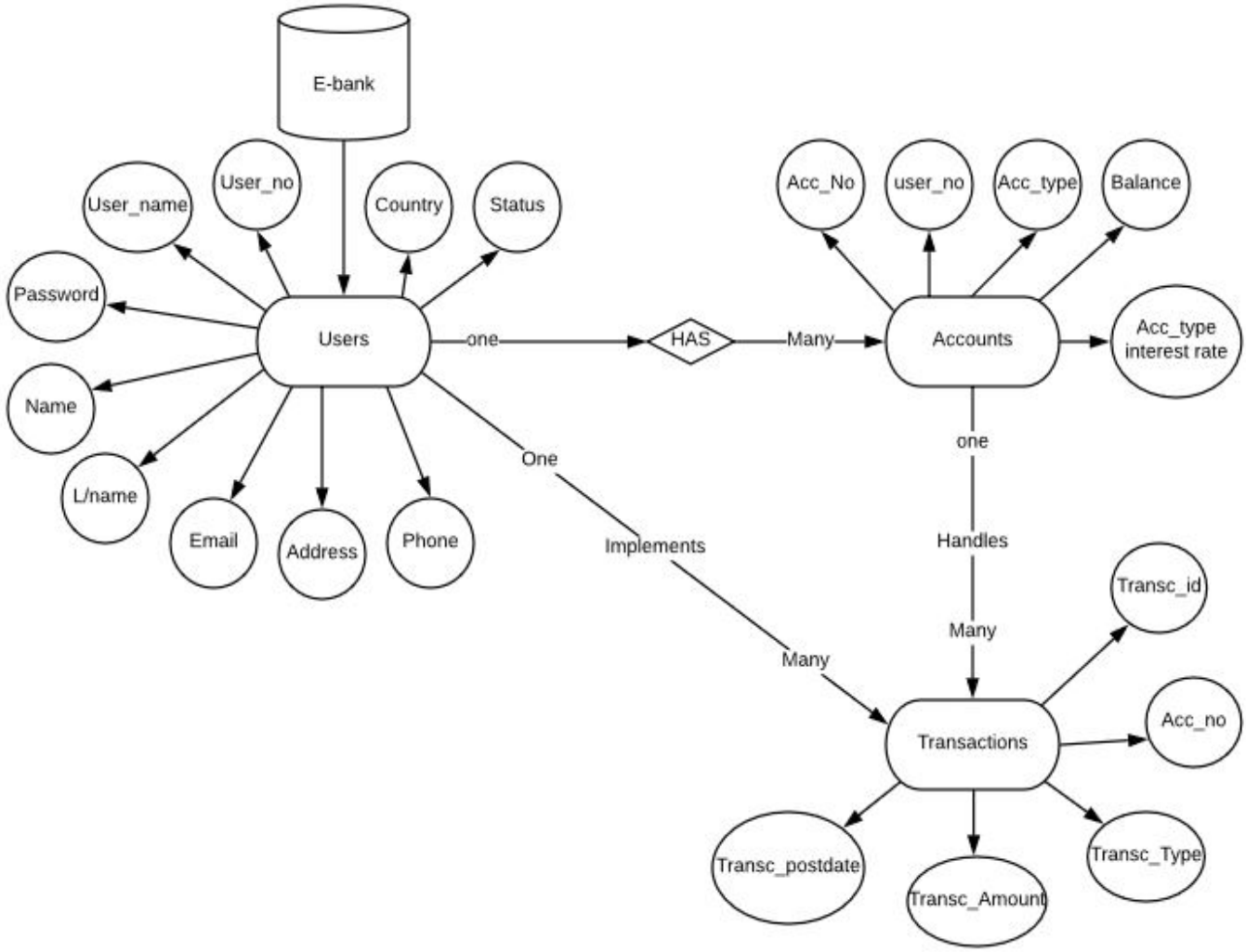
2) **Transactions;** the designed schema should be able to associate the user and the banking product that he is involved with the following rules: restrict the amount of permitted redraw, defining the deposit interest of accounts and impose credit overall pay limit.

3**) Users;** the registered user information includes a unique user identifier, their user name, first and last names, email address, their phone number, country of residence and status (A – active, B- banned-temporarily, P- banned permanently) for the country use the three letter ISO 3166.

