SCHOOL OF COMPUTER SCIENCES
UNIVERSITI SAINS MALAYSIA

CMT221/CMM222: Database Organization and Design
Semester 1, Academic Session: 2021/2022

System Implementation

Group Number 11
Case Study Number: 37

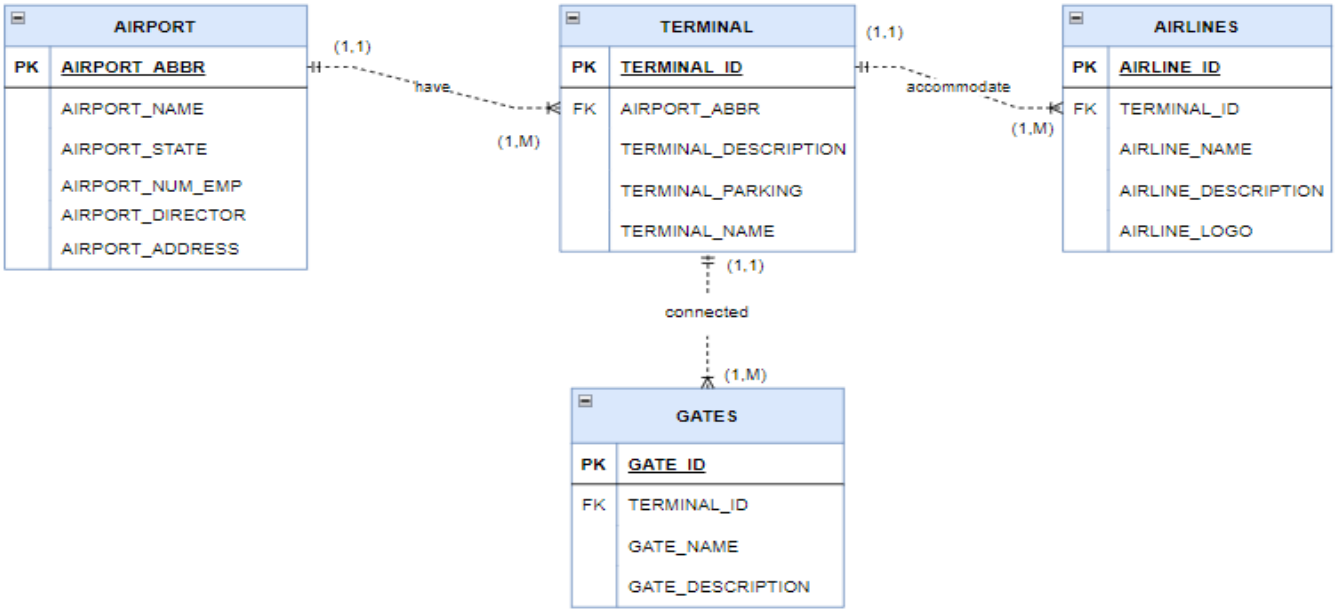
Name	Matric No.	USM Email	Module	Role	Core/Minor
MUHAMMAD NUR HAFIZ BIN JAMAL	153451	hafizjamal17@student.usm.my	1 (Airport Information)	Leader	Core
HAZIQ BIN HIZUL	152770	haziq.hizul@student.usm.my	2 (Aircraft Information)	Member	Core
MOHAMMED HAMMAD	154434	hammad@student.usm.my	3 (Maintenance)	Member	Core
AZRI ZAMRUD BIN KIMIN	153507	azrizamrud4@student.usm.my	4 (Flight Information)	Member	Core

Date of Submission
6 February 2021

1.0 Business Rules and Partial ERDs

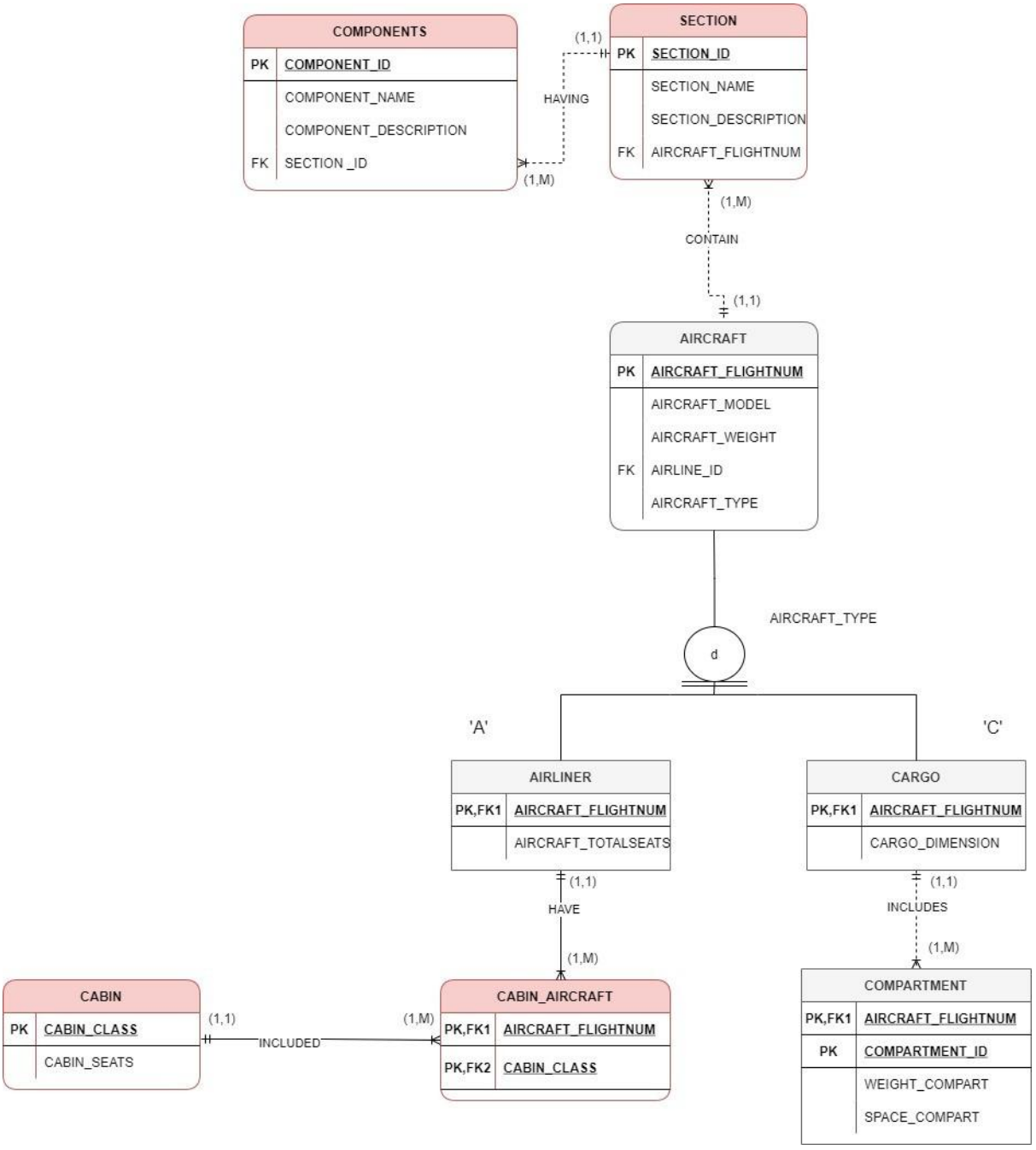
Module 1: [Airport Information – Muhammad Nur Hafiz bin Jamal]

- Each airport can have more than one terminal and each terminal can have only one airport.
- Each terminal can accommodate one or more airlines and each airline can accommodate only one terminal.
- Each terminal is connected to multiple gates and each gate should be connected to one terminal.
- Each airport involves more than one flight, and each flight is involved in one airport.
- Each airline has many aircraft, and each aircraft has one airline.



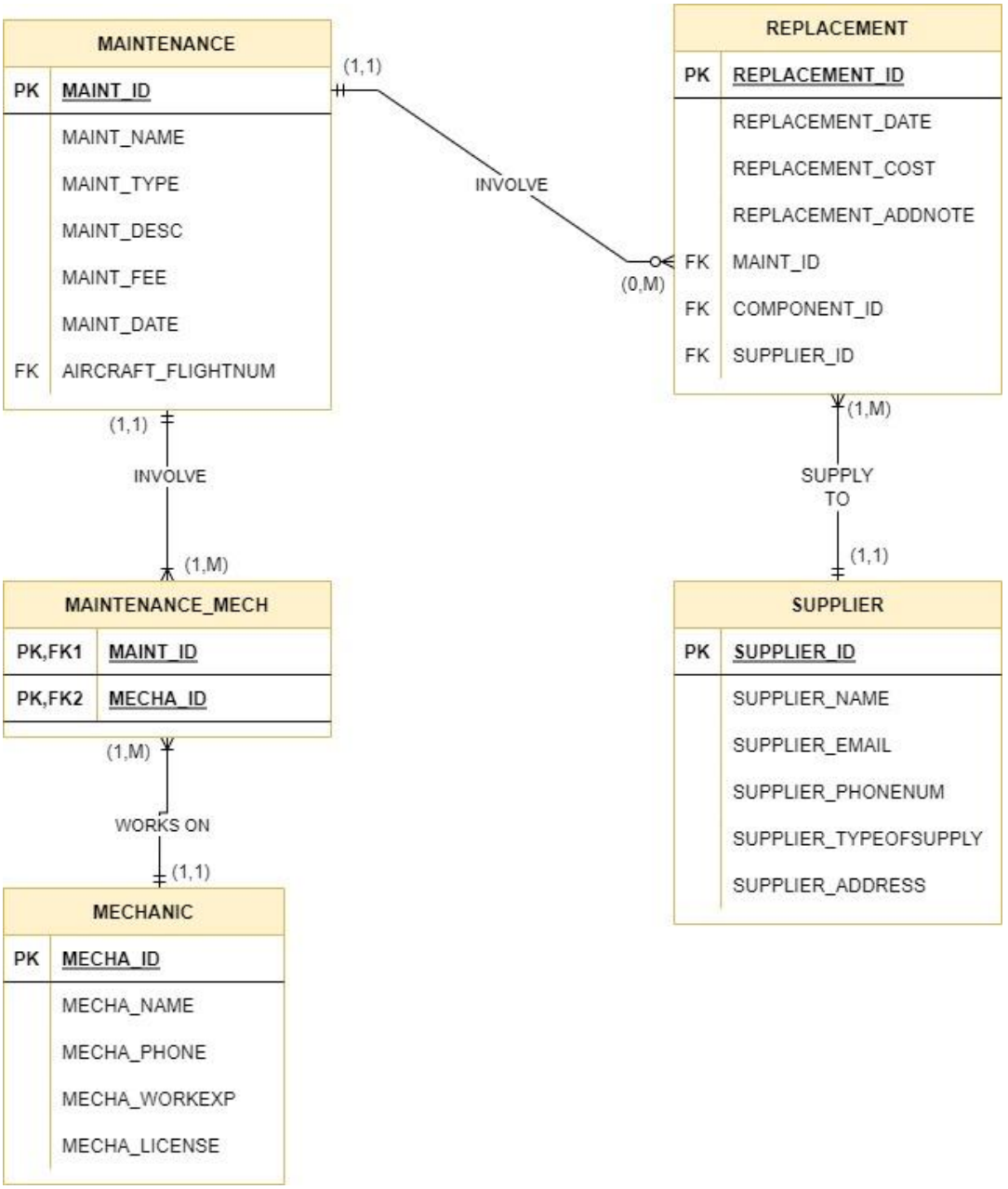
Module 2: [Aircraft Information – Haziq bin Hizul]

- Each airline should have multiple aircraft and each aircraft only one airline
- Each aircraft can have many cabins classes and each cabin class is available for many aircraft
- Each aircraft will also have many sections and each section only in an aircraft
- Each section will have many components and each component will only be available for one section.



