SCHOOL OF COMPUTER SCIENCES

UNIVERSITI SAINS MALAYSIA

CMT221/CMM222: Database Organization and Design

Semester 1, Academic Session: 2023/2024

System Implementation

Group Number: 33

Case Study Number 21: CT BANK MANAGEMENT DATABASE SYSTEM

Name	Matric No.	USM Email	Module	Role	Core/ Minor
NUR IRDINA SYHUHADA BINTI AZMAN	160394	irdinaazman@student.usm.my	1	Leader	Core
NURIN FARAH IZZATI BINTI MOHD RUSDI	160406	inurin32@student.usm.my	2	Member	Core
NUR HIDAYATI MUNIRAH BINTI JAMNUL AZAZI	160398	hidayatimunirah@student.usm.my	3	Member	Core
AQILAH SYAZWANI BINTI SHAWEL	160463	aqilahshawel03@student.usm.my	4	Member	Core

Date of Submission

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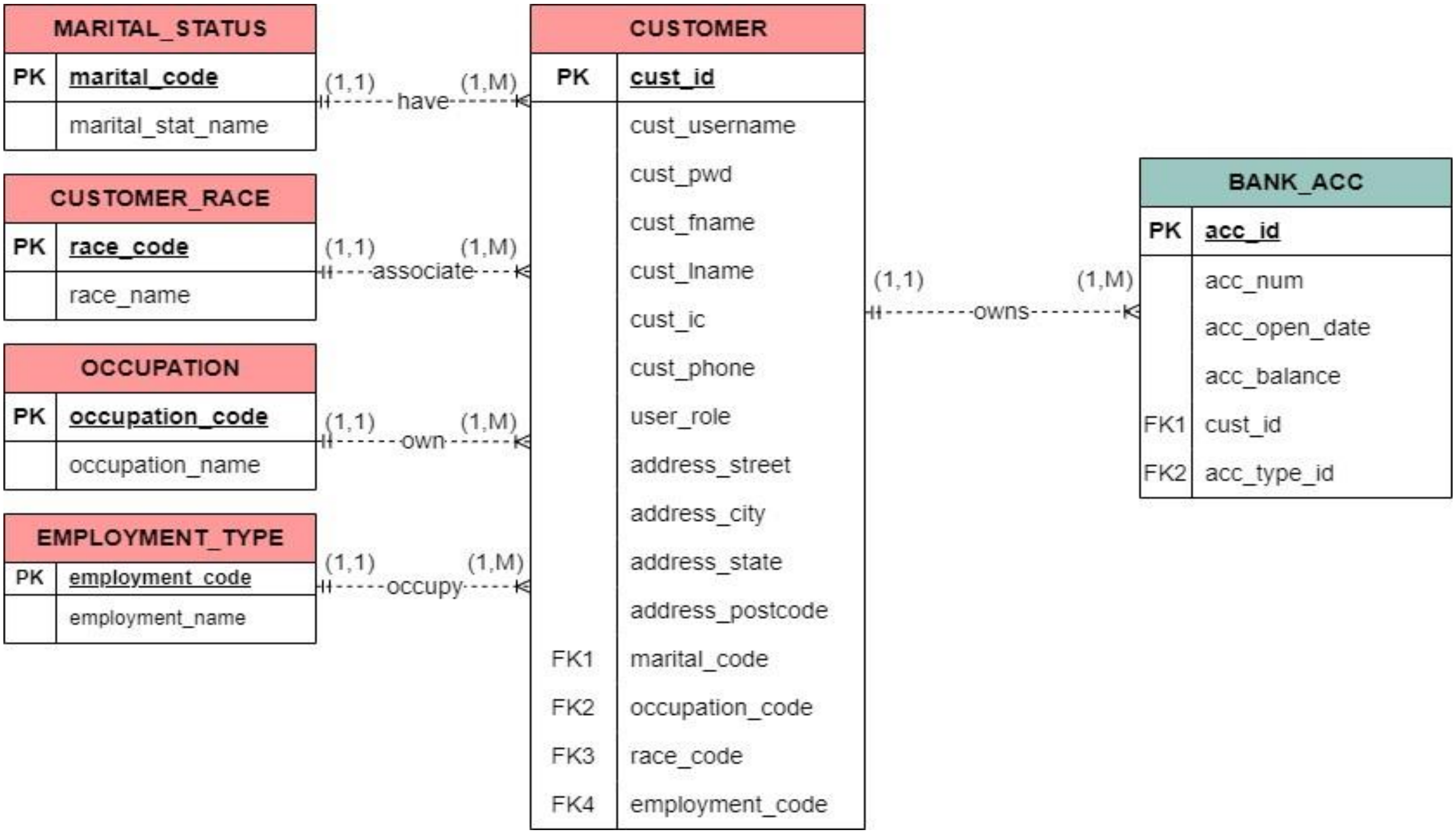
1.0 Business Rules and Partial ERDs

Module 1: Profile Registration – Nur Irdina Syhuhada

Business rule:

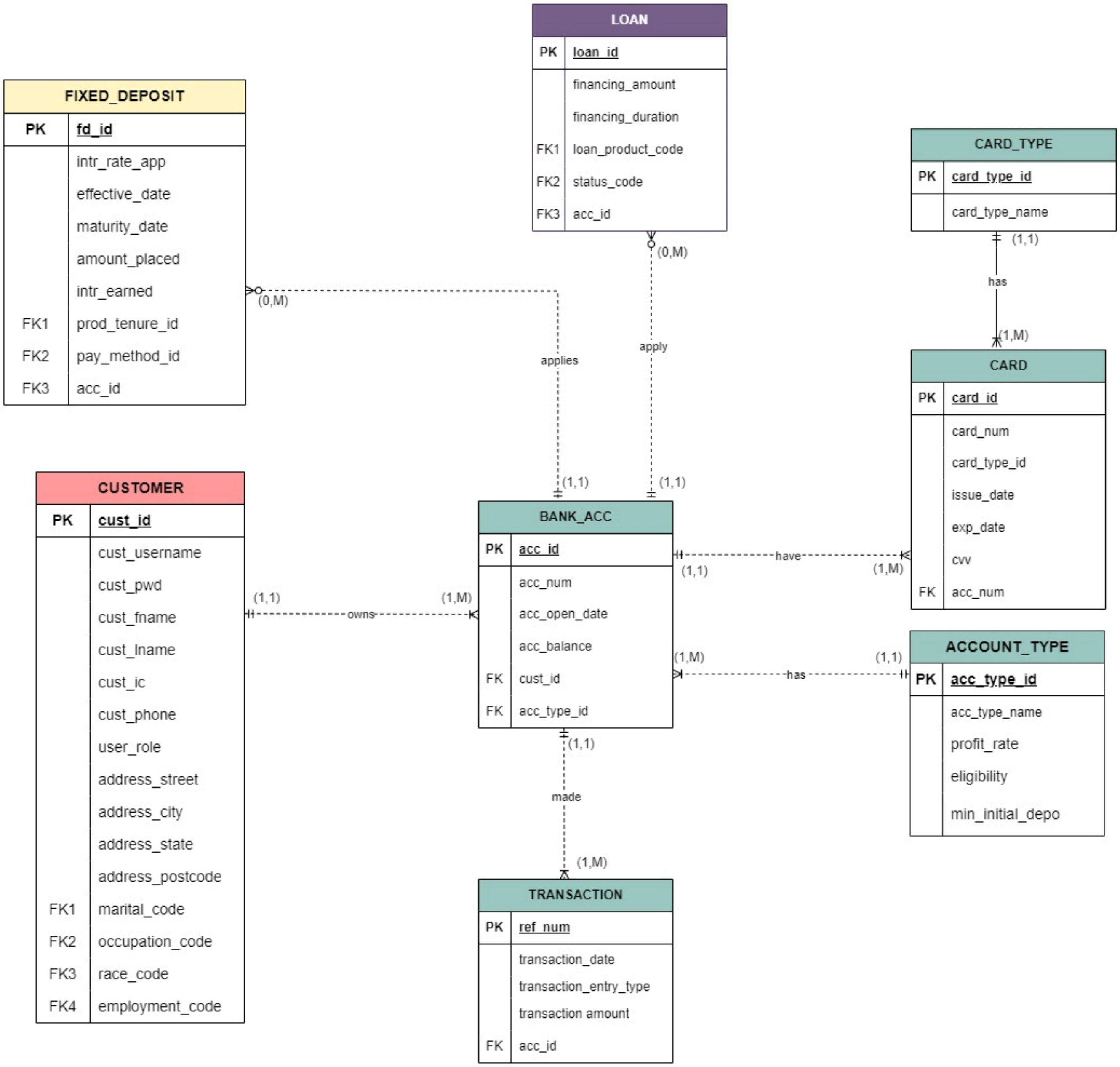
- Customer & Marital Status
  - One customer can only have one marital status. Each marital status belongs to one to many customers.
- Customer & Occupation
  - One customer can own only one occupation, but each occupation can be owned by one to many customers.
- Customer & Race
  - One customer associate with only one race. Each race can be associated with one to many customers.
- Customer & Employment Type
  - One customer may occupy one employment type. One employment type can be occupied by one to many customers.



Module 2: Bank Account – Nurin Farah Izzati

Business rule:

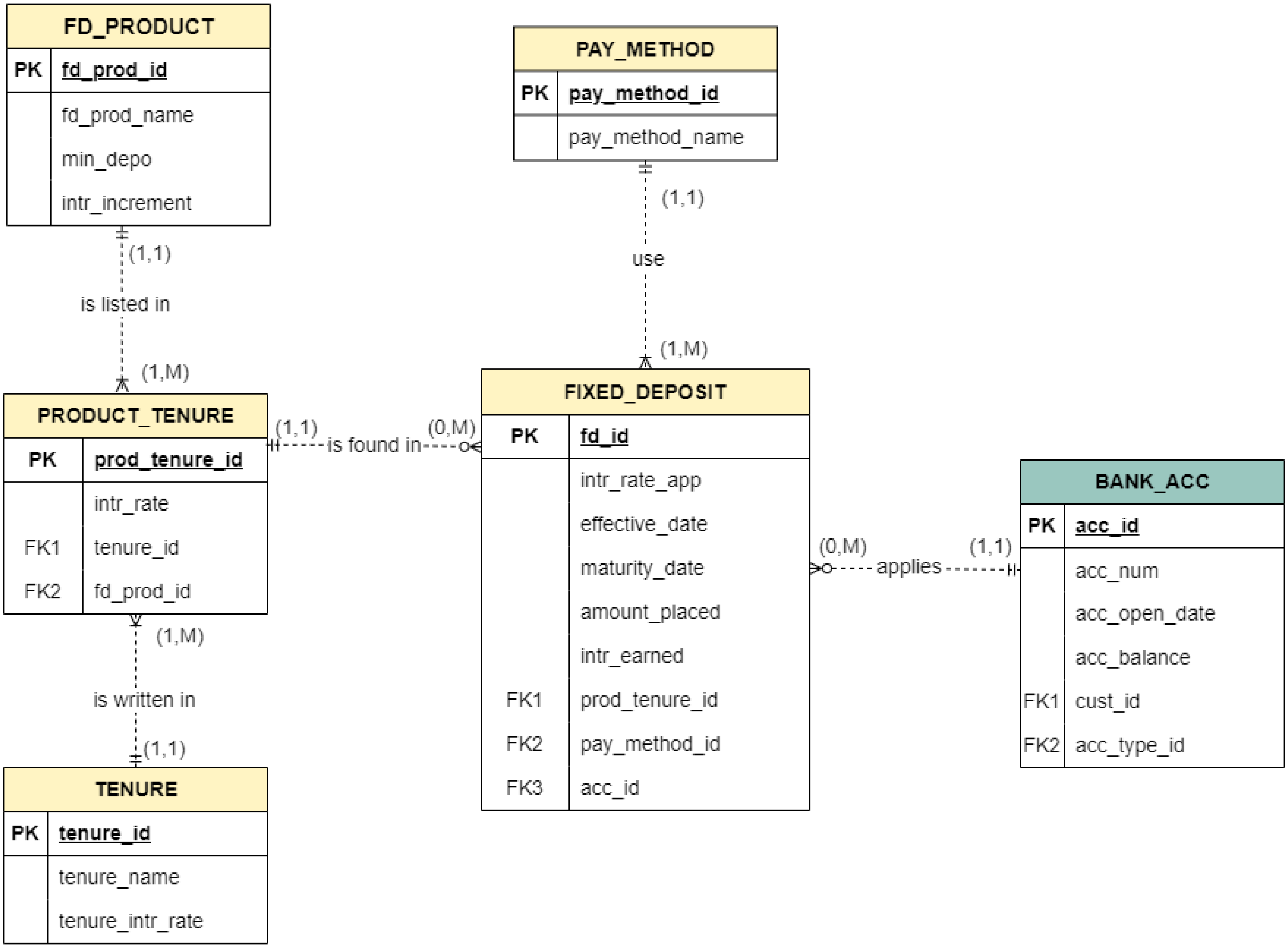
- Bank Account & Account Type
  - One bank account only has one account type. One account type belongs one to many bank accounts.
- Bank Account & Card
  - One bank account can have one to many cards. Each card belongs to only one bank account.
- Bank Account & Transaction
  - One bank account can make many transaction history and each transaction history made by one bank account profile only.
- Customer & Bank account
  - One customer may own many bank accounts. Each bank account is owned by one customer.
- Fixed Deposit & Bank Account
  - Each fixed deposit belongs to one account. One bank account can have zero to many fixed deposits.
- Bank Account & Loan
  - Each bank account can apply zero to many loans. One loan can be applied by one bank account.
- Card & Card Type
  - One card only has one card type. One card type belongs to one to many cards.


LOAN
PK loan_id
financing_amount
financing_duration
FK1 loan_product_code
FK2 status_code
FK3 acc_id
FIXED_DEPOSIT
PK fd_id
intr_rate_app
effective_date
maturity_date
amount_placed
intr_earned
FK1 prod_tenure_id
FK2 pay_method_id
FK3 acc_id
CARD_TYPE
PK card_type_id
card_type_name
(1,1)
has
(1,M)
CARD
PK card_id
card_num
card_type_id
issue_date
exp_date
cvv
FK acc_num
(0,M)
(0,M)
applies
apply
(1,1)
(1,1)
CUSTOMER
PK cust_id
cust_username
cust_pwd
cust_fname
cust_lname
cust_ic
cust_phone
user_role
address_street
address_city
address_state
address_postcode
FK1 marital_code
FK2 occupation_code
FK3 race_code
FK4 employment_code
(1,1)
owns
(1,M)
BANK_ACC
PK acc_id
acc_num
acc_open_date
acc_balance
FK cust_id
FK acc_type_id
have
(1,1)
(1,M)
(1,M)
has
(1,1)
ACCOUNT_TYPE
PK acc_type_id
acc_type_name
profit_rate
eligibility
min_initial_depo
(1,1)
made
(1,M)
TRANSACTION
PK ref_num
transaction_date
transaction_entry_type
transaction amount
FK acc_id

Module 3: Fixed Deposit – Nur Hidayati Munirah

Business Rule:

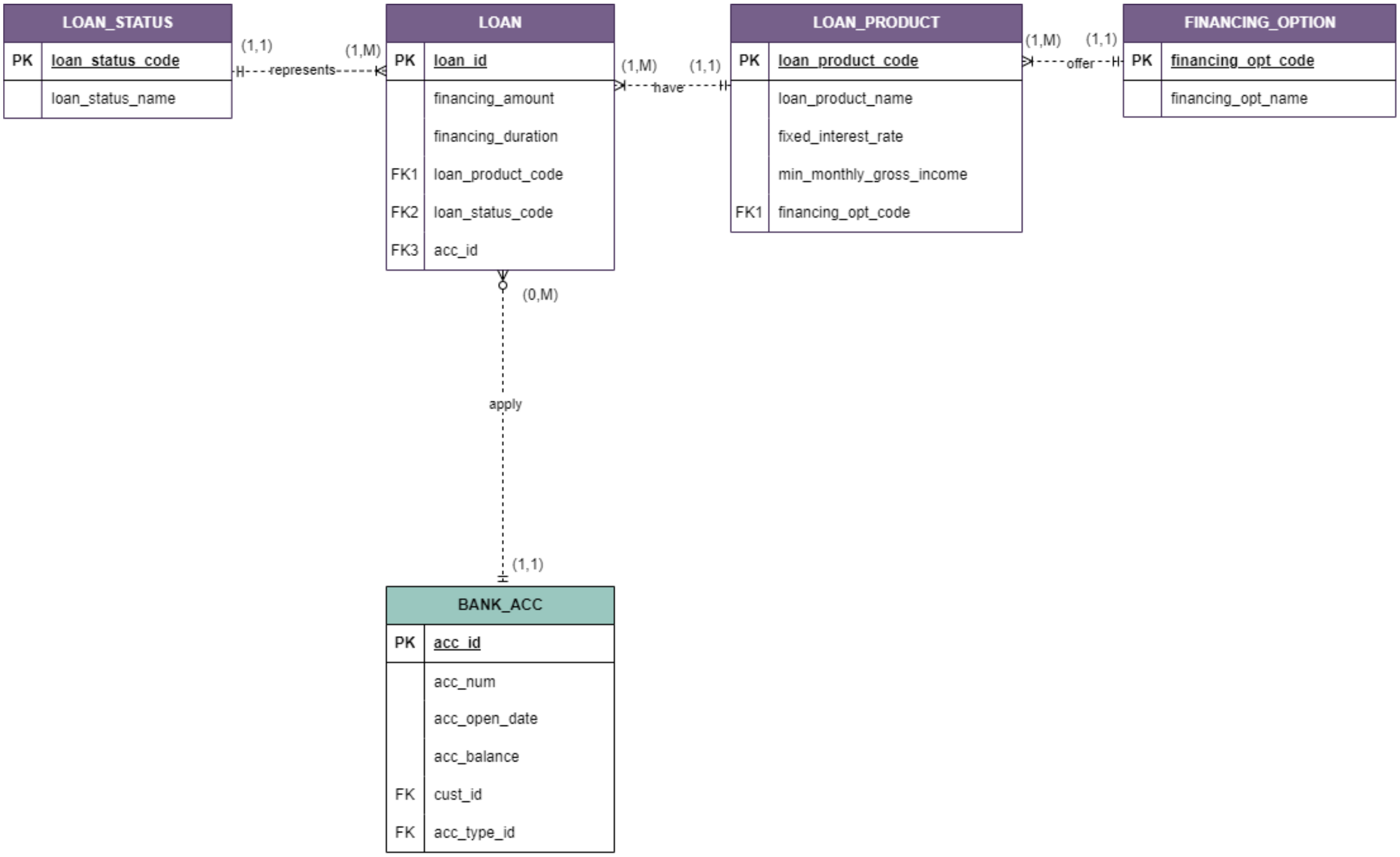
- Product & Tenure
    - A product can associate with one to many tenures. One tenure can be associated with one to many products.
- Fixed Deposit & Bank Account
    - Each fixed deposit belongs to one account but one bank account can have zero to many fixed deposit.
- Fixed Deposit & Product_Tenure
    - Each fixed deposit contains only one product_tenure but one product_tenure can be contained in zero to many fixed deposit.
- Fixed Deposit & Payment Method
    - One fixed deposit use only one payment method. One payment method can be used by one to many fixed deposit.



Module 4: Loan – Aqilah Syazwani

Business Rule:

- Financing Option & Loan Product
  - Each financing option offers one to many loan products but each loan product can be offered only one financing option.
- Bank Account & Loan
  - Each bank account can apply zero to many loan but one loan can be applied by one bank account.
- Loan Status & Loan
  - One loan status represents one to many loan, but one loan can be represented by one to many loan status.
- Loan & Loan Product
  - Each loan have one loan product but one loan product belongs to one to many loan.



LOAN_STATUS	
PK	loan_status_code
	loan_status_name

LOAN	
PK	loan_id
	financing_amount
	financing_duration
FK1	loan_product_code
FK2	loan_status_code
FK3	acc_id

LOAN_PRODUCT	
PK	loan_product_code
	loan_product_name
	fixed_interest_rate
	min_monthly_gross_income
FK1	financing_opt_code

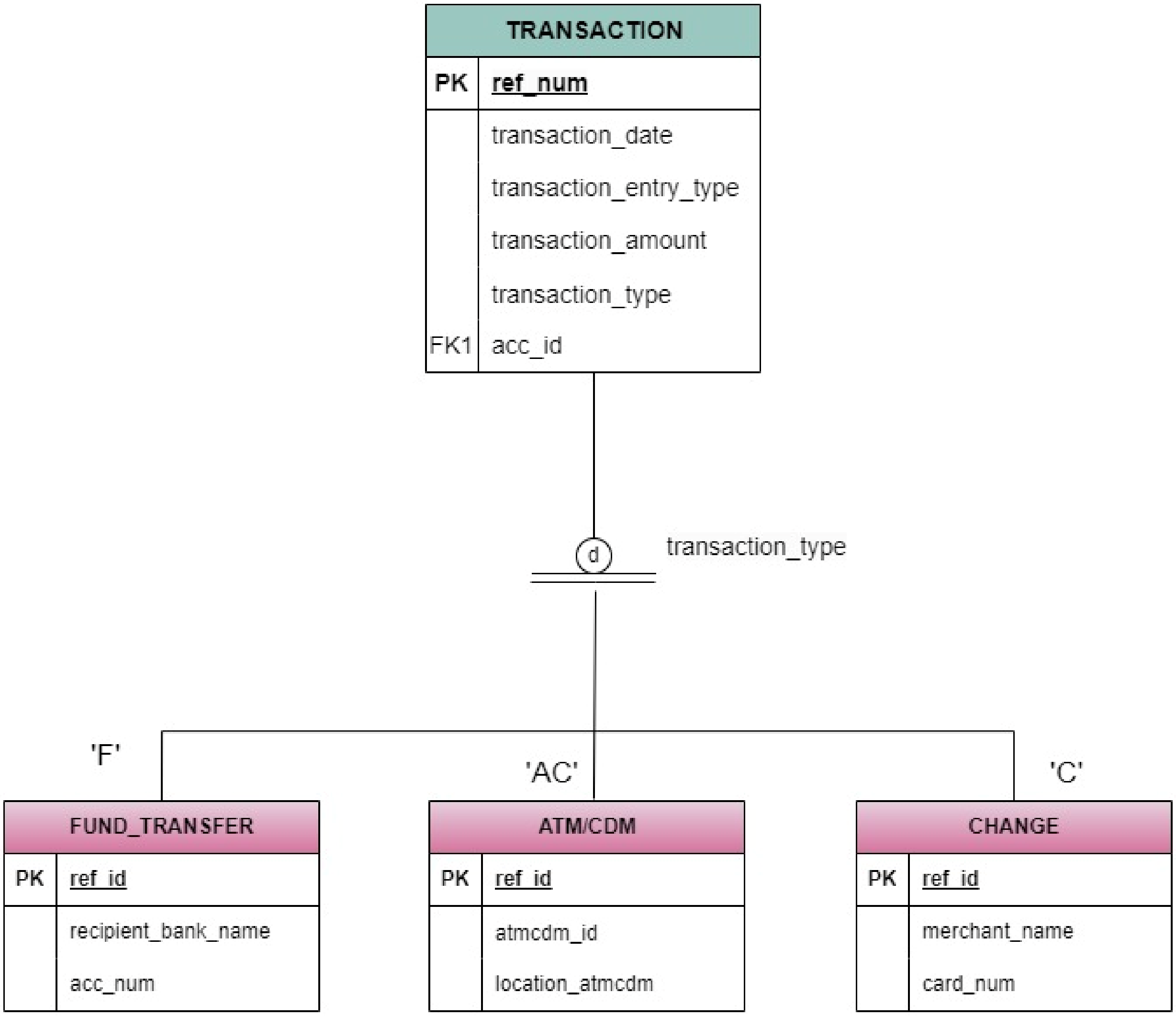
FINANCING_OPTION	
PK	financing_opt_code
	financing_opt_name

BANK_ACC	
PK	acc_id
	acc_num
	acc_open_date
	acc_balance
FK	cust_id
FK	acc_type_id

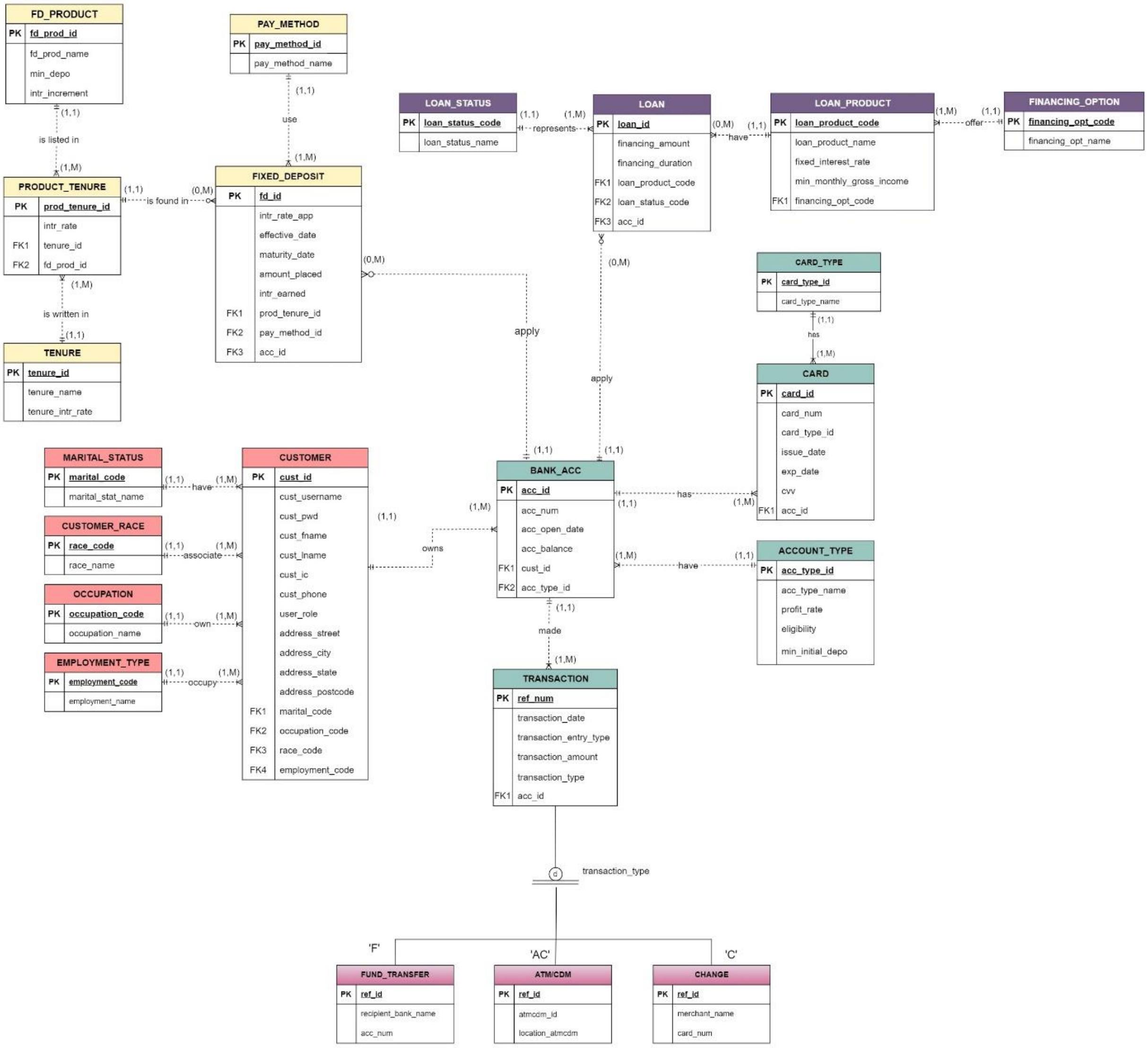
Section 2.0

❖ Transaction & Transaction Type

  - One transaction can have only one type of transaction. Each type of transaction can made many transaction.



2.0 Extended ERD (EERD)

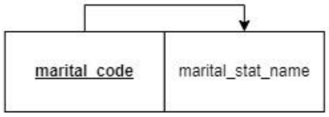


3.0 Normalization

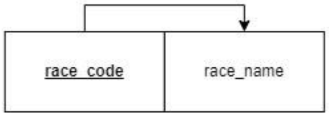
Module 1: Profile Registration – Nur Irdina Syhuhada

All the tables in Profile Registration Module are already in 3NF to start with as it does not have any partial dependencies and transitive dependencies, so no further change is done to the tables.

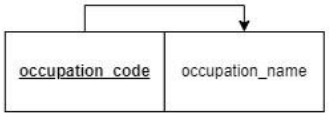
MARITAL_STATUS



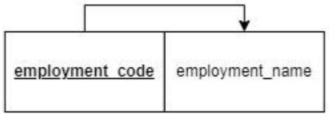
CUSTOMER_RACE



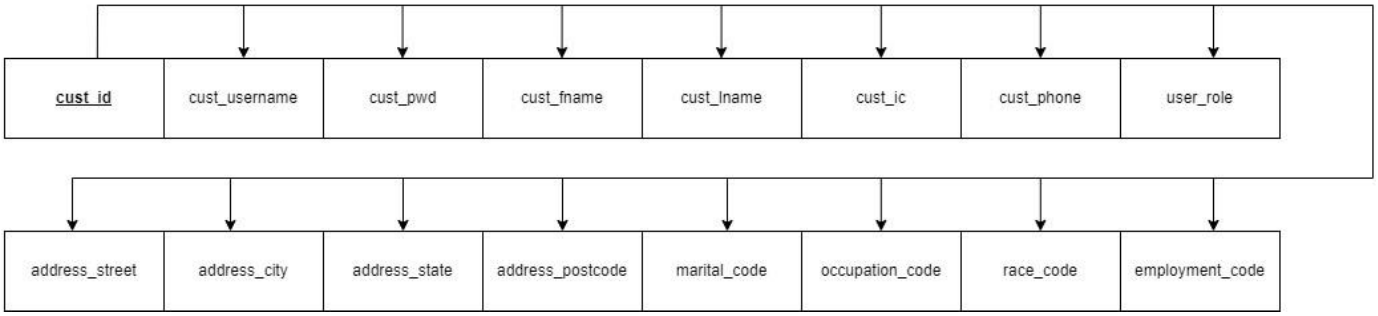
OCCUPATION



EMPLOYMENT_TYPE

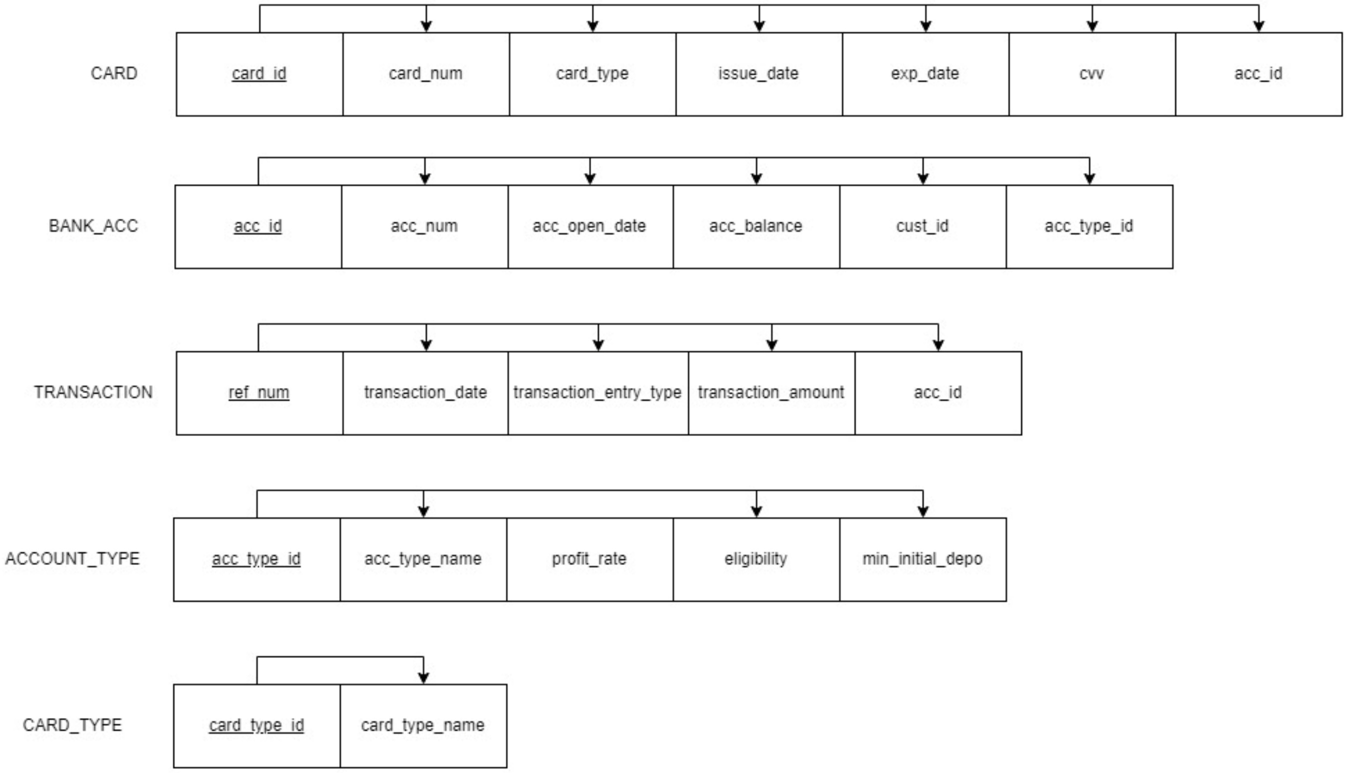


CUSTOMER



Module 2: Bank Account – Nurin Farah Izzati

All the tables in Bank Account Module are already in 3NF to start with as it does not have any partial dependencies and transitive dependencies, so no further change is done to the tables.



CARD	card_id	card_num	card_type	issue_date	exp_date	cvv	acc_id

BANK_ACC	acc_id	acc_num	acc_open_date	acc_balance	cust_id	acc_type_id

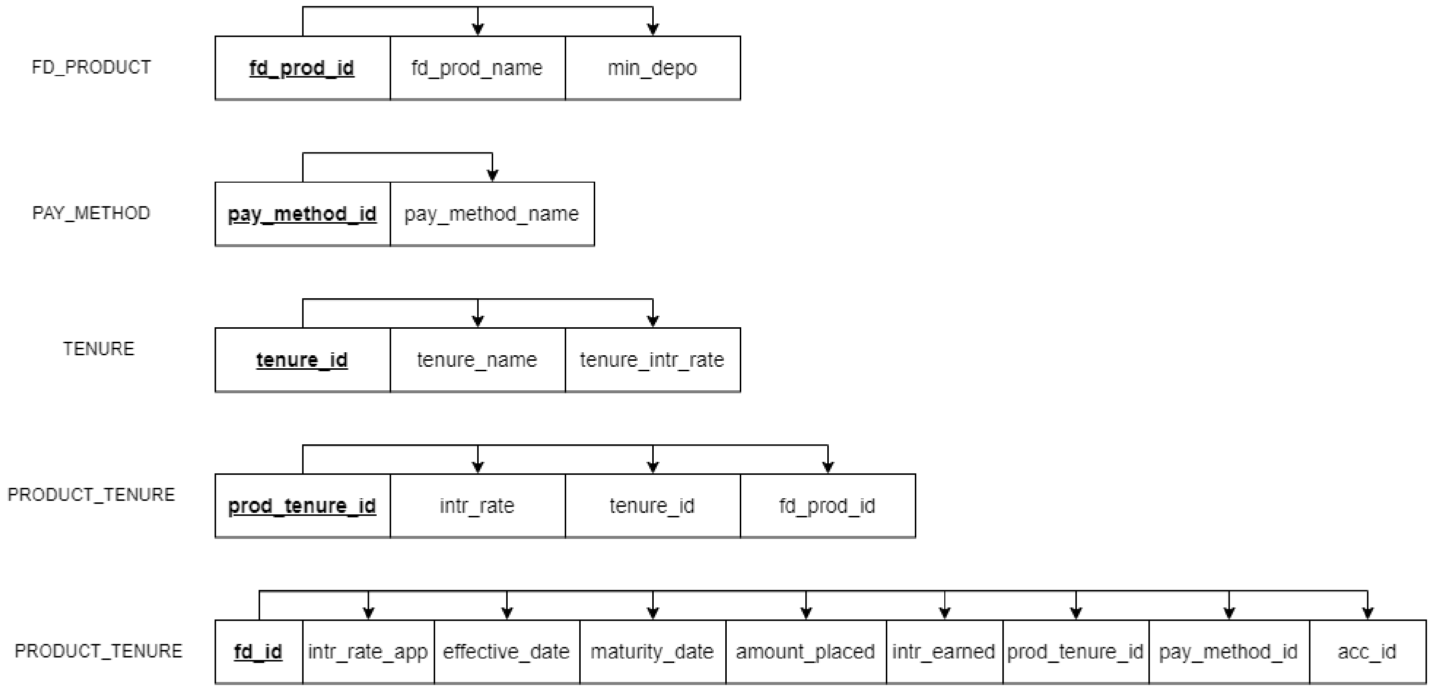
TRANSACTION	ref_num	transaction_date	transaction_entry_type	transaction_amount	acc_id

ACCOUNT_TYPE	acc_type_id	acc_type_name	profit_rate	eligibility	min_initial_depo

CARD_TYPE	card_type_id	card_type_name

Module 3: Fixed Deposit – Nur Hidayati Munirah

All the tables in Fixed Deposit Module are already in 3NF to start with as they do not have any partial dependencies and transitive dependencies, so no further change is done to the tables.



FD_PRODUCT

fd_prod_id	fd_prod_name	min_depo

PAY_METHOD

pay_method_id	pay_method_name

TENURE

tenure_id	tenure_name	tenure_intr_rate

PRODUCT_TENURE

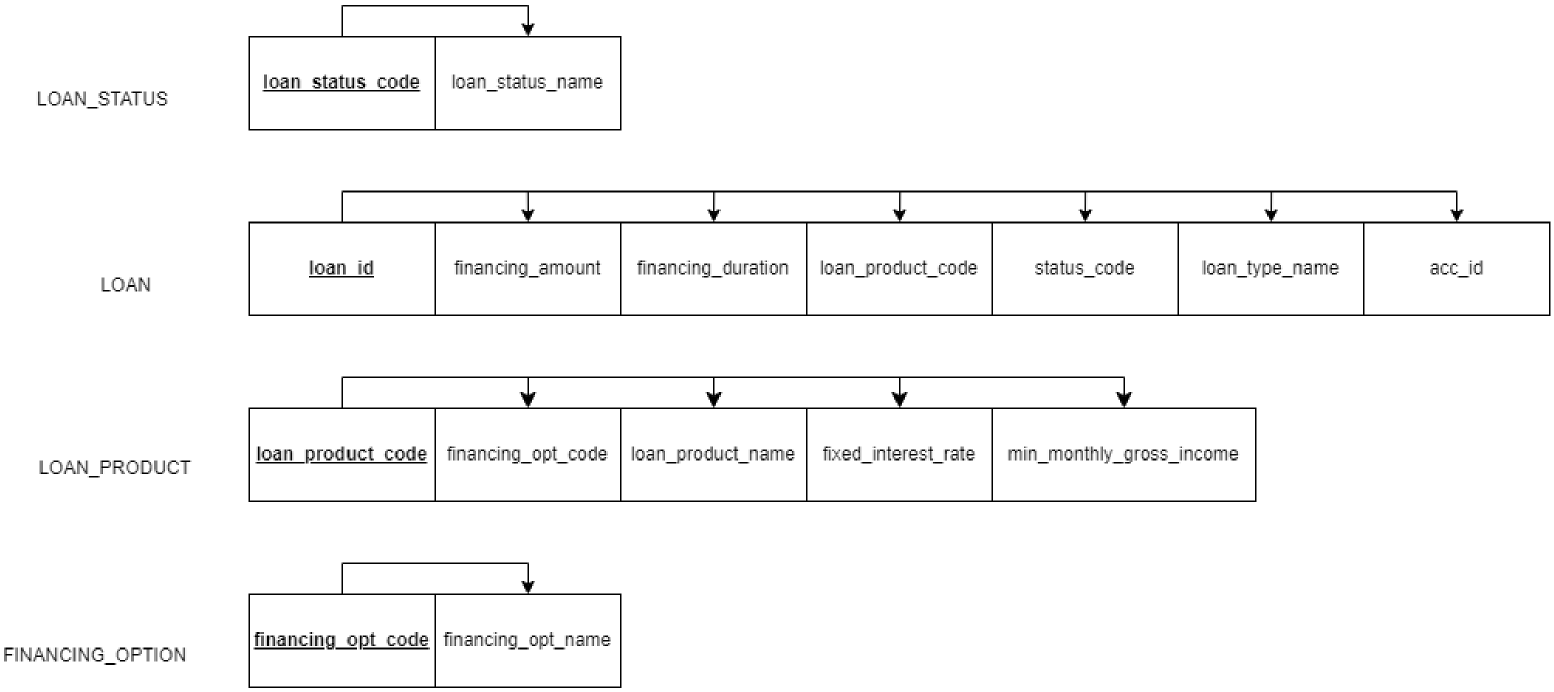
prod_tenure_id	intr_rate	tenure_id	fd_prod_id

PRODUCT_TENURE

fd_id	intr_rate_app	effective_date	maturity_date	amount_placed	intr_earned	prod_tenure_id	pay_method_id	acc_id

Module 4: Loan– Aqilah Syazwani

All the tables in Loan Module are already in 3NF to start with as they do not have any partial dependencies and transitive dependencies, so no further change is done to the tables.



4.0 Data Dictionary

Table Name	Attribute Name	Contents	Data Type	Format	Range	Required	PK or FK	FK Referenced Table
MODULE 1								
CUSTOMER	cust_id	ID for customer	NUMBER(*,0)			Y	PK	
	cust_username	Customer's username	VARCHAR2(50)			Y		
	cust_pwd	Customer's password	VARCHAR2(50)			Y		
	cust_fname	Customer's first name	VARCHAR2(50)			Y		
	cust_lname	Customer's last name	VARCHAR2(50)			Y		
	cust_ic	Customer's identity card number	VARCHAR2(12)	xxxxxxxxxxxx		Y		
	cust_phone	Customer's phone number	VARCHAR2(20)			Y		
	user_role	Role of user	VARCHAR2(30)			N		
	address_street	Customer's street of address	VARCHAR2(255)			Y		
	address_city	Customer's city of address	VARCHAR2(50)			Y		
	address_state	Customer's state of address	VARCHAR2(50)			Y		

	address_postcode	Customer’s postcode of address	VARCHAR2(10)			Y		
	marital_code	Customer’s marital code	NUMBER(*,0)			Y	FK1	MARITAL_STATUS
	occupation_code	Customer’s occupation code	VARCHAR2(6)			Y	FK2	OCCUPATION
	race_code	Customer’s race code	NUMBER(*,0)			Y	FK3	CUSTOMER_RACE
	employment_code	Customer’s employment code	VARCHAR2(6)			Y	FK4	EMPLOYMENT_TYPE
MARITAL_STATUS	marital_code	Code for marital status	NUMBER(*,0)			Y	PK	
	marital_stat_name	Name for marital status	VARCHAR2(20)			Y		
OCCUPATION	occupation_code	Code for occupation	VARCHAR2(6)			Y	PK	
	occupation_name	Occupation’s name	VARCHAR2(20)			Y		
CUSTOMER_RACE	race_code	Code for customer’s race	NUMBER(*,0)			Y	PK	
	race_name	Name for customer’s race	VARCHAR2(10)			Y		
EMPLOYMENT_TYPE	employment_code	Code for employment type	VARCHAR2(6)			Y	PK	

	employment_name	Name for employment type	VARCHAR2(30)			Y		
MODULE 2								
BANK_ACC	acc_id	Customer account ID	NUMBER(*,0)			Y	PK	
	acc_num	Customer account number	VARCHAR2(12)	xxxx-xxxx-xxxx				
	acc_open_date	Customer account open date	DATE	dd-mmm-yyyy				
	acc_balance	Customer account balance	NUMBER(*,2)					
	cust_id	Customer ID	NUMBER(*,0)			Y	FK	CUSTOMER
	acc_type_id	Customer account type ID	VARCHAR2(5)			Y	FK	ACCOUNT_TYPE
CARD	card_id	Customer’s card ID	NUMBER(*,0)			Y	PK	
	card_num	Customer’s card num	VARCHAR2(16)	xxxx-xxxx-xxxx-xxxx				
	card_type_ID	Customer’s card type	VARCHAR2(5)			Y	FK	CARD_TYPE
	issue_date	Customer’s card issue date	DATE	dd-mmm-yyyy				
	exp_date	Customer’s card expire date	DATE	dd-mmm-yyyy				

	cvv	Customer’s Card Verification Value	VARCHAR2(3)					
	acc_ID	Customer account ID	NUMBER(*,0)			Y	FK	BANK_ACC
ACCOUNT_TYPE	acc_type_id	Customer account type ID	VARCHAR2(5)			Y	PK	
	acc_type_name	Customer account type name	VARCHAR2(30)					
	profit_rate	Customer account profit rate	NUMBER(3,2)					
	eligibility	Customer account eligibility	NUMBER(*,0)					
	min_initial_depo	Customer minimum initial deposit	NUMBER(10,2)					
TRANSACTION	ref_num	Customer transaction reference number	VARCHAR2(30)	xxxxxxxxxx		Y	PK	
	transaction_date	Customer transaction date	DATE	dd-mmm-yyyy				
	transaction_entry_type	Customer transaction entry type	VARCHAR2(6)					

	transaction_amount	Customer transaction amount	NUMBER(*,2)					
	transaction_type	Type Of Customer Transaction						
	acc_ID	Customer account ID	VARCHAR2(12)	xxxx-xxxx-xxxx		Y	FK	BANK_ACC
CARD_TYPE	card_type_id	Card Type ID	VARCHAR2(5)			Y	PK	
	card_type_name	Card Type Name	VARCHAR2(30)					
ATMCDM	ref_num	Customer transaction reference number	VARCHAR2(30)	xxxxxxxxxx		Y	PKFK	TRANSACTION
	atmcdm_id	ATM/CDM ID	VARCHAR2(12)					
	location_atmcdm	Location of ATM/CDM	VARCHAR2(100)					
CHARGE	ref_num	Customer transaction reference number	VARCHAR2(30)	xxxxxxxxxx		Y	PKFK	TRANSACTION
	merchant_name	Merchant Name	VARCHAR2(100)					
	card_num	Customer Card Number	VARCHAR2(16)					
MODULE 3								

FUND_TRANSFER	ref_num	Customer transaction reference number	VARCHAR2(30)	xxxxxxxxxx		Y	PKFK	TRANSACTION
	rec_bank_name	Recepient Bank Name	VARCHAR2(100)					
	rec_acc_num	Recepient Account Number	VARCHAR2(12					
FD_PRODUCT	fd_prod_id	Fixed Deposit Product ID	NUMBER(*,0)			Y	PK	
	fd_prod_name	Fixed Deposit Product Name	VARCHAR2(100)					
	min_depo	Minimum Deposit Placement Amount	NUMBER(10,2)					
	intr_increment	Interest Increment	NUMBER(5,2)					
FIXED_DEPOSIT	fd_id	Fixed Deposit ID	NUMBER(*,0)			Y	PK	
	intr_rate_app	Interest Rate at point of Application	NUMBER(5,2)					
	effective_date	Effective Date (Date Application)	DATE					

	maturity_date	Maturity Date (After selected tenure)	DATE					
	amount_placed	Amount Deposit Placed	NUMBER(12,2)					
	intr_earned	Interest Earned	NUMBER(12,2)					
	prod_tenure_id	Product Tenure ID	NUMBER(*,0)			Y	FK1	PRODUCT_TENURE
	pay_method_id	Payment Method ID	NUMBER(*,0)			Y	FK2	PAY_METHOD
	acc_id	Customer account ID	NUMBER(*,0)			Y	FK3	BANK_ACC
TENURE	tenure_id	Tenure ID	NUMBER(*,0)			Y	PK	
	tenure_name	Tenure Name	VARCHAR2(50)					
	tenure_intr_rate	Tenure Interest Rate	NUMBER(5,2)					
PRODUCT_TENURE	prod_tenure_id	Product Tenure ID	NUMBER(*,0)			Y	PK	
	intr_rate	Interest Rate	NUMBER(5,2)					
	tenure_id	Tenure ID	NUMBER(*,0)			Y	FK1	TENURE
	fd_prod_id	Fixed Deposit Product ID	NUMBER(*,0)			Y	FK2	FD_PRODUCT
PAY_METHOD	pay_method_id	Payment Method ID	NUMBER(*,0)			Y	PK	

	pay_method_name	Payment Method Name	VARCHAR2(50)					
MODULE 4								
LOAN	loan_id	Customer’s applied loan ID	NUMBER	XX		Y	PK	
	financing_amount	Total financing amount applied by Customer	NUMBER(15,2)	RMX,XXX.XX		Y		
	financing_duration	Duration of loan applied.	NUMBER	X month(s)		Y		
	loan_product_code	Code for applied loan product.	VARCHAR2(5 BYTE)	XXX		Y	FK1	LOAN_PRODUCT
	loan_status_code	Code that represents current status of the loan applied.	VARCHAR2(3 BYTE)	LS1, LS2, LS3		Y	FK2	LOAN_STATUS
	acc_id	Account ID of the user that applied for the loan	NUMBER			Y	FK3	BANK_ACC
LOAN_STATUS	loan_status_code	Code that represents current status of the loan applied.	VARCHAR2(3 BYTE)	LS1, LS2, LS3		Y	PK	
	loan_status_name	Current Status of loan applied.	VARCHAR(20 BYTE)					

LOAN_PRODUCT	Loan_produt_code	Code for applied loan product.	VARCHAR2(5 BYTE)			Y	PK	
	loan_product name	Name of the loan product.	VARCHAR2(20 BYTE)					
	fixed_interest rate	Fixed interest rate based on selected loan product.	NUMBER(5,2)					
	min_monthly_gross_income	Minimum requirement of gross income to be apply to apply the selected loan.	NUMBER(10,2)	RMX,XXX.XX				
	financing_opt_code	Selected code of financing option type.	VARCHAR2(25 BYTE)			Y	FK	FINANCING_OPTION
FINANCING_OPTION	financing_opt_code		VARCHAR2(25 BYTE)			Y	PK	
	financing_opt_name		VARCHAR2(20 BYTE)			Y		
	financing_opt_desc		VARCHAR2(500 BYTE)			Y		
	financing_opt_img		BLOB			N		

5.0 Database Implementation

5.1 DDL

MODULE 1:

```
DROP TABLE MARITAL_STATUS;
DROP TABLE CUSTOMER_RACE;
DROP TABLE OCCUPATION;
DROP TABLE EMPLOYMENT_TYPE;
DROP TABLE CUSTOMER;
DROP SEQUENCE CUSTOMER_SEQ;


CREATE SEQUENCE CUSTOMER_SEQ START WITH 1000 INCREMENT BY 1 NOCACHE NOCYCLE;


CREATE TABLE MARITAL_STATUS (
    marital_code NUMBER,
    marital_stat_name VARCHAR2(20) NOT NULL,
    CONSTRAINT pk_marital_status PRIMARY KEY (marital_code)
);


CREATE TABLE CUSTOMER_RACE (
    race_code NUMBER,
    race_name VARCHAR2(10) NOT NULL,
    CONSTRAINT pk_customer_race PRIMARY KEY (race_code)
);
```

```
CREATE TABLE OCCUPATION (
   occupation_code VARCHAR2(6),
   occupation_name VARCHAR2(20) NOT NULL,
   CONSTRAINT pk_occupation PRIMARY KEY (occupation_code)
);

CREATE TABLE EMPLOYMENT_TYPE (
   employment_code VARCHAR2(6),
   employment_name VARCHAR2(30) NOT NULL,
   CONSTRAINT pk_employment_type PRIMARY KEY (employ
ent_code)
);
```

```
CREATE TABLE CUSTOMER (
   cust_id INTEGER DEFAULT CUSTOMER_SEQ.NEXTVAL,
   cust_username VARCHAR2(25) UNIQUE,
   cust_pwd VARCHAR2(50) NOT NULL,
   cust_fname VARCHAR2(50) NOT NULL,
   cust_lname VARCHAR2(50) NOT NULL,
   cust_ic VARCHAR2(12) UNIQUE,
   cust_phone VARCHAR2(20) UNIQUE,
   address_street VARCHAR2(255) NOT NULL,
   address_city VARCHAR2(50) NOT NULL,
   address_state VARCHAR2(50) NOT NULL,
   address_postcode VARCHAR2(10) NOT NULL,
   marital_code NUMBER NOT NULL,
   race_code NUMBER NOT NULL,
   occupation_code VARCHAR2(6) NOT NULL,
   employment_code VARCHAR2(6) NOT NULL,
   user_role VARCHAR2(30) DEFAULT 'Customer',
   CONSTRAINT pk_cust_id PRIMARY KEY (cust_id)
   CONSTRAINT fk_marital_status FOREIGN KEY (marital_code) REFERENCES
MARITAL_STATUS(marital_code) ON DELETE CASCADE,
   CONSTRAINT fk_occupation FOREIGN KEY (occupation_code) REFERENCES
OCCUPATION(occupation_code) ON DELETE CASCADE,
   CONSTRAINT fk_race_code FOREIGN KEY (race_code) REFERENCES
CUSTOMER_RACE(race_code) ON DELETE CASCADE,
   CONSTRAINT fk_employment_code FOREIGN KEY (employment_code) REFERENCES
EMPLOYMENT_TYPE(employment_code) ON DELETE CASCADE
);
```

MODULE 2:

```
DROP TABLE CARD_TYPE;
DROP TABLE ACCOUNT_TYPE;
DROP TABLE BANK_ACC;
DROP TABLE CARD;
DROP TABLE TRANSACTION;

CREATE SEQUENCE ACCOUNT_ID_SEQ START WITH 1000 INCREMENT BY 1
NOCACHE NOCYCLE;
CREATE SEQUENCE CARD_ID_SEQ START WITH 11000 INCREMENT BY 1 NOCACHE
NOCYCLE;


CREATE TABLE CARD_TYPE (
   card_type_id VARCHAR2(5) ,
   card_type_name VARCHAR2(30) NOT NULL,
   CONSTRAINT pk_card_type PRIMARY KEY(card_type_id)
);

CREATE TABLE ACCOUNT_TYPE (
   acc_type_id VARCHAR2(5),
   acc_type_name VARCHAR(30),
   profit_rate NUMBER(3,2),
   eligibility INTEGER,
   min_initial_depo NUMBER(10,2),
   CONSTRAINT pk_acc_type PRIMARY KEY(acc_type_id)
);

CREATE TABLE BANK_ACC (
   acc_id NUMBER(*,0) DEFAULT ACCOUNT_ID_SEQ.NEXTVAL,
   acc_num VARCHAR2(12) ,
   acc_open_date DATE,
   acc_balance NUMBER(*,2) ,
   cust_id INTEGER DEFAULT CUSTOMER_SEQ.NEXTVAL NOT NULL,
   acc_type_id VARCHAR2(5) NOT NULL,
   CONSTRAINT pk_bank_acc PRIMARY KEY(acc_id) ,
   CONSTRAINT fk_customer FOREIGN KEY(cust_id) REFERENCES CUSTOMER(cust_id)
ON DELETE CASCADE,
   CONSTRAINT fk_acc_type FOREIGN KEY(acc_type_id) REFERENCES
ACCOUNT_TYPE(acc_type_id) ON DELETE CASCADE
);

CREATE TABLE CARD (
   card_id NUMBER(*,0) DEFAULT CARD_ID_SEQ.NEXTVAL,
   card_num VARCHAR2(16) ,
   card_type_id VARCHAR2(5) NOT NULL,
   issue_date DATE,
   exp_date DATE,
   cvv VARCHAR2(3),
   acc_id INTEGER DEFAULT CUSTOMER_SEQ.NEXTVAL NOT NULL,
   CONSTRAINT pk_card PRIMARY KEY(card_id),
   CONSTRAINT fk_card_type FOREIGN KEY(card_type_id) REFERENCES
CARD_TYPE(card_type_id) ON DELETE CASCADE,
   CONSTRAINT fk_bank_acc FOREIGN KEY(acc_id) REFERENCES BANK_ACC(acc_id)
ON DELETE CASCADE
);


CREATE TABLE TRANSACTION (
   ref_num VARCHAR2(30) ,
   transaction_date DATE,
   transaction_entry_type VARCHAR2(6) ,
   transaction_amount NUMBER(*,2),
   acc_id INTEGER DEFAULT CUSTOMER_SEQ.NEXTVAL NOT NULL,
   transaction_type VARCHAR2(5) ,
   CONSTRAINT pk_transaction PRIMARY KEY(ref_num),
   CONSTRAINT fk_bank_acc_trans FOREIGN KEY(acc_id) REFERENCES
BANK_ACC(acc_id) ON DELETE CASCADE
);


CREATE TABLE FUND_TRANSFER (
   ref_num VARCHAR2(30),
   rec_bank_name VARCHAR2(100),
   rec_acc_num VARCHAR2(12),
   CONSTRAINT pk_transaction_ft PRIMARY KEY(ref_num)
);

CREATE TABLE ATMCDM (
   ref_num VARCHAR2(30),
   atmcdm_id VARCHAR2(12),
   location_atmcdm VARCHAR2(100),
   CONSTRAINT pk_transaction_ac PRIMARY KEY(ref_num)
);

CREATE TABLE CHARGE (
   ref_num VARCHAR2(30),
   merchant_name VARCHAR2(100),
   card_num VARCHAR2(16),
   CONSTRAINT pk_transaction_c PRIMARY KEY(ref_num)
);
```

MODULE 3:

```
DROP TABLE FIXED_DEPOSIT;

DROP TABLE PRODUCT_TENURE;

DROP TABLE FD_PRODUCT;

DROP TABLE TENURE

DROP TABLE PAY_METHOD;

DROP SEQUENCE TENURE_SEQ;

DROP SEQUENCE PAY_METHOD_SEQ;

DROP SEQUENCE FD_PRODUCT_SEQ;

DROP SEQUENCE PRODUCT_TENURE_SEQ;

DROP SEQUENCE FIXED_DEPOSIT_SEQ;


CREATE SEQUENCE TENURE_SEQ START WITH 1 INCREMENT BY 1 NOCACHE
NOCYCLE;

CREATE SEQUENCE PAY_METHOD_SEQ START WITH 1 INCREMENT BY 1
NOCACHE NOCYCLE;

CREATE SEQUENCE FD_PRODUCT_SEQ START WITH 10 INCREMENT BY 1
NOCACHE NOCYCLE;

CREATE SEQUENCE PRODUCT_TENURE_SEQ START WITH 1 INCREMENT BY 1
NOCACHE NOCYCLE;

CREATE SEQUENCE FIXED_DEPOSIT_SEQ START WITH 10000 INCREMENT BY 1
NOCACHE NOCYCLE;


CREATE TABLE TENURE

(

   tenure_id          INTEGER DEFAULT TENURE_SEQ.NEXTVAL,

   tenure_name          VARCHAR2(50)    NOT NULL,

   tenure_intr_rate     NUMBER(5,2)     NOT NULL,

   CONSTRAINT PK_TENURE PRIMARY KEY(tenure_id)

);
```

```
CREATE TABLE PAY_METHOD
(
   pay_method_id   INTEGER DEFAULT PAY_METHOD_SEQ.NEXTVAL,
   pay_method_name VARCHAR2(50)    NOT NULL,
   CONSTRAINT PK_PAY_METHOD PRIMARY KEY(pay_method_id)
);

CREATE TABLE FD_PRODUCT
(
   fd_prod_id    INTEGER DEFAULT FD_PRODUCT_SEQ.NEXTVAL,
   fd_prod_name  VARCHAR2(100)   NOT NULL,
   min_depo      NUMBER(10,2)    NOT NULL,
   intr_increment NUMBER(5,2)    NOT NULL,
   CONSTRAINT PK_FD_PRODUCT PRIMARY KEY(fd_prod_id)
);

CREATE TABLE PRODUCT_TENURE
(
   prod_tenure_id INTEGER DEFAULT PRODUCT_TENURE_SEQ.NEXTVAL,
   intr_rate      NUMBER(5,2) NOT NULL,
   tenure_id      INTEGER,
   fd_prod_id     INTEGER,
   CONSTRAINT PK_PRODUCT_TENURE PRIMARY KEY(prod_tenure_id),
   CONSTRAINT FK_TENURE FOREIGN KEY(tenure_id) REFERENCES TENURE(tenure_id) ON DELETE CASCADE,
   CONSTRAINT FK_FD_PRODUCT FOREIGN KEY(fd_prod_id) REFERENCES FD_PRODUCT(fd_prod_id) ON DELETE CASCADE
);
```

```
CREATE TABLE FIXED_DEPOSIT
(
   fd_id          INTEGER DEFAULT FIXED_DEPOSIT_SEQ.NEXTVAL,
   intr_rate_app  NUMBER(5,2) NOT NULL,
   effective_date DATE DEFAULT SYSDATE NOT NULL,
   maturity_date  DATE NOT NULL,
   amount_placed  NUMBER(12,2) NOT NULL,
   intr_earned    NUMBER(12,2) NOT NULL,
   prod_tenure_id INTEGER,
   pay_method_id  INTEGER,
   acc_id         INTEGER,
   CONSTRAINT PK_FIXED_DEPOSIT PRIMARY KEY(fd_id),
   CONSTRAINT FK_PRODUCT_TENURE FOREIGN KEY(prod_tenure_id) REFERENCES
PRODUCT_TENURE(prod_tenure_id) ON DELETE CASCADE,
   CONSTRAINT FK_PAY_METHOD FOREIGN KEY(pay_method_id) REFERENCES
PAY_METHOD(pay_method_id) ON DELETE CASCADE,
   CONSTRAINT FK_BANK_ACC_FD FOREIGN KEY(acc_id) REFERENCES
BANK_ACC(acc_id) ON DELETE CASCADE
);
```

MODULE 4:

```
 CREATE TABLE "FINANCING_OPTION"
  (	"FINANCING_OPT_CODE" VARCHAR2(25),
	"FINANCING_OPT_NAME" VARCHAR2(20) NOT NULL ENABLE,
	"FINANCING_OPT_DESC" VARCHAR2(500),
	"FINANCING_OPT_IMG" BLOB,
	 PRIMARY KEY ("FINANCING_OPT_CODE")
 USING INDEX  ENABLE
  ) ;

 CREATE TABLE "LOAN_PRODUCT"
  (	"LOAN_PRODUCT_CODE" VARCHAR2(5),
	"LOAN_PRODUCT_NAME" VARCHAR2(50) NOT NULL ENABLE,
	"FIXED_INTEREST_RATE" NUMBER(5,2) NOT NULL ENABLE,
	"MIN_MONTHLY_GROSS_INCOME" NUMBER(10,2) NOT NULL ENABLE,
	"FINANCING_OPT_CODE" VARCHAR2(25),
	 CHECK (fixed_interest_rate >= 0) ENABLE,
	 CHECK (min_monthly_gross_income >= 0) ENABLE,
	 PRIMARY KEY ("LOAN_PRODUCT_CODE")
 USING INDEX  ENABLE
  ) ;

 ALTER TABLE "LOAN_PRODUCT" ADD FOREIGN KEY ("FINANCING_OPT_CODE")
	  REFERENCES "FINANCING_OPTION" ("FINANCING_OPT_CODE") ON
DELETE CASCADE ENABLE;

CREATE TABLE "LOAN_STATUS"
  (	"LOAN_STATUS_CODE" VARCHAR2(3),
	"LOAN_STATUS_NAME" VARCHAR2(20) NOT NULL ENABLE,
            PRIMARY KEY ("LOAN_STATUS_CODE")
  USING INDEX  ENABLE,
            CONSTRAINT "CHECK_LSC" CHECK (loan_status_code IN ('LS1','LS2','LS3'))
ENABLE
   ) ;


CREATE TABLE "LOAN"
   (        "LOAN_ID" NUMBER,
            "FINANCING_AMOUNT" NUMBER(15,2) NOT NULL ENABLE,
            "FINANCING_DURATION" NUMBER NOT NULL ENABLE,
            "LOAN_PRODUCT_CODE" VARCHAR2(5),
            "LOAN_STATUS_CODE" VARCHAR2(3),
            "ACC_ID" NUMBER(*,0) DEFAULT
"WKSP_CMT221GROUP33"."ACCOUNT_ID_SEQ"."NEXTVAL",
            PRIMARY KEY ("LOAN_ID")
  USING INDEX  ENABLE
   ) ;


  ALTER TABLE "LOAN" ADD FOREIGN KEY ("LOAN_PRODUCT_CODE")
             REFERENCES "LOAN_PRODUCT" ("LOAN_PRODUCT_CODE") ENABLE;
  ALTER TABLE "LOAN" ADD FOREIGN KEY ("LOAN_STATUS_CODE")
             REFERENCES "LOAN_STATUS" ("LOAN_STATUS_CODE") ENABLE;
  ALTER TABLE "LOAN" ADD FOREIGN KEY ("ACC_ID")
             REFERENCES "BANK_ACC" ("ACC_ID") ENABLE;


CREATE SEQUENCE  "LOAN_ID_SEQUENCE"  MINVALUE 1 MAXVALUE
9999999999999999999999999999 INCREMENT BY 1 START WITH 2227 NOCACHE
NOORDER  NOCYCLE  NOKEEP  NOSCALE  GLOBAL ;

   CREATE SEQUENCE  "LOAN_PRODUCT_ID_SEQ"  MINVALUE 1 MAXVALUE
9999999999999999999999999999 INCREMENT BY 1 START WITH 74 NOCACHE
NOORDER  NOCYCLE  NOKEEP  NOSCALE  GLOBAL ;
```

5.2 DML

```
SELECT
  C.CARD_NUM,
  CT.CARD_TYPE_NAME,
  B.ACC_NUM,
  CUST.CUST_FNAME || ' ' || CUST.CUST_LNAME AS ACCOUNT_HOLDER_NAME,
  SUM(T.TRANSACTION_AMOUNT) AS AMOUNT_SPENT
FROM
  CARD C
JOIN
  BANK_ACC B ON C.ACC_ID = B.ACC_ID
JOIN
  CUSTOMER CUST ON B.CUST_ID = CUST.CUST_ID
JOIN
  TRANSACTION T ON B.ACC_ID = T.ACC_ID
JOIN
  CARD_TYPE CT ON CT.CARD_TYPE_ID = C.CARD_TYPE_ID
WHERE
  T.TRANSACTION_DATE >= TO_DATE('2021-09-01', 'YYYY-MM-DD')
  AND T.TRANSACTION_DATE < TO_DATE('2021-10-01', 'YYYY-MM-DD')
GROUP BY C.CARD_NUM, CT.CARD_TYPE_NAME, B.ACC_NUM,
CUST.CUST_FNAME, CUST.CUST_LNAME
HAVING SUM(T.TRANSACTION_AMOUNT) >= 5000
ORDER BY SUM(T.TRANSACTION_AMOUNT) DESC;
```

6.0 Reflection

6.1 PROJECT PROBLEMS AND PITFALLS

- **Complexity of Oracle Apex**
  The functionalities of the application can be complex and the team faced challenges to explore to the limited resources of references.

- **High Learning Curve**
  The application’s technologies made the team encounter a steep learning curve that requires us constantly exploration of the functions and applications.

- **Inconsistent Maintenance Time**
  The Oracle Apex server would be in maintenance at unpredictable times resulting in inability to operate any further until the maintenance has finished.

6.2 DISCOVERIES AND LEARNINGS

- **Technical Skills**
  Throughout the project we have acquired and enhanced our knowledge regarding how database works and especially how to implement the SQL language we have learnt in class and tutorials.

- **Learning From Setbacks**
  Our team understood how to learn from our setbacks and failures and change them into a chance for improvements and growth.

- **Adaptability**
  After experiencing changes in requirements the members have enhanced our adaptability in response and even unexpected obstacles such as limitations in terms of knowledge.

7.0 System Demo

Short Demo URL: https://youtu.be/A1llkq53NTc

Oracle APEX Cloud Login Details

Workspace: CMT221_group33

Username: NHMNIRH@GMAIL.COM

Password: CMT221Group33@

App name: CT BANK MANAGEMENT SYSTEM