Keep logging; log any user transaction, include information like timestamp and IP of client's login, timestamp of any transactions, id's of transactions that the user inserted.

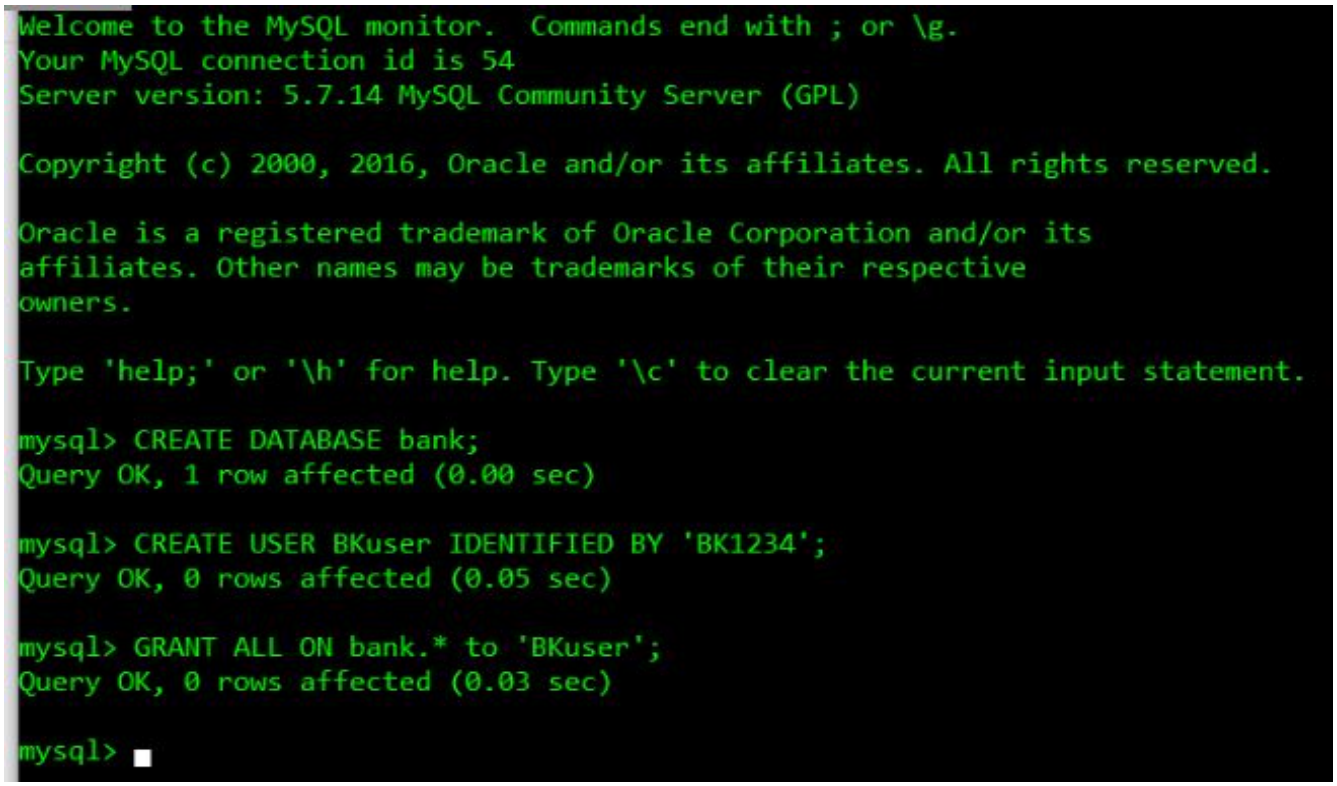
Logical ERD Model

The following figure represents the design of entity relationship diagram it also indicates the attributes of each entity defined based on requirements and the type of relationship build in between them.