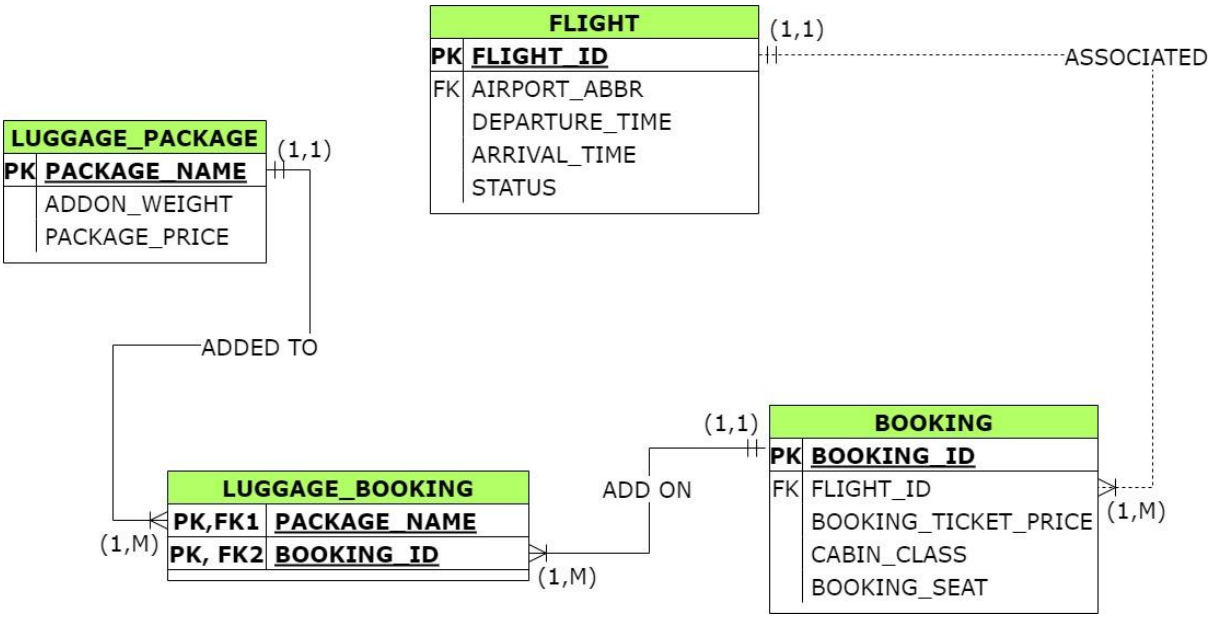
Module 3: [Maintenance Information – Mohammed Hammad]

- Each mechanic can be involved in one or many maintenances jobs
- Each maintenance job should involve one or many mechanics
- A supplier may supply one or more replacement components
- A replacement component can be supplied by one supplier
- A Maintenance job can have zero or more replacements



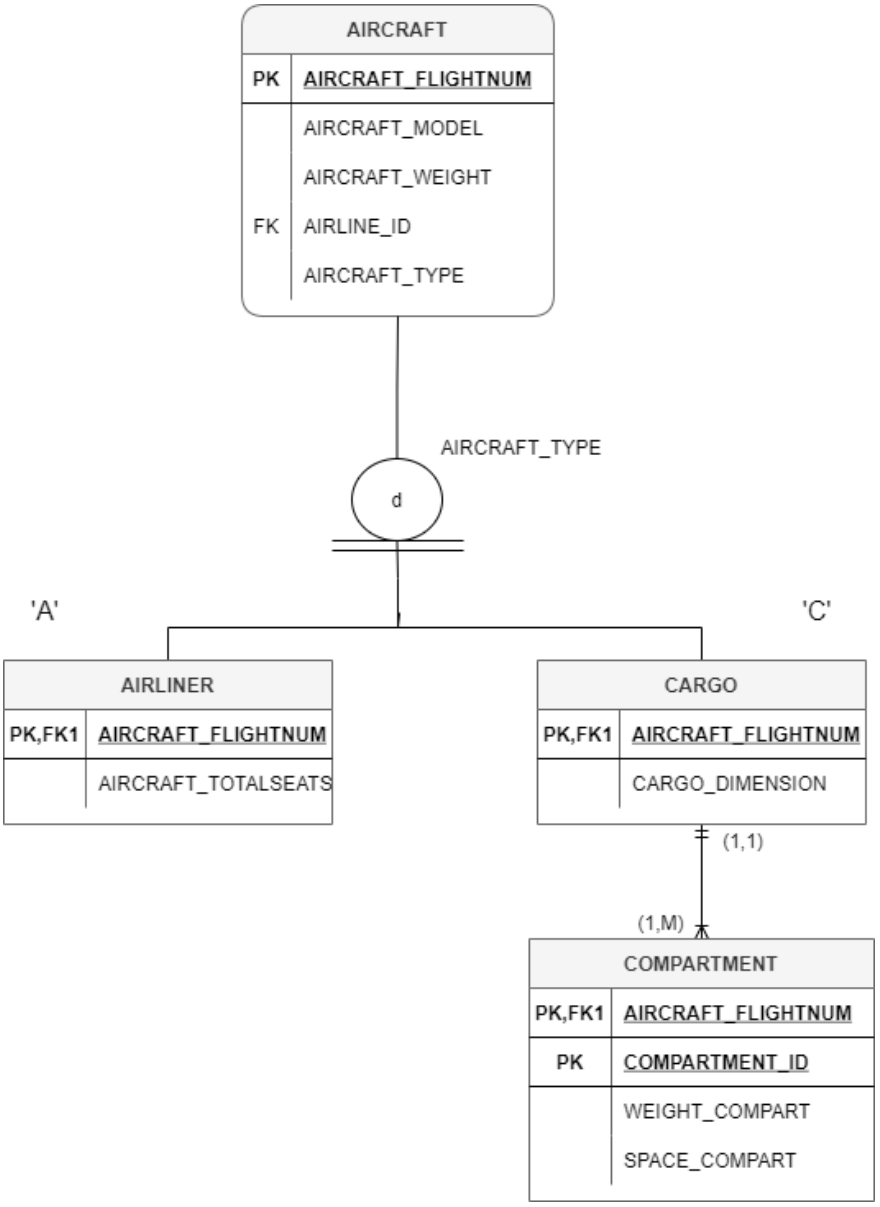
Module 4: [Flight Information – Azri Zamrud bin Kimin]

- Each airport should be involved in many flights and each flight can be in one airport
- Multiple bookings are associated with each flight and each flight should link with multiple bookings.
- Each booking can be added to multiple luggage packages and each luggage package can be added to multiple bookings

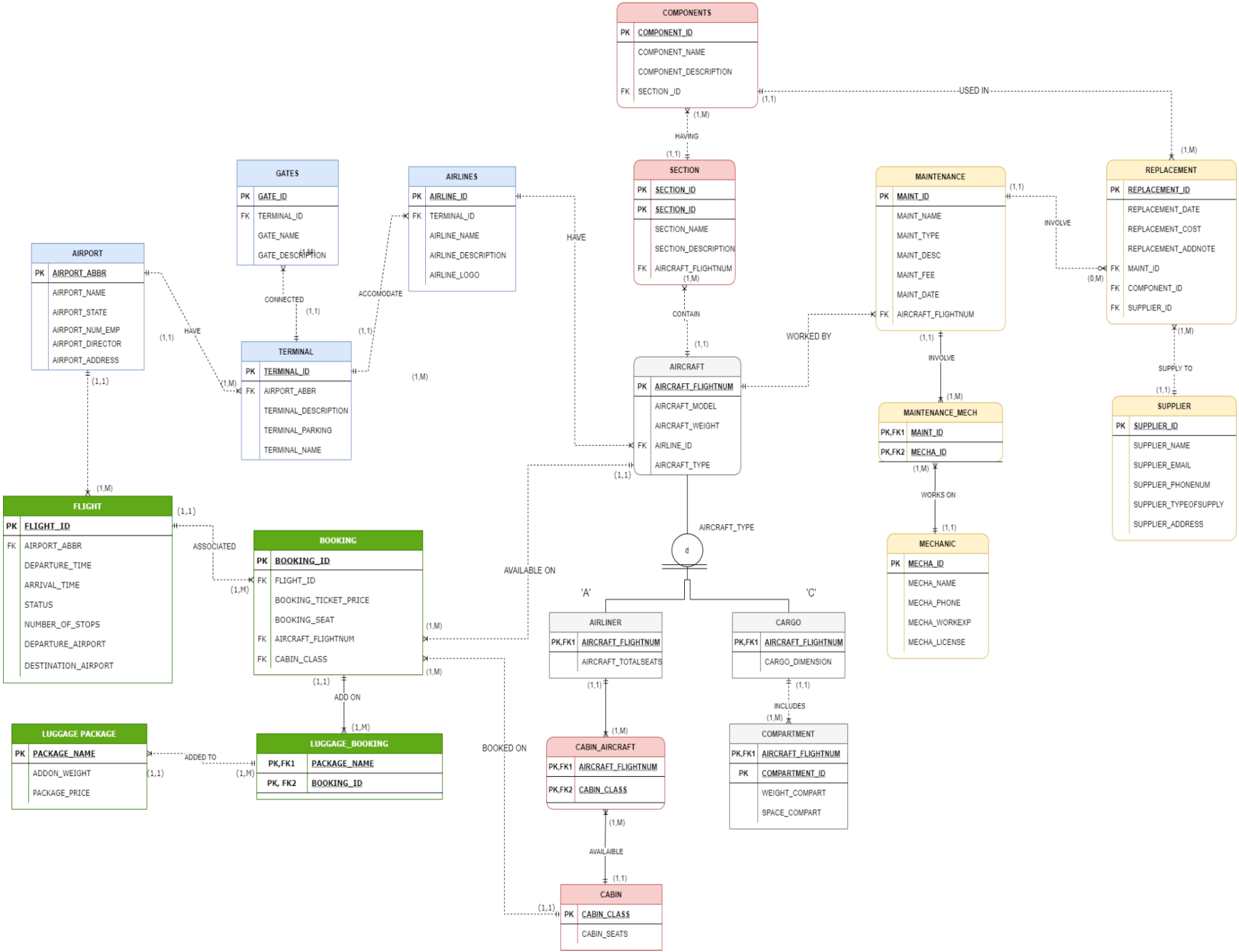


Section 2.0

- An aircraft can only be either airliner or cargo plane and an aircraft cannot be both types at the same time.
- Cargo planes can include one or many compartments and each compartment is included in one and only cargo.



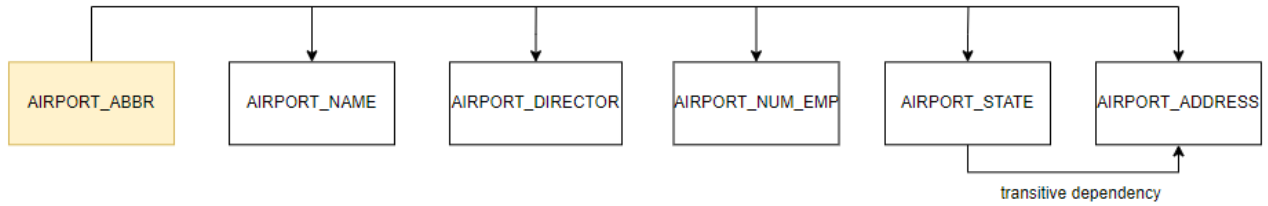
2.0 Extended ERD (EERD)


COMPONENTS
PK COMPONENT_ID
COMPONENT_NAME
COMPONENT_DESCRIPTION
FK SECTION _ID
USED IN
(1,1)
(1,M)
HAVING
(1,1)
(1,M)
SECTION
PK SECTION_ID
PK SECTION_ID
SECTION_NAME
SECTION_DESCRIPTION
FK AIRCRAFT_FLIGHTNUM
(1,M)
CONTAIN
(1,1)
GATES
PK GATE_ID
FK TERMINAL_ID
GATE_NAME
GATE_DESCRIPTION
(1,M)
CONNECTED
(1,1)
AIRLINES
PK AIRLINE_ID
FK TERMINAL_ID
AIRLINE_NAME
AIRLINE_DESCRIPTION
AIRLINE_LOGO
ACCOMODATE
(1,1)
(1,M)
HAVE
AIRPORT
PK AIRPORT_ABBR
AIRPORT_NAME
AIRPORT_STATE
AIRPORT_NUM_EMP
AIRPORT_DIRECTOR
AIRPORT_ADDRESS
(1,1)
HAVE
(1,M)
(1,1)
TERMINAL
PK TERMINAL_ID
FK AIRPORT_ABBR
TERMINAL_DESCRIPTION
TERMINAL_PARKING
TERMINAL_NAME
(1,M)
AIRCRAFT
PK AIRCRAFT_FLIGHTNUM
AIRCRAFT_MODEL
AIRCRAFT_WEIGHT
FK AIRLINE_ID
AIRCRAFT_TYPE
(1,1)
WORKED BY
MAINTENANCE
PK MAINT_ID
MAINT_NAME
MAINT_TYPE
MAINT_DESC
MAINT_FEE
MAINT_DATE
FK AIRCRAFT_FLIGHTNUM
(1,1)
INVOLVE
(0,M)
INVOLVE
(1,1)
(1,M)
REPLACEMENT
PK REPLACEMENT_ID
REPLACEMENT_DATE
REPLACEMENT_COST
REPLACEMENT_ADDNOTE
FK MAINT_ID
FK COMPONENT_ID
FK SUPPLIER_ID
(1,M)
SUPPLY TO
(1,1)
SUPPLIER
PK SUPPLIER_ID
SUPPLIER_NAME
SUPPLIER_EMAIL
SUPPLIER_PHONENUM
SUPPLIER_TYPEOFSUPPLY
SUPPLIER_ADDRESS
MAINTENANCE_MECH
PK,FK1 MAINT_ID
PK,FK2 MECHA_ID
(1,M)
WORKS ON
(1,1)
MECHANIC
PK MECHA_ID
MECHA_NAME
MECHA_PHONE
MECHA_WORKEXP
MECHA_LICENSE
FLIGHT
PK FLIGHT_ID
FK AIRPORT_ABBR
DEPARTURE_TIME
ARRIVAL_TIME
STATUS
NUMBER_OF_STOPS
DEPARTURE_AIRPORT
DESTINATION_AIRPORT
(1,M)
(1,1)
ASSOCIATED
(1,M)
BOOKING
PK BOOKING_ID
FK FLIGHT_ID
BOOKING_TICKET_PRICE
BOOKING_SEAT
FK AIRCRAFT_FLIGHTNUM
FK CABIN_CLASS
(1,M)
(1,M)
(1,1)
ADD ON
(1,M)
AVAILABLE ON
AIRCRAFT_TYPE
d
'A'
'C'
AIRLINER
PK,FK1 AIRCRAFT_FLIGHTNUM
AIRCRAFT_TOTALSEATS
(1,1)
(1,M)
CARGO
PK,FK1 AIRCRAFT_FLIGHTNUM
CARGO_DIMENSION
(1,1)
INCLUDES
(1,M)
COMPARTMENT
PK,FK1 AIRCRAFT_FLIGHTNUM
PK COMPARTMENT_ID
WEIGHT_COMPART
SPACE_COMPART
LUGGAGE PACKAGE
PK PACKAGE_NAME
ADDON_WEIGHT
PACKAGE_PRICE
(1,1)
ADDED TO
(1,M)
LUGGAGE_BOOKING
PK,FK1 PACKAGE_NAME
PK, FK2 BOOKING_ID
BOOKED ON
CABIN_AIRCRAFT
PK,FK1 AIRCRAFT_FLIGHTNUM
PK,FK2 CABIN_CLASS
(1,M)
AVAILAIBLE
(1,1)
CABIN
PK CABIN_CLASS
CABIN_SEATS
(1,1)

3.0 Normalization

Module 1: [Airport Information – Muhammad Nur Hafiz bin Jamal]

2NF
Table: AIRPORT



This table AIRPORT, we have not achieved high normal form yet. There are transitive dependency between non key attributes AIRPORT_ADDRESS and AIRPORT_STATE. To achieve high form, we need to remove the transitive dependency by creating a new table.

3NF (remove the transitive dependency)
Table: AIRPORT

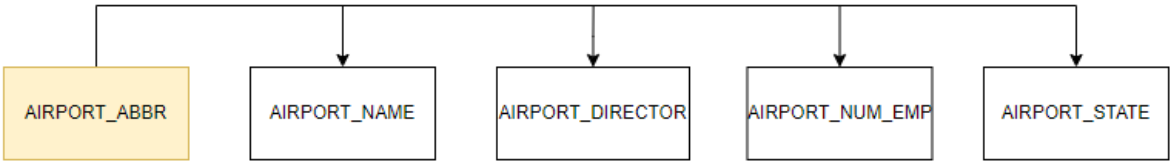
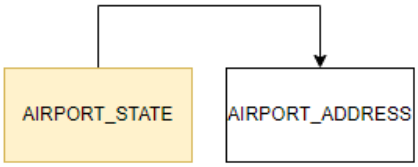


Table: ADDRESS

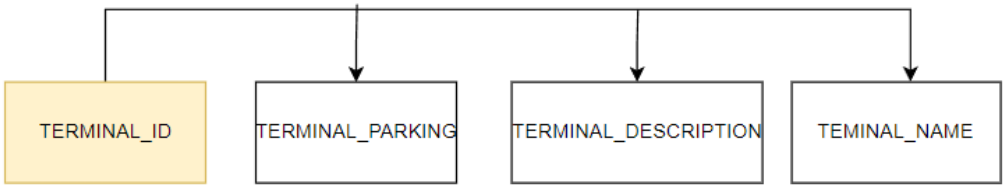


AIRPORT(<u>AIRPORT_ABBR</u>, AIRPORT_NAME, AIRPORT_DIRECTOR, AIRPORT_NUM_EMP, AIRPORT_STATE)

ADDRESS(<u>AIRPORT_STATE</u>, AIRPORT_ADDRESS)

There is no more partial dependency or transitive dependency. These tables are already in higher normal form.

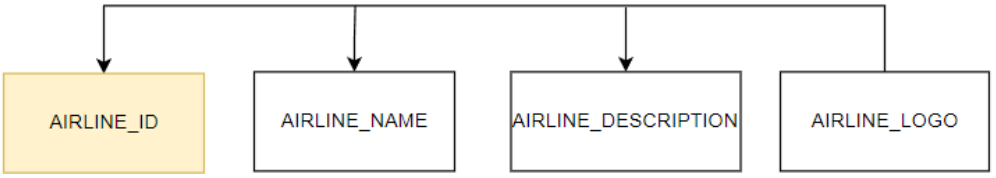
3NF
Table: TERMINAL



TERMINAL(TERMINAL_ID, TERMINAL_PARKING, TERMINAL_DESCRIPTION, TERMINAL_NAME)

There is no more partial dependency or transitive dependency. This table is already in higher normal form.

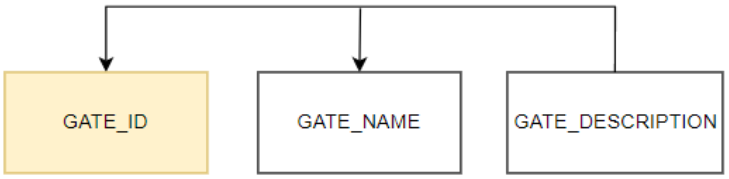
3NF
Table: AIRLINES



AIRLINES(AIRLINE_ID, AIRLINE_NAME, AIRLINE_DESCRIPTION, AIRLINE_LOGO)

There is no more partial dependency or transitive dependency. This table is already in higher normal form.

3NF
Table: GATES



GATES(GATE_ID, GATE_NAME, GATE_DESCRIPTION)

There is no more partial dependency or transitive dependency. This table is already in higher normal form.

Module 2: [Aircraft Information – Haziq Bin Hizul]

Table name: AIRCRAFT

3NF

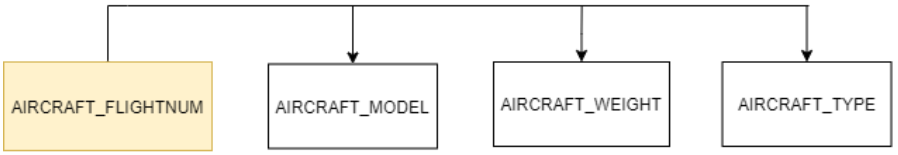


Table name: SECTION

3NF

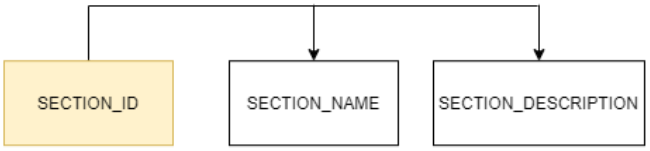


Table name: COMPONENTS

3NF

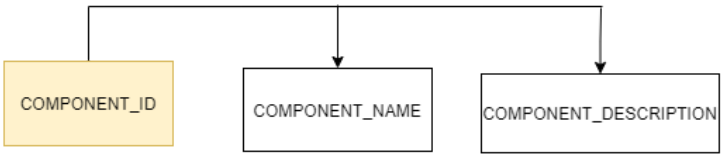


Table name : CABIN

3NF

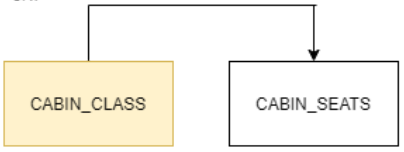


Table name : CABIN_AIRCRAFT

3NF

Table name : COMPARTMENT

3NF

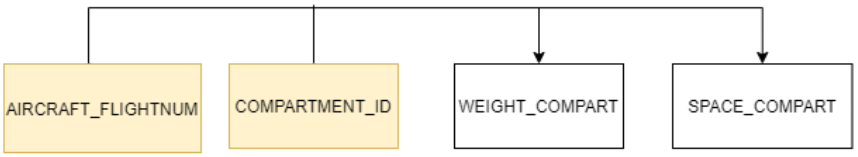
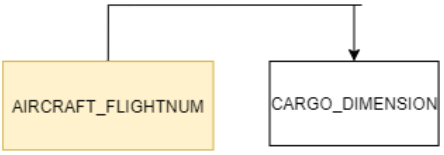


Table name : AIRLINER

3NF

Table name : CARGO

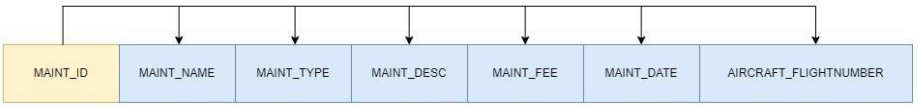
3NF



Module 3: Maintenance Information – Mohammed Hammad]

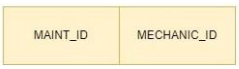
3NF

Table name: MAINTENANCE



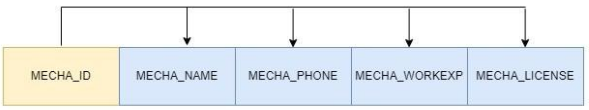
3NF

Table name: MAINTENANCE_MECH



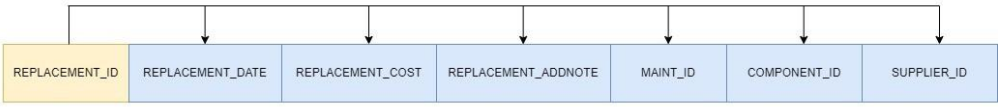
3NF

Table name: MECHANIC



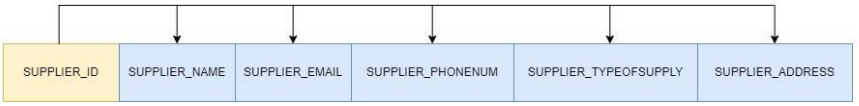
3NF

Table name: REPLACEMENT

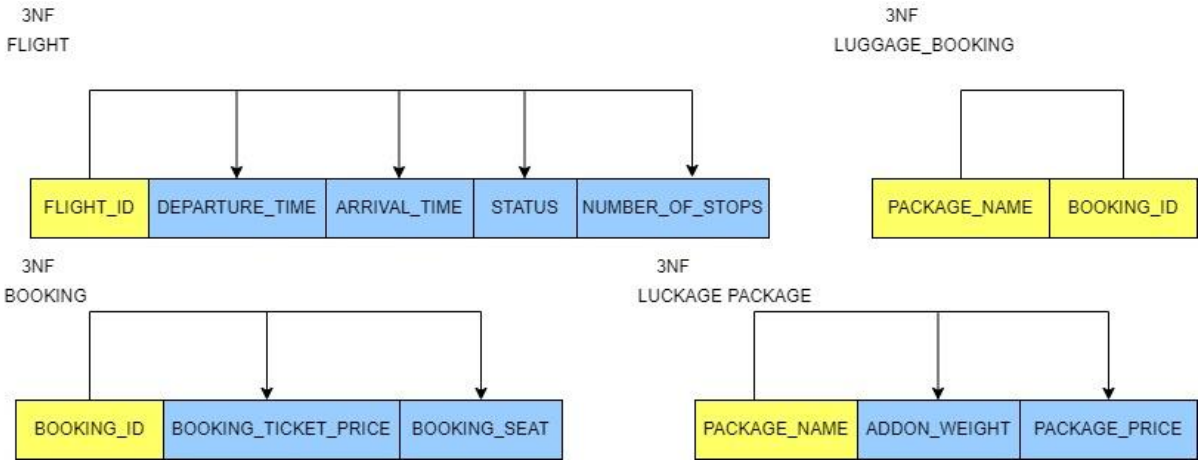


3NF

Table name: SUPPLIER



Module 4: [Flight Information – Azri Zamrud bin Kimin]



4.0 Data Dictionary

Table Name	Attribute Name	Contents	Data Type	Format	Range	Required	PK or FK	FK Referenced Table
AIRPORT	AIRPORT_ABBR	Airport abbreviation	CHAR (3)	XXX	NA	Y	PK	
	AIRPORT_NAME	Airport name	VARCHAR (50)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX	NA	Y		
	AIRPORT_DIRECTOR	Airport director	VARCHAR (30)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX	NA	Y		
	AIRPORT_NUM_EMP	Number of employees	NUMBER(5, 0)	#####	1000-40000	Y		
	AIRPORT_STATE	Airport State	VARCHAR (30)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX	NA	Y		
ADDRESS	AIRPORT_STATE	Airport State	VARCHAR (30)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX	NA	Y	PK	
	AIRPORT_ADDRESS	Airport Address	VARCHAR (100)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXX	NA	Y		
TERMINAL	TERMINAL_ID	Terminal ID	INTEGER	#####	10000 - 99999	Y	PK	
	AIRPORT_ABBR	Airport abbreviation	CHAR (3)	XXX	NA		FK	AIRPORT
	TERMINAL_DESCRIPTION	Terminal Description	VARCHAR (100)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXX	NA	Y		
	TERMINAL_PARKING	Terminal Parking	NUMBER (4,0)	1234	100-9999	Y		

	TERMINAL_NAME	Terminal Name	VARCHAR (30)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX	NA	Y		
AIRLINES	AIRLINE_ID	Airline ID	INTEGER	#####	1 - 99999	Y	PK	
	TERMINAL_ID	Terminal ID	INTEGER	#####	1 - 99999		FK	TERMINAL
	AIRLINE_NAME	Airline Name	VARCHAR (30)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX	NA	Y		
	AIRLINE_DESCRIPTION	Airline Description	VARCHAR (100)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXX	NA	Y		
	AIRLINE_LOGO	Airline Logo	VARCHAR (30)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX	NA	Y		
GATES	GATE_ID	Gate ID	VARCHAR (5)	X1234	NA	Y	PK	
	TERMINAL_ID	Terminal ID	INTEGER	#####	1 - 99999		FK	TERMINAL
	GATE_NAME	Gate name	VARCHAR (30)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX	NA	Y		
	GATE_DESCRIPTION	Gate description	VARCHAR (100)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXX	NA	Y		
AIRCRAFT	AIRCRAFT_FLIGHTNUM	Aircraft Flight number	VARCHAR2 (7)	AB12345	NA		PK	
	AIRCRAFT_MODEL	The model of each aircraft	VARCHAR2 (30)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX	NA			
	AIRCRAFT_WEIGHT	Aircraft weight	INTEGER	1234567899	0			
	AIRCRAFT_TYPE	Aircraft type	VARCHAR2 (8)	XXXXXXXX XX	AIRLINER CARGO			

	AIRLINE_ID		VARCHAR2 (8)	XXX12345	NA		FK	AIRLINE
CABIN	CABIN_CLASS	The 4 Cabin Class	VARCHAR2 (30)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX	NA		PK	
	CABIN SEATS	The seats in the Cabin	INTEGER	123	0			
SECTION	SECTION_ID	The Section ID	INTEGER	123	0		PK	
	SECTION_NAME	The Section Name	VARCHAR2 (30)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX	NA			
	SECTION_DESCRIPTION	The Section Description	VARCHAR2 (100)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXX	NA			
	AIRCRAFT_FLIGHTNUM	Aircraft Flight number	VARCHAR2 (7)	AB12345	NA		FK	AIRCRAFT
COMPONENT	COMPONENT_ID	The Component ID	VARCHAR2 (30)	1234	0		PK	
	COMPONENT_DESCRIPTION	The description for component	VARCHAR2 (100)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXX	NA			
	COMPONENT_NAME	The component name	VARCHAR2 (100)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXX				
	SECTION_ID	The ID for section	INTEGER	1234	0		PK	

AIRLINER	AIRCRAFT_FLIGHTNUM	Aircraft Flight number	VARCHAR2(7)	AB12345	NA		FK	AIRCRAFT
	AIRCRAFT_TOTALSEATS		INTEGER	123	0			
CARGO	AIRCRAFT_FLIGHTNUM	Aircraft Flight number	VARCHAR2(7)	AB12345			PK, FK	AIRCRAFT
	CARGO_DIMENSION		INTEGER	123	0			
COMPARTMENT	AIRCRAFT_FLIGHTNUM		VARCHAR2(7)	XX12345	NA		PK, FK	AIRCRAFT
	COMPARTMENT_ID	The ID for compartment	VARCHAR2(30)	XXXXXXXXXXXXXXXXXXXXXX	0			
	WEIGHT_COMPART	The compartment weight in kilogram	INTEGER	123	0			
	SPACE_COMPART	The space dimension of compartment	INTEGER	123	0			
MAINTENANCE	MAINT_ID	Maintenance ID	VARCHAR(8)	XXXXXXXX	NA	Y	PK	
	MAINT_NAME	Maintenance Name	VARCHAR(30)	XXXXXXXXXXXXXXXXXXXXXX	NA	Y		
	MAINT_TYPE	Maintenance type	VARCHAR(30)	XXXXXXXXXXXXXXX	NA	Y		
	MAINT_DESC	Maintenance description	VARCHAR(100)	XXXXXXXXXXXXXXX	NA	Y		
	MAINT_FEE	Maintenance fee	NUMBER(9,2)	1234567.89		Y		
	MAINT_DATE	Maintenance date	DATE	DD-MON-YY	NA	Y		
	AIRCRAFT_FLIGHTNUM	Aircraft flight number	VARCHAR2(7)	XXXXXXX	NA	Y	FK	AIRCRAFT
MAINTENANCE_MECH	MAINT_ID	Maintenance ID	VARCHAR(8)	XXXXXXXX		Y	PK,FK1	MAINTENANCE
	MECHA_ID	Mechanic ID	VARCHAR(8)	XXXXXXXX		Y	PK,FK2	MECHANIC
MECHANIC	MECHA_ID	Mechanic ID	VARCHAR(8)	XXXXXXXX	NA	Y	PK	
	MECHA_NAME	Mechanic Name	VARCHAR(30)	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	NA	Y		
	MECHA_PHONE	Mechanic Phone	VARCHAR(10)	XXXXXXXXXX	NA	Y		
	MECHA_WORKEXP	Mechanic Work experience	NUMBER(3)	XXX	1-999	Y		
	MECHA_LICENSE	Mechanic licence	VARCHAR(8)	XXXXXXXX	NA	Y		
REPLACEMENT	REPLACEMENT_ID	Replacement ID	VARCHAR(8)	XXXXXXXX	NA	Y	PK	
	REPLACEMENT_DATE	Replacement date	DATE	DD-MON-YY	NA	Y		
	REPLACEMENT_COST	Replacement cost	NUMBER(9,2)	1234567.89	0.00 - 9999999.99	Y		
	REPLACEMENT_ADDNOTE	Replacement addnote	VARCHAR(100)	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX		Y		

				XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX				
	MAINT_ID	Maintenance ID	VARCHAR(8)	XXXXXXXX		Y	FK	MAINTENANCE
	COMPONENT_ID	Component ID	VARCHAR2(30)	XXXXXXXX XXXXXXXX XXXXXXXX	NA	Y	FK	COMPONENT
	SUPPLIER_ID	Supplier ID	VARCHAR(8)	XXXXXXXX		Y	FK	SUPPLIER
SUPPLIER	SUPPLIER_ID	Supplier ID	VARCHAR(8)	XXXXXXXX	NA	Y	PK	
	SUPPLIER_NAME	Supplier Name	VARCHAR(30)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX	NA	Y		
	SUPPLIER_EMAIL	Supplier email	VARCHAR(40)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX	NA	Y		
	SUPPLIER_PHONE NUM	Supplier phone number	VARCHAR(15)	XXXXXXXX XX	NA	Y		
	SUPPLIER_TYPEOF SUPPLY	Supplier type of supply	VARCHAR(30)	XXXXXXXX XXXXXXXX	NA	Y		
	SUPPLIER_ADDRE SS	Supplier Address	VARCHAR(100)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX XXXXXXXX	NA	Y		
FLIGHT	FLIGHT_ID	Flight ID	VARCHAR(7)	AB12345	NA		PK	
	AIRPORT_ABBR	Airport abbreviation	CHAR(3)	XXX	NA		FK	AIRPORT
	DEPARTURE_TIME	Departure time	INTEGER	HH:MM:SS	00:00:00 - 23:59:59			
	ARRIVAL_TIME	Arrival time	INTEGER	HH:MM:SS	00:00:00 - 23:59:59			
	STATUS	Flight status	VARCHAR(20)	XXXXXXXX XXXXXXXX XXXX	NA			
BOOKING	BOOKING_ID	Booking ID	VARCHAR(7)	XXXXXXX	NA		PK	
	FLIGHT_ID	Flight ID	VARCHAR(7)	AB12345	NA		FK	FLIGHT
	BOOKING_TICKET _PRICE	Booking ticket price	INTEGER	######	0-999999			
	CABIN_CLASS	Cabin class	VARCHAR(20)	XXXXXXXX XXXXXXXX XXXX	NA			
	BOOKING_SEAT	Booking seat for passengers	VARCHAR(10)	XXXXXXXX XX	NA			
LUGGAGE _PACKAGE	PACKAGE_NAME	Package name	VARCHAR(30)	XXXXXXXX XXXXXXXX XXXXXXXX XXXXXX	NA		PK	
	ADDON_WEIGHT	Add-on weight	INTEGER	##	0-99			

	PACKAGE_PRICE	Package price	INTEGER	#####	0-99999			

5.0 Database Implementation

5.1 DDL

Module 1: [Airport Information – Muhammad Nur Hafiz bin Jamal]

AIRPORT TABLE:

```
CREATE TABLE AIRPORT(
AIRPORT_ABBR        CHAR(3)      PRIMARY KEY,
AIRPORT_NAME        VARCHAR(30) NOT NULL,
AIRPORT_DIRECTOR    VARCHAR(30) NOT NULL,
AIRPORT_NUM_EMP     NUMBER(5,0) NOT NULL,
AIRPORT_STATE       VARCHAR(30) NOT NULL
);
```

ADDRESS TABLE:

```
CREATE TABLE ADDRESS(
AIRPORT_STATE       VARCHAR(30)  PRIMARY KEY,
AIRPORT_ADDRESS     VARCHAR(100) NOT NULL
);
```

TERMINAL TABLE:

```
CREATE TABLE TERMINAL(
TERMINAL_ID           INTEGER      PRIMARY KEY,
TERMINAL_DESCRIPTION  VARCHAR(100) NOT NULL,
TERMINAL_PARKING      NUMBER(4,0)  NOT NULL,
TERMINAL_NAME         VARCHAR(30)  NOT NULL,
AIRPORT_ABBR          CHAR(3)      NOT NULL,
CONSTRAINT AIRPORT_ABBR_FK FOREIGN KEY(AIRPORT_ABBR) REFERENCES AIRPORT
);
```

AIRLINES TABLE:

```
CREATE TABLE AIRLINES(
AIRLINE_ID          INTEGER         PRIMARY KEY,
AIRLINE_NAME        VARCHAR(30)     NOT NULL,
AIRLINE_DESCRIPTION VARCHAR(100)    NOT NULL,
AIRLINE_LOGO        VARCHAR(30)     NOT NULL,
TERMINAL_ID         INTEGER         NOT NULL,
CONSTRAINT TERMINAL_ID_FK FOREIGN KEY(TERMINAL_ID) REFERENCES TERMINAL
);
```

GATES TABLE:

```
CREATE TABLE GATES(
GATE_ID             VARCHAR(5)      PRIMARY KEY,
GATE_NAME           VARCHAR(30)     NOT NULL,
GATE_DESCRIPTION    VARCHAR(100)    NOT NULL,
TERMINAL_ID         INTEGER         NOT NULL,
CONSTRAINT TERMINAL_ID2_FK FOREIGN KEY(TERMINAL_ID) REFERENCES TERMINAL
);
```

TRIGGER & SEQUENCE FOR TERMINAL ID & AIRLINES ID:

```
CREATE SEQUENCE TERMINAL_ID_SEQ
START WITH 1 NOCACHE;

CREATE TRIGGER TERMINAL_ID_TRG
BEFORE INSERT ON TERMINAL
FOR EACH ROW
BEGIN
    SELECT TERMINAL_ID_SEQ.NEXTVAL
    INTO: NEW.TERMINAL_ID
    FROM DUAL;
END;


CREATE SEQUENCE AIRLINE_ID_SEQ
START WITH 1 NOCACHE;

CREATE TRIGGER AIRLINE_ID_TRG
BEFORE INSERT ON AIRLINES
FOR EACH ROW
BEGIN
    SELECT AIRLINE_ID_SEQ.NEXTVAL
    INTO: NEW.AIRLINE_ID
    FROM DUAL;
END;
```

Module 2: [Aircraft Information – HAZIQ HIZULI]

AIRCRAFT TABLE:

```
CREATE TABLE  "AIRCRAFT"
  (       "AIRCRAFT_FLIGHTNUM" VARCHAR2(7) NOT NULL ENABLE,
          "AIRCRAFT_MODEL" VARCHAR2(30) NOT NULL ENABLE,
          "AIRCRAFT_WEIGHT" NUMBER(8,0) NOT NULL ENABLE,
          "AIRCRAFT_TYPE" VARCHAR2(8) NOT NULL ENABLE,
          "AIRLINE_ID" NUMBER,
           CONSTRAINT "AIRCRAFT_PK" PRIMARY KEY ("AIRCRAFT_FLIGHTNUM")
 USING INDEX  ENABLE
  )
/
ALTER TABLE   "AIRCRAFT" ADD CONSTRAINT "AIRCRAFT_AIRLINES_FK" FOREIGN
KEY ("AIRLINE_ID")
          REFERENCES  "AIRLINES" ("AIRLINE_ID") ENABLE
/
```

AIRLINER TABLE:

```
CREATE TABLE  "AIRLINER"
  (       "AIRCRAFT_FLIGHTNUM" VARCHAR2(7),
          "AIRCRAFT_TOTALSEATS" NUMBER(3,0) NOT NULL ENABLE,
           CONSTRAINT "AIRLINER_FK" PRIMARY KEY ("AIRCRAFT_FLIGHTNUM")
 USING INDEX  ENABLE
  )
/
ALTER TABLE    "AIRLINER" ADD CONSTRAINT "AIR_AIRCRAFTFLIGHTNUM_FK"
FOREIGN KEY ("AIRCRAFT_FLIGHTNUM")
          REFERