Relational Database Specification

**Table of Contents**

[1.0 A Description of the Application Background 3](#_TOC_250006)

[2.0 A Specification of the Database Requirements 3](#_TOC_250005)

[3.0 The ER Diagram 5](#_TOC_250004)

[4.0 The Relational Database Schema 6](#_TOC_250003)

[5.0 The Sample Database (instance) 6](#_TOC_250002)

6.0 The SQL Statements 11

[7.0 The Query/Update results 13](#_TOC_250001)

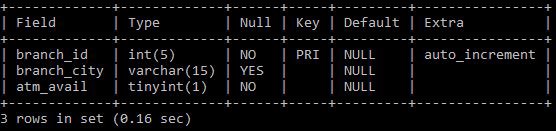
# 1 .0 A Description of the Application Background

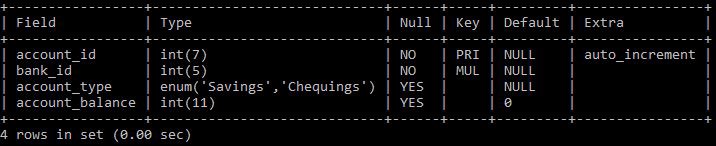
#### The database system we have chosen is that of a simple local banking system such as TCF Bank with multiple branches, due to our familiarity with banking systems.The database will keep records of customer attributes, For our sample database banks have multiple Bankers working for them. Each banker is assigned to a single customer. Bankers can assign customers loans. Customers will be able to borrow loans, get credit cards. Bank branches have ATMs and bankers working for them.

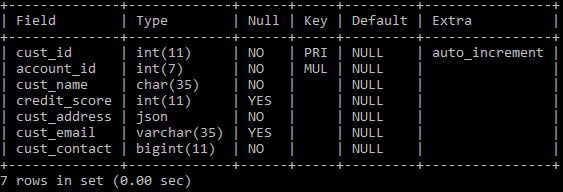
# 2 .0 A Specification of the Database Requirements

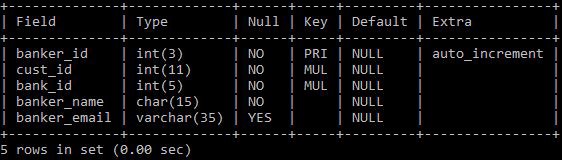
Our Database is designed in MySQL Version 5.7.32. It will have tables of each entity

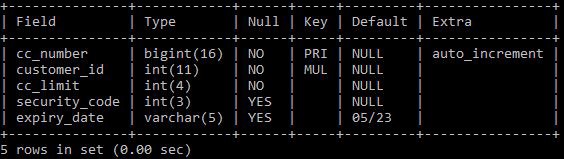
from the following ER Diagram. Each entity will have attributes with a primary key and may also have a foreign key to refer to different tables. Here are descriptions of each table:

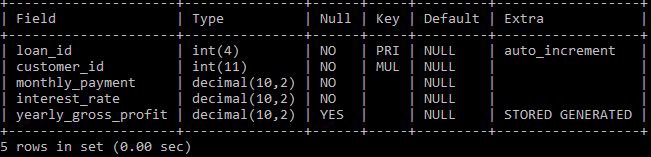
Bank Table:

Account Table:

Customer Table:

Banker Table:

Credit Card Table:

Loan Table:

# 3 .0 The ER Diagram

# 4 .0 The Relational Database Schema

# 5 .0 The Sample Database (instance)

#[1]

INSERT INTO bank\_tb(branch\_city,atm\_avail) VALUES('Troy',True); INSERT INTO account\_tb(bank\_id,account\_type,account\_balance) VALUES(1,'Savings',17823);

INSERT INTO

customer\_tb(account\_id,cust\_name,credit\_score,cust\_address,cust\_email,cust\_contact) VALUES(2587495,'John King',790,'{"Street":"1234, Brook

Dr","City":"Troy","State":"MI","Zip":48089}',"[john121@gmail.com](mailto:john121@gmail.com)", 2482501234);

INSERT INTO banker\_tb(cust\_id,bank\_id,banker\_name,banker\_email) VALUES(1,1,'Paul Toledo',"[paultol@gmail.com](mailto:paultol@gmail.com)");

INSERT INTO credit\_card(customer\_id,cc\_limit,security\_code) VALUES(1,2000,763);

INSERT INTO loan\_tb(customer\_id,monthly\_payment,interest\_rate) VALUES(1,170,3.2);

#[2]

INSERT INTO bank\_tb(branch\_city, atm\_avail) VALUES('Detroit', False); INSERT INTO account\_tb(bank\_id,account\_type,account\_balance) VALUES(2,'Chequings', 5562);

INSERT INTO

customer\_tb(account\_id,cust\_name,credit\_score,cust\_address,cust\_email,cust\_contact) VALUES(2587496,'Julie Nice',470,'{"Street":"463, Bonnie Ln","City":"Detroit","State":"MI","Zip":48128}',"[julnic101@yahoo.com](mailto:julnic101@yahoo.com)", 3133445632); INSERT INTO banker\_tb(cust\_id,bank\_id,banker\_name,banker\_email) VALUES(2,2,'John Williams',"[jwill1009@outlook.com](mailto:jwill1009@outlook.com)");

INSERT INTO credit\_card(customer\_id,cc\_limit,security\_code) VALUES(2,5000,345); INSERT INTO loan\_tb(customer\_id,monthly\_payment,interest\_rate) VALUES(2,145,2.5);

#[3]

INSERT INTO bank\_tb(branch\_city, atm\_avail) VALUES('Dearborn', True); INSERT INTO account\_tb(bank\_id,account\_type,account\_balance) VALUES(3,'Savings', 14567);

INSERT INTO

customer\_tb(account\_id,cust\_name,credit\_score,cust\_address,cust\_email,cust\_contact) VALUES(2587497,'Manish Patel', 560,'{"Street":"789, Ford Road","City":"Dearborn","State":"MI","Zip":48126}',"[mannipa119@hotmail.com](mailto:mannipa119@hotmail.com)", 3135436756);

INSERT INTO banker\_tb(cust\_id,bank\_id,banker\_name,banker\_email) VALUES(3,3,'Logan Lee',"[loglee@gmail.com](mailto:loglee@gmail.com)");

INSERT INTO credit\_card(customer\_id,cc\_limit,security\_code) VALUES(3,2500,129);

#[4]

INSERT INTO bank\_tb(branch\_city, atm\_avail) VALUES('Rochester Hills', True); INSERT INTO account\_tb(bank\_id,account\_type,account\_balance) VALUES(4,'Chequings', 150950);

INSERT INTO

customer\_tb(account\_id,cust\_name,credit\_score,cust\_address,cust\_email,cust\_contact) VALUES(2587498,'Jessica Paul', 670,'{"Street":"1239, Rochester Road","City":"Rochester Hills","State":"MI","Zip":48306}',"[jesspaul007@outlook.com](mailto:jesspaul007@outlook.com)", 2487653214);

INSERT INTO banker\_tb(cust\_id,bank\_id,banker\_name,banker\_email)

VALUES(4,4,'Lucy Johnson',"[johnsonlucy11@yahoo.com](mailto:johnsonlucy11@yahoo.com)"); INSERT INTO loan\_tb(customer\_id,monthly\_payment,interest\_rate) VALUES(4,163.4,3.2);

#[5]

INSERT INTO account\_tb(bank\_id,account\_type,account\_balance) VALUES(2,'Chequings', 112098);

INSERT INTO

customer\_tb(account\_id,cust\_name,credit\_score,cust\_address,cust\_email,cust\_contact) VALUES(2587499,'Nick Snow',720,'{"Street":"544,John

Circle","City":"Detroit","State":"MI","Zip":48129}',"[nicsno1289@yahoo.com](mailto:nicsno1289@yahoo.com)", 3133441290);

INSERT INTO banker\_tb(cust\_id,bank\_id,banker\_name,banker\_email)

VALUES(5,2,'Jay Stafford',"[jstaff0909@gmail.com](mailto:jstaff0909@gmail.com)");

#[6]

INSERT INTO account\_tb(bank\_id,account\_type,account\_balance) VALUES(1,'Savings', 402098);

INSERT INTO

customer\_tb(account\_id,cust\_name,credit\_score,cust\_address,cust\_email,cust\_contact) VALUES(2587500,'Joel Groove',750,'{"Street":"112, Bear Dr","City":"Troy","State":"MI","Zip":48093}',"[jgroove500@gmail.com](mailto:jgroove500@gmail.com)", 2482534562); INSERT INTO banker\_tb(cust\_id,bank\_id,banker\_name,banker\_email) VALUES(6,1,'Ashley Ford',"[ashford001@outlook.com](mailto:ashford001@outlook.com)");

INSERT INTO credit\_card(customer\_id,cc\_limit,security\_code) VALUES(6,10000,912);

#[7]

INSERT INTO account\_tb(bank\_id,account\_type,account\_balance) VALUES(3,'Chequings', 195000);

INSERT INTO

customer\_tb(account\_id,cust\_name,credit\_score,cust\_address,cust\_email,cust\_contact) VALUES(2587501,'Jill Borden',320,'{"Street":"544, Marwa Lane","City":"Dearborn","State":"MI","Zip":48121}',"[marla89@outlook.com](mailto:marla89@outlook.com)", 3132219032);

INSERT INTO banker\_tb(cust\_id,bank\_id,banker\_name,banker\_email) VALUES(7,3,'Mary Williams',"[marwill19@gmail.com](mailto:marwill19@gmail.com)");

INSERT INTO loan\_tb(customer\_id,monthly\_payment,interest\_rate) VALUES(7,122,3.2);

#[8]

INSERT INTO account\_tb(bank\_id,account\_type,account\_balance) VALUES(4,'Chequings', 65008);

INSERT INTO

customer\_tb(account\_id,cust\_name,credit\_score,cust\_address,cust\_email,cust\_contact) VALUES(2587502,'Steve Kerr', 610,'{"Street":"119, Gatlin Lane","City":"Port Huron","State":"MI","Zip":48060}',"[skerr1002@hotmail.com](mailto:skerr1002@hotmail.com)", 8109211009);

INSERT INTO credit\_card(customer\_id,cc\_limit,security\_code) VALUES(8,5000,542); #[9]

INSERT INTO account\_tb(bank\_id,account\_type,account\_balance) VALUES(2,NULL, NULL);

INSERT INTO

customer\_tb(account\_id,cust\_name,credit\_score,cust\_address,cust\_email,cust\_contact) VALUES(2587503,'Joe Billy',700,'{"Street":"121, Jordy

Dr","City":"Detroit","State":"MI","Zip":48126}',"[marla89@outlook.com](mailto:marla89@outlook.com)", 3132215632); INSERT INTO banker\_tb(cust\_id,bank\_id,banker\_name,banker\_email) VALUES(9,3,'Macy Trillium',"[matrill1109@outlook.com](mailto:matrill1109@outlook.com)");

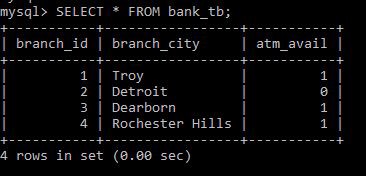
INSERT INTO loan\_tb(customer\_id,monthly\_payment,interest\_rate) VALUES(9,231,1.9);

#[10]

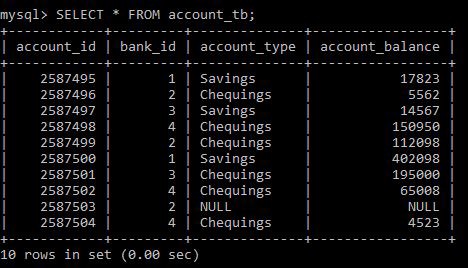
INSERT INTO account\_tb(bank\_id,account\_type,account\_balance) VALUES(4,'Chequings', 4523);

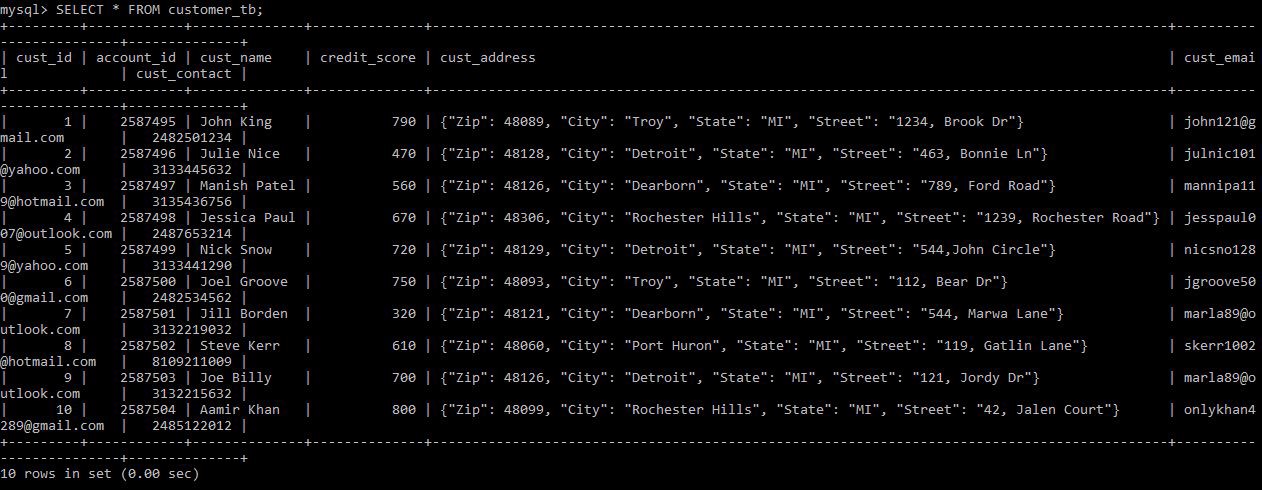
INSERT INTO

customer\_tb(account\_id,cust\_name,credit\_score,cust\_address,cust\_email,cust\_contact) VALUES(2587504,'Aamir Khan',800,'{"Street":"42, Jalen Court","City":"Rochester Hills","State":"MI","Zip":48099}',"[onlykhan4289@gmail.com](mailto:onlykhan4289@gmail.com)", 2485122012);

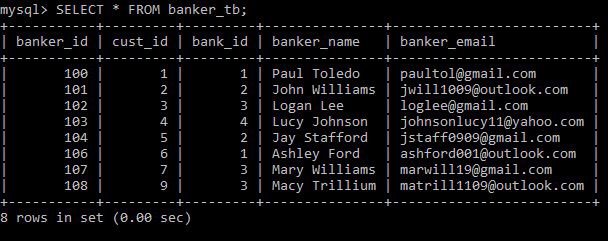
SELECT \* FROM bank\_tb;

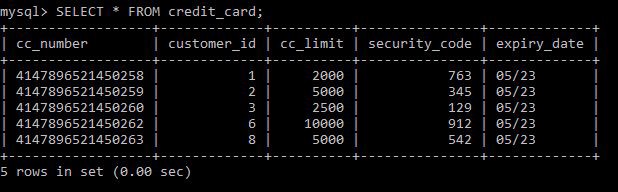
SELECT \* FROM account\_tb;

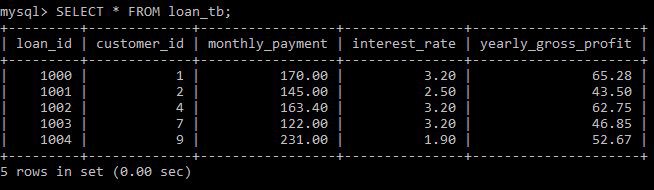


SELECT \* FROM customer\_tb;

SELECT \* FROM banker\_tb;



SELECT \* FROM credit\_card;

SELECT \* FROM loan\_tb;

**6 .0 The SQL Statements - Loading Data**

DROP DATABASE IF EXISTS bank\_db; CREATE DATABASE IF NOT EXISTS bank\_db;

USE bank\_db;

DROP TABLE IF EXISTS bank\_tb; CREATE TABLE IF NOT EXISTS bank\_tb(

branch\_id INT(5) AUTO\_INCREMENT, branch\_city VARCHAR(15),

atm\_avail BOOLEAN NOT NULL,

CONSTRAINT pk\_branch\_id PRIMARY KEY(branch\_id)

);

DROP TABLE IF EXISTS account\_tb; CREATE TABLE IF NOT EXISTS account\_tb( account\_id INT(7) AUTO\_INCREMENT, bank\_id INT(5) NOT NULL,

account\_type ENUM('Savings','Chequings'), account\_balance INT(11) DEFAULT 0,

CONSTRAINT pk\_acc\_id PRIMARY KEY(account\_id),

CONSTRAINT fk\_bank\_id\_account FOREIGN KEY(bank\_id) REFERENCES bank\_tb(branch\_id)

)AUTO\_INCREMENT=2587495;

DROP TABLE IF EXISTS customer\_tb; CREATE TABLE IF NOT EXISTS customer\_tb( cust\_id INT(11) AUTO\_INCREMENT,

account\_id INT(7) NOT NULL, cust\_name CHAR(35) NOT NULL, credit\_score INT(11), cust\_address JSON NOT NULL, cust\_email VARCHAR(35),

cust\_contact BIGINT(11) NOT NULL, CONSTRAINT pk\_custid PRIMARY KEY(cust\_id),

CONSTRAINT fk\_accnt\_id FOREIGN KEY(account\_id) REFERENCES

account\_tb(account\_id)

);

DROP TABLE IF EXISTS banker\_tb; CREATE TABLE IF NOT EXISTS banker\_tb(

banker\_id INT(3) AUTO\_INCREMENT,

cust\_id INT(11) NOT NULL, bank\_id INT(5) NOT NULL,

banker\_name CHAR(15) NOT NULL,

banker\_email VARCHAR(35),

CONSTRAINT pk\_banker\_id PRIMARY KEY(banker\_id),

CONSTRAINT fk\_bank\_id\_banker FOREIGN KEY(bank\_id) REFERENCES bank\_tb(branch\_id),

CONSTRAINT fk\_cust\_id\_banker FOREIGN KEY(cust\_id) REFERENCES

customer\_tb(cust\_id)

)AUTO\_INCREMENT=100;

DROP TABLE IF EXISTS credit\_card; CREATE TABLE IF NOT EXISTS credit\_card( cc\_number BIGINT(16) AUTO\_INCREMENT,

customer\_id INT(11) NOT NULL, cc\_limit INT(4) NOT NULL, security\_code INT(3),

expiry\_date VARCHAR(5) DEFAULT "05/23", CONSTRAINT pk\_cc\_num PRIMARY KEY(cc\_number),

CONSTRAINT fk\_cc\_cus\_id FOREIGN KEY(customer\_id) REFERENCES customer\_tb(cust\_id)

)AUTO\_INCREMENT=4147896521450258;

DROP TABLE IF EXISTS loan\_tb; CREATE TABLE IF NOT EXISTS loan\_tb( loan\_id INT(4) AUTO\_INCREMENT,

customer\_id INT(11) NOT NULL, monthly\_payment DECIMAL(10,2) NOT NULL, interest\_rate DECIMAL(10,2) NOT NULL,

yearly\_gross\_profit DECIMAL(10,2) GENERATED ALWAYS AS(12\*(monthly\_payment\*interest\_rate/100)) STORED, CONSTRAINT pk\_loan\_loan\_id PRIMARY KEY(loan\_id),

CONSTRAINT fk\_loan\_cus\_id FOREIGN KEY(customer\_id) REFERENCES customer\_tb(cust\_id)

)AUTO\_INCREMENT=1000;

# 7 .0 The Query/Update results

##### Queries

#1 Bank customer's ID, Name and Zip code with high credit scores/No credit cards.

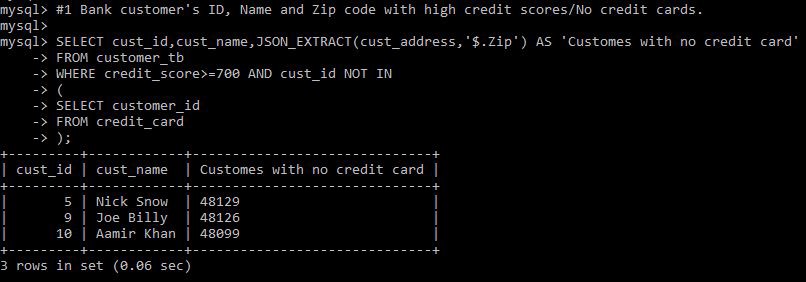
SELECT cust\_id,cust\_name,JSON\_EXTRACT(cust\_address,'$.Zip') AS 'Customers with no credit card'

FROM customer\_tb

WHERE credit\_score>=700 AND cust\_id NOT IN (

SELECT customer\_id FROM credit\_card

);



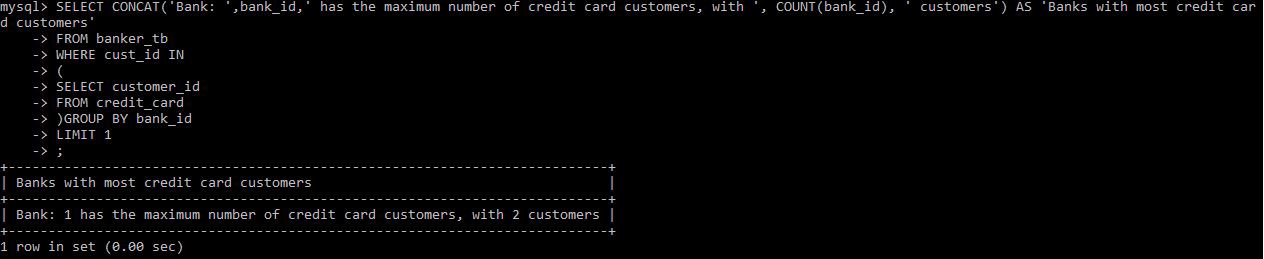
#2 Bank ID of Bank with the most credit card customers

SELECT CONCAT('Bank: ',bank\_id,' has the maximum number of credit card customers, with ', COUNT(bank\_id), ' customers') AS 'Banks with most credit card customers' FROM banker\_tb

WHERE cust\_id IN (

SELECT customer\_id FROM credit\_card

)GROUP BY bank\_id LIMIT 1;



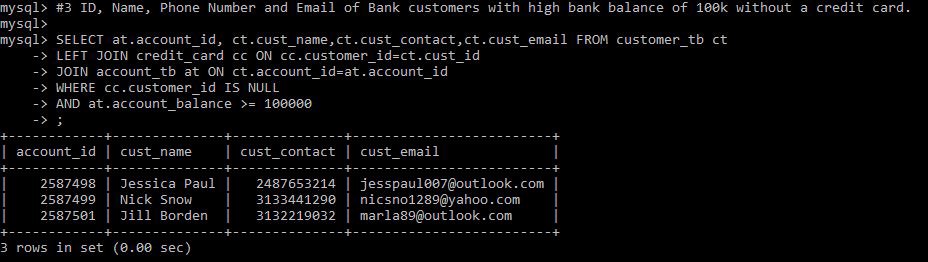
#3 ID, Name, Phone Number and Email of Bank customers with a high bank balance of 100k without a credit card.

SELECT at.account\_id, ct.cust\_name,ct.cust\_contact,ct.cust\_email FROM customer\_tb ct

LEFT JOIN credit\_card cc ON cc.customer\_id=ct.cust\_id

JOIN account\_tb at ON ct.account\_id=at.account\_id WHERE cc.customer\_id IS NULL

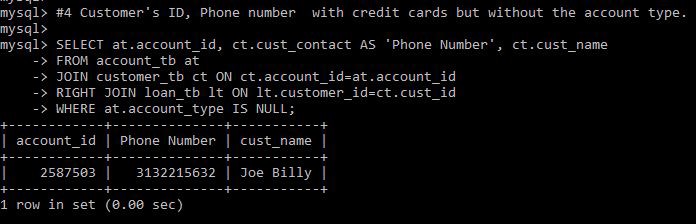
AND at.account\_balance >= 100000;



#4 Customer's ID, Phone number with credit cards but without the account type.

SELECT at.account\_id, ct.cust\_contact AS 'Phone Number', ct.cust\_name FROM account\_tb at

JOIN customer\_tb ct ON ct.account\_id=at.account\_id RIGHT JOIN loan\_tb lt ON lt.customer\_id=ct.cust\_id WHERE at.account\_type IS NULL;

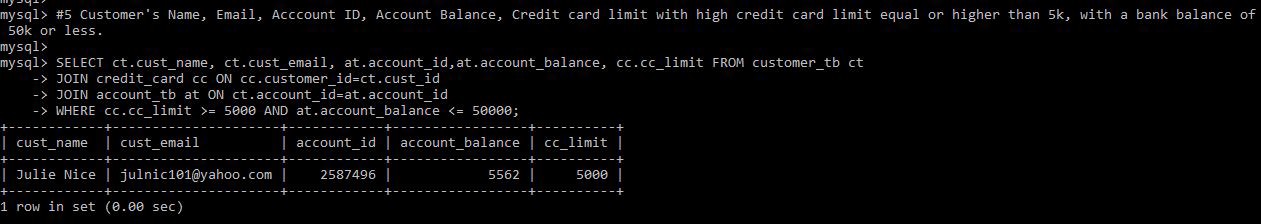


#5 Customer's Name, Email, Account ID, Account Balance, Credit card limit with high credit card limit equal or higher than 5k, with a bank balance of 50k or less.

SELECT ct.cust\_name, ct.cust\_email, at.account\_id,at.account\_balance, cc.cc\_limit FROM customer\_tb ct

JOIN credit\_card cc ON cc.customer\_id=ct.cust\_id JOIN account\_tb at ON ct.account\_id=at.account\_id

WHERE cc.cc\_limit >= 5000 AND at.account\_balance <= 50000;

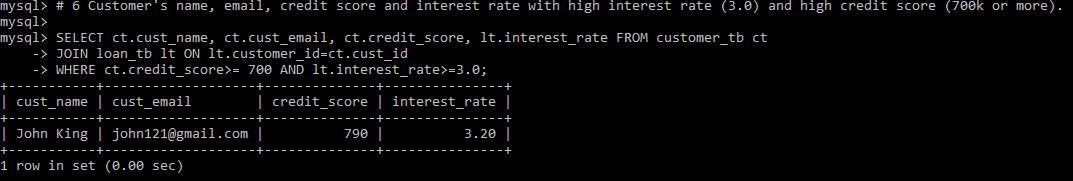


# 6 Customer's name, email, credit score and interest rate with high interest rate (3.0) and high credit score (700k or more).

SELECT ct.cust\_name, ct.cust\_email, ct.credit\_score, lt.interest\_rate FROM customer\_tb ct

JOIN loan\_tb lt ON lt.customer\_id=ct.cust\_id

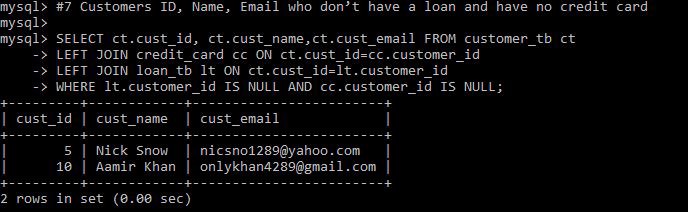
WHERE ct.credit\_score>= 700 AND lt.interest\_rate>=3.0;



#7 Customers ID, Name, Email who don’t have a loan and have no credit card

SELECT ct.cust\_id, ct.cust\_name,ct.cust\_email FROM customer\_tb ct LEFT JOIN credit\_card cc ON ct.cust\_id=cc.customer\_id

LEFT JOIN loan\_tb lt ON ct.cust\_id=lt.customer\_id

WHERE lt.customer\_id IS NULL AND cc.customer\_id IS NULL;

#8 Banker name, id and email of the loan number 1002

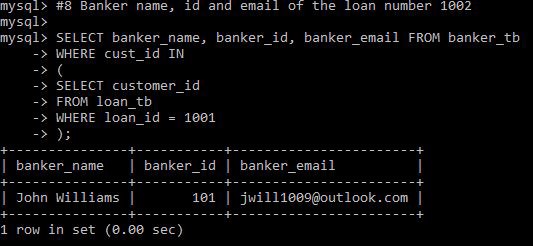
SELECT banker\_name, banker\_id, banker\_email FROM banker\_tb WHERE cust\_id IN

(

SELECT customer\_id FROM loan\_tb

WHERE loan\_id = 1001

);



#9 Number of customers who bank in Troy and have a balance under 50k

SELECT count(cust\_name) AS 'Num of customers', cust\_name, cust\_email FROM customer\_tb

WHERE account\_id IN

(

SELECT account\_id FROM account\_tb

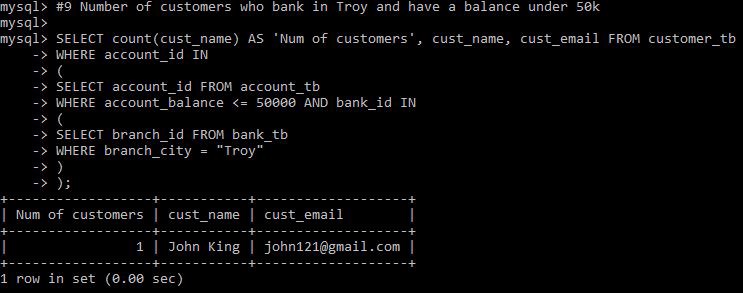
WHERE account\_balance <= 50000 AND bank\_id IN (

SELECT branch\_id FROM bank\_tb

WHERE branch\_city = "Troy"

)

);



#10 Name, Phone number and email of customers who bank at a branch without an ATM with a high bank balance of 100k or more

SELECT cust\_name, cust\_contact, cust\_email FROM customer\_tb WHERE account\_id IN

(

SELECT account\_id FROM account\_tb

WHERE account\_balance <= 100000 AND bank\_id IN (

SELECT branch\_id FROM bank\_tb

WHERE atm\_avail = "False"

)

);