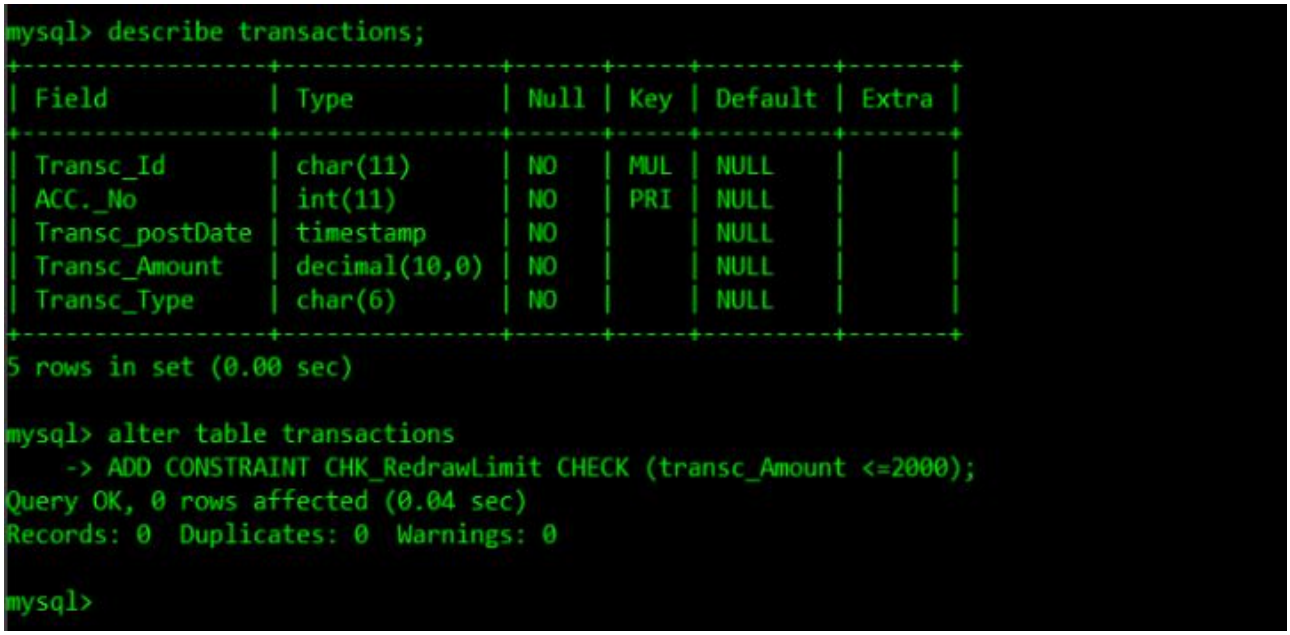


Database & Table Creation, Data Insertion and Additional Database Objects

The following screenshots represents the actual quires used and steps have been taken to create the database ***bank***, attributes of each entity, constraints that were imposed on required fields.



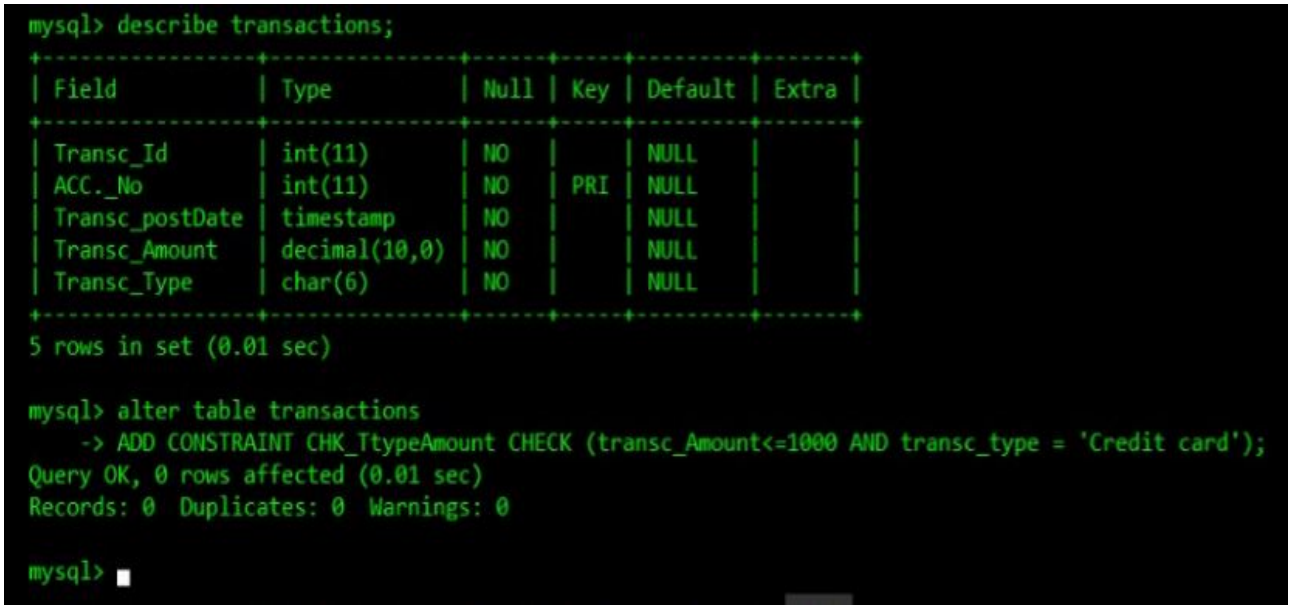
The following images describe the constraints imposed on transaction amount which is to limit by 2.000 and the credit card overall payment limit is set to 1.000.



```
mysql> describe transactions;
+-----------------+---------------+------+-----+---------+-------+
| Field           | Type          | Null | Key | Default | Extra |
+-----------------+---------------+------+-----+---------+-------+
| Transc_Id       | char(11)      | NO   | MUL | NULL    |       |
| ACC._No         | int(11)       | NO   | PRI | NULL    |       |
| Transc_postDate | timestamp     | NO   |     | NULL    |       |
| Transc_Amount   | decimal(10,0) | NO   |     | NULL    |       |
| Transc_Type     | char(6)       | NO   |     | NULL    |       |
+-----------------+---------------+------+-----+---------+-------+
5 rows in set (0.00 sec)

mysql> alter table transactions
    -> ADD CONSTRAINT CHK_RedrawLimit CHECK (transc_Amount <=2000);
Query OK, 0 rows affected (0.04 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql>
```



```
mysql> describe transactions;
+-----------------+---------------+------+-----+---------+-------+
| Field           | Type          | Null | Key | Default | Extra |
+-----------------+---------------+------+-----+---------+-------+
| Transc_Id       | int(11)       | NO   |     | NULL    |       |
| ACC._No         | int(11)       | NO   | PRI | NULL    |       |
| Transc_postDate | timestamp     | NO   |     | NULL    |       |
| Transc_Amount   | decimal(10,0) | NO   |     | NULL    |       |
| Transc_Type     | char(6)       | NO   |     | NULL    |       |
+-----------------+---------------+------+-----+---------+-------+
5 rows in set (0.01 sec)

mysql> alter table transactions
    -> ADD CONSTRAINT CHK_TtypeAmount CHECK (transc_Amount<=1000 AND transc_type = 'Credit card');
Query OK, 0 rows affected (0.01 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql>
```

1. Create a script to allow a user to add a new e-banking user to the USERS table;

```
INSERT INTO `user`(`User_No`, `User_name`, `Password`, `Name`, `Last name`, `Email`, `Address`, `Phone`, `Country`, `Status`) VALUES ([value-1],[value-2],[value-3],[value-4],[value-5],[value-6],[value-7],[value-8],[value-9],[value-10]);
```

2. Add the following users using the script created in step 1. Query the USERS table to confirm that the new rows have been added.

```
mysql> INSERT INTO `user` (`User_No`, `User_name`, `Password`, `Name`, `Last name`, `Email`, `Address`, `Phone`, `Country`, `Status`) VALUES ('2723'
, 'glazy', '17017kdhl', 'George', 'serfakis', 'gesertf@dronem.com', '7th avenue, Athens', '1223427350', 'USA', 'A');
Query OK, 1 row affected (0.01 sec)

mysql> select * from user;
+---------+-----------+------------+----------+-----------+--------------------+--------------------------+------------+---------------+--------+
| User_No | User_name | Password   | Name     | Last name | Email              | Address                  | Phone      | Country       | Status |
+---------+-----------+------------+----------+-----------+--------------------+--------------------------+------------+---------------+--------+
| 1210    | smithh    | 11001@128  | smith    | hall      | smithha@yahoo.com  | 9th avenue london        |  408047242 | UK            | B      |
| 1211    | Jallen    | jan@19831  | jonson   | allen     | allenjan@yahoo.com | 9th avenue, Manchester   |   10283082 | UK            | P      |
| 1212    | wyoung    | will@17533 | williams | young     | wliam@gmail.com    | 5th avenue, paris        |   25002752 | France        | B      |
| 1213    | mlopez    | @1212alB   | miller   | lopez     | lopez92@yahoo.com  | 7th avenue, Barcelona    |  205720132 | Spain         | P      |
| 1235    | eli72     | eli@pass12 | eli      | julian    | julianeli@yahoo.com| 7th avenue, Athens       |  694876562 | Greece        | A      |
| 1236    | fadelh    | fah56592   | fadel    | hamid     | fadelh@gmail.com   | 8th avenue Athens        |   69592580 | Greece        | A      |
| 1237    | ja2424    | ja114112   | james    | addison   | addisonja@yahoo.com| 8th avenue, sofia        |  385037602 | Bulgaria      | A      |
| 1238    | haziz     | 26720@13?  | haris    | aziz      | haris94@yahoo.com  | 9th avenue, Bayreuth     |  275027223 | Lebanan       | B      |
| 1239    | mmurphy   | 78ma@183/  | michel   | murphy    | murphymic@gmail.com| 9th avenue, Washington DC|  102205720 | United States | P      |
| 2723    | glazy     | 17017kdhl  | George   | serfakis  | gesertf@dronem.com | 7th avenue, Athens       | 1223427350 | USA           | A      |
+---------+-----------+------------+----------+-----------+--------------------+--------------------------+------------+---------------+--------+
10 rows in set (0.00 sec)

mysql>
```

3. Add a new saving account for one user;

```
mysql> INSERT INTO `accounts` (`ACC_NO`, `User_No`, `ACC_Type`, `ACC_TypeINTERESTRATE`, `Balance`) VALUES ('2724', '2724', 'saving', '2.0', '1785.45'
);
Query OK, 1 row affected, 1 warning (0.02 sec)

mysql> select * from accounts;
+----------+---------+----------+----------------------+---------+
| ACC_NO   | User_No | ACC_Type | ACC_TypeINTERESTRATE | Balance |
+----------+---------+----------+----------------------+---------+
| 1210     | 1414    | loan     |                    2 |  145234 |
| 1211     | 4132    | saving   |                    2 |     876 |
| 1212     | 36323   | depos    |                    1 |   17545 |
| 1213     | 1533    | loan     |                    3 |    7853 |
| 1214     | 24942   | saving   |                    3 |   14152 |
| 1235     | 2       | saving   |                    4 |   12321 |
| 1236     | 3       | saving   |                    4 |     944 |
| 1237     | 4       | loan     |                    2 |    1232 |
| 1238     | 5       | saving   |                    2 |   76548 |
| 1239     | 1412    | loan     |                    1 |   42141 |
| 2722     | 2722    | deposit  |                    1 |    2151 |
| 2723     | 2723    | saving   |                    3 |    1644 |
| 2724     | 2724    | saving   |                    2 |    1785 |
| 6591010  | 2722    | saving   |                    2 |    2970 |
| AH124411 | 1       | deposit  |                    4 |    1234 |
+----------+---------+----------+----------------------+---------+
15 rows in set (0.00 sec)

mysql>
```

4. Add a deposit for the account you have created;
5. Change the user status to P- Banned permanently;

```
mysql> UPDATE `user` SET `Status` = 'P' WHERE `user`.`User_No` = '1210';
Query OK, 1 row affected (0.01 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql>
```

6. Delete all the information of the user;

```
mysql> DELETE FROM user WHERE user_no = 1237;
Query OK, 1 row affected (0.03 sec)

mysql>
```

7. The DBA of bankers.com has requested the creation of sequences for the primary key columns of the ACCOUNTS and TRANSACTIONS tables. After creating the sequences, add a new account to the ACCOUNTS table using the appropriate sequence. (Use any values for the remainder of columns.). Add a row to the TRANSACTIONS table referencing the sequence-s value already created. (Use any values for the remainder of columns.)

```
mysql> describe transactions;
+------------------+---------------+------+-----+---------+----------------+
| Field            | Type          | Null | Key | Default | Extra          |
+------------------+---------------+------+-----+---------+----------------+
| Transc_Id        | int(8)        | NO   | MUL | NULL    | auto_increment |
| AccNo            | char(11)      | NO   | PRI | NULL    |                |
| Transc_postDate  | timestamp     | NO   |     | NULL    |                |
| Transc_Amount    | decimal(10,0) | NO   |     | NULL    |                |
| Transc_Type      | char(6)       | NO   |     | NULL    |                |
+------------------+---------------+------+-----+---------+----------------+
5 rows in set (0.00 sec)
```

```
mysql> describe accounts;
+----------------------+---------------+------+-----+---------+----------------+
| Field                | Type          | Null | Key | Default | Extra          |
+----------------------+---------------+------+-----+---------+----------------+
| AccNo                | int(8)        | NO   | PRI | NULL    | auto_increment |
| UserId               | char(8)       | NO   | MUL | NULL    |                |
| ACC_Type             | char(8)       | NO   |     | NULL    |                |
| ACC_TypeINTERESTRATE | decimal(4,0)  | NO   |     | NULL    |                |
| Balance              | decimal(10,0) | NO   |     | NULL    |                |
| Acc_Postdate         | date          | NO   |     | NULL    |                |
+----------------------+---------------+------+-----+---------+----------------+
6 rows in set (0.00 sec)
```

8. The user name and last name columns of the USERS table are used quite often in the WHERE clause condition of a query. Assuming that the USERS table is a table containing more than a million rows, create object-s that might improve the retrieval of data for these queries.
   Indexes are used to provide quick access to rows in a table. Indexes provide faster access to data for operations that return a small portion of a table's rows. The users cannot see the indexes; they are just used to speed up searches/queries.

```
mysql> CREATE INDEX idx_userNL
    -> ON user(Name,Last_name);
Query OK, 0 rows affected (0.06 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql>
```

9. Would a BITMAP index be appropriate for any columns in the database (assuming that the columns are used in search and/or sort operations)? If so, identify the columns and explain why a bitmap index is appropriate for these columns.
   For an e-banking database use of a BITMAP index would be appropriate concerning the massive number of records stored in database therefore it will provide the following advantages: it will reduce the response time for queries send to database, a substantial reduction of space usage compared to the other indexing techniques, very efficient maintenance during parallel DML and loads. So it can be applied on status which has three distinct values or on user Id, account number even on user name and last name which is often queried with other columns in database therefore It will improve query performance AND and OR conditions in WHERE clause of a query can be resolved by performing the corresponding Boolean operation directly on the bitmaps before converting the resulting bitmap in rowids. In such case if the resulting number of rows is small, the query can be answered very quickly without resorting to a full table scan of a table.
10. Would using the database be any easier with the creation of any synonyms? Explain why or why not.
    Synonyms provide both data independence and location transparency. Synonyms permit applications to function without modification regardless of which user owns the table or view and regardless of which database holds the table or view. Therefore it could make it easier using the database However; synonyms are not a substitute for privileges on database objects. Appropriate privileges must be granted to a user before the user can use the synonym.

Questions Sections C – Database Queries

1. List the id, user name, first name and last name of all users registered. Sort the results alphabetically according to last name, first name.

```
mysql> select UserId,Name,Last_name,User_name FROM user ORDER BY Last_name ASC,Name ASC;
+--------+--------+-----------+-----------+
| UserId | Name   | Last_name | User_name |
+--------+--------+-----------+-----------+
| 1211   | jonson | allen     | Jallen    |
| 1238   | haris  | aziz      | haziz     |
| 1210   | smith  | hall      | smithh    |
| 1235   | eli    | julian    | eli72     |
| 1239   | michel | murphy    | mmurphy   |
| 2723   | George | serfakis  | glazy     |
+--------+--------+-----------+-----------+
6 rows in set (0.00 sec)
```

2. List the user name, status, accounts, cards, loans of all users who are currently in an “Active” mode. Order the results alphabetically according to last name, first name.

```
mysql> select * from user INNER JOIN accounts ON user.UserId= accounts.AccNo WHERE Status='A' ORDER BY Last_name ASC, Name ASC;
+--------+-----------+------------+--------+-----------+--------------------+----------------------+------------+---------+--------+-------+------+
--+----------+--------------------+---------+--------------+
| UserId | User_name | Password   | Name   | Last_name | Email              | Address              | Phone      | Country | Status | AccNo | UserI
d | ACC_Type | ACC_TypeINTERESTRATE | Balance | Acc_Postdate |
+--------+-----------+------------+--------+-----------+--------------------+----------------------+------------+---------+--------+-------+------+
--+----------+--------------------+---------+--------------+
| 1238   | haziz     | 26720@13?  | haris  | aziz      | haris94@yahoo.com  | 9th avenue, Bayreuth |  275027223 | Lebanan | A      | 1238  | 5
  | saving   |                  2 |   76548 | 2018-02-13   |
| 1210   | smithh    | 11001@128  | smith  | hall      | smithha@yahoo.com  | 9th avenue london    |  408047242 | UK      | A      | 1210  | 1414
  | loan     |                  2 |  145234 | 2018-01-01   |
| 1235   | eli72     | eli@pass12 | eli    | julian    | julianeli@yahoo.com | 7th avenue, Athens   |  694876562 | Greece  | A      | 1235  | 2
  | saving   |                  4 |   12321 | 2018-02-04   |
| 2723   | glazy     | 17017kdhl  | George | serfakis  | gesertf@dronem.com | 7th avenue, Athens   | 1223427350 | USA     | A      | 2723  | 2723
  | saving   |                  3 |    1644 | 2018-02-23   |
+--------+-----------+------------+--------+-----------+--------------------+----------------------+------------+---------+--------+-------+------+
--+----------+--------------------+---------+--------------+
4 rows in set (0.00 sec)
```

3. Create a list of countries and the number of users from each county.

```
mysql> select Country,Name,Last_name from user;
+----------------+--------+-----------+
| Country        | Name   | Last_name |
+----------------+--------+-----------+
| UK             | smith  | hall      |
| UK             | jonson | allen     |
| Greece         | eli    | julian    |
| Lebanan        | haris  | aziz      |
| United States  | michel | murphy    |
| USA            | George | serfakis  |
+----------------+--------+-----------+
6 rows in set (0.00 sec)
```

```
mysql> select * from user WHERE Country='Greece';
+--------+-----------+------------+------+-----------+--------------------+-------------------+-----------+---------+--------+
| UserId | User_name | Password   | Name | Last_name | Email              | Address           | Phone     | Country | Status |
+--------+-----------+------------+------+-----------+--------------------+-------------------+-----------+---------+--------+
| 1235   | eli72     | eli@pass12 | eli  | julian    | julianeli@yahoo.com | 7th avenue, Athens | 694876562 | Greece  | A      |
+--------+-----------+------------+------+-----------+--------------------+-------------------+-----------+---------+--------+
1 row in set (0.00 sec)

mysql> select * from user where Country='UK';
+--------+-----------+-----------+--------+-----------+-------------------+-----------------------+-----------+---------+--------+
| UserId | User_name | Password  | Name   | Last_name | Email             | Address               | Phone     | Country | Status |
+--------+-----------+-----------+--------+-----------+-------------------+-----------------------+-----------+---------+--------+
| 1210   | smithh    | 11001@128 | smith  | hall      | smithha@yahoo.com | 9th avenue london     | 408047242 | UK      | P      |
| 1211   | Jallen    | jan@19831 | jonson | allen     | allenjan@yahoo.com | 9th avenue, Manchester |  10283082 | UK      | P      |
+--------+-----------+-----------+--------+-----------+-------------------+-----------------------+-----------+---------+--------+
2 rows in set (0.00 sec)
```

4. Find the users that have exceeded a 2.000 Euros redraw limit from their banking accounts per month, in any of the last 3 months. Exclude credit cards and loans.

```
mysql> select* from transactions WHERE Transc_Amount >2000;
+------------+----------+---------------------+---------------+--------------+
| Transc_Id  | AccNo    | Transc_postDate     | Transc_Amount | Transc_Type  |
+------------+----------+---------------------+---------------+--------------+
| 15422      | 1210     | 2018-02-23 14:05:22 |          3400 | saving       |
| 25241      | 1211     | 2018-02-23 14:05:22 |          2140 | depos        |
| 17533      | 1213     | 2018-02-23 14:05:22 |          2400 | saving       |
| 41342      | 6591010  | 2018-02-23 14:05:22 |          3400 | depos        |
| 5447       | AH124411 | 2018-02-23 14:05:22 |          4100 | depos        |
+------------+----------+---------------------+---------------+--------------+
5 rows in set (0.00 sec)
```

5. Order the customer list according the number of transactions per month; include all banking products the user has purchased.

```
mysql> select Transc_Id, Transc_POSTDATE, Transc_Amount, Transc_Type FROM transactions LEFT JOIN user ON user.UserId=transactions.AccNO ORDER BY Tran
sc_POSTDATE;
+-----------+---------------------+---------------+-------------+
| Transc_Id | Transc_POSTDATE     | Transc_Amount | Transc_Type |
+-----------+---------------------+---------------+-------------+
| 15422     | 2018-02-23 14:05:22 |          3400 | saving      |
| 25241     | 2018-02-23 14:05:22 |          2140 | depos       |
| 17533     | 2018-02-23 14:05:22 |          2400 | saving      |
| 175427    | 2018-02-23 14:05:22 |           590 | saving      |
| 31212     | 2018-02-23 14:05:22 |             2 | sav         |
| 3131      | 2018-02-23 14:05:22 |             1 | depos       |
| 252523    | 2018-02-23 14:05:22 |           781 | depos       |
| 26592     | 2018-02-23 14:05:22 |          1201 | saving      |
| 41342     | 2018-02-23 14:05:22 |          3400 | depos       |
| 5447      | 2018-02-23 14:05:22 |          4100 | depos       |
+-----------+---------------------+---------------+-------------+
10 rows in set (0.00 sec)
```

Another way of fetching the same data is the following script

```
mysql> select Transc_Id, Transc_Amount, Transc_Type, Transc_POSTDATE FROM transactions ORDER BY Transc_POSTDATE;
+-----------+---------------+-------------+---------------------+
| Transc_Id | Transc_Amount | Transc_Type | Transc_POSTDATE     |
+-----------+---------------+-------------+---------------------+
| 15422     |          3400 | saving      | 2018-02-23 14:05:22 |
| 25241     |          2140 | depos       | 2018-02-23 14:05:22 |
| 17533     |          2400 | saving      | 2018-02-23 14:05:22 |
| 175427    |           590 | saving      | 2018-02-23 14:05:22 |
| 31212     |             2 | sav         | 2018-02-23 14:05:22 |
| 3131      |             1 | depos       | 2018-02-23 14:05:22 |
| 252523    |           781 | depos       | 2018-02-23 14:05:22 |
| 26592     |          1201 | saving      | 2018-02-23 14:05:22 |
| 41342     |          3400 | depos       | 2018-02-23 14:05:22 |
| 5447      |          4100 | depos       | 2018-02-23 14:05:22 |
+-----------+---------------+-------------+---------------------+
10 rows in set (0.00 sec)
```

6. Create a statement that indicates the balance of any account , loan , card of a user in a given date

```
mysql> select AccNo,UserId,Balance,ACC_Type FROM accounts WHERE Acc_Postdate BETWEEN('2017-01-01') AND ('2018-02-20');
+-------+--------+---------+----------+
| AccNo | UserId | Balance | ACC_Type |
+-------+--------+---------+----------+
| 1210  | 1414   |  145234 | loan     |
| 1211  | 4132   |     876 | saving   |
| 1212  | 36323  |   17545 | depos    |
| 1213  | 1533   |    7853 | loan     |
| 1235  | 2      |   12321 | saving   |
| 1236  | 3      |     944 | saving   |
| 1238  | 5      |   76548 | saving   |
| 1240  | 8692   |    4243 | loan     |
| 2722  | 2722   |    2151 | deposit  |
| 2724  | 2724   |    1785 | saving   |
+-------+--------+---------+----------+
10 rows in set (0.00 sec)
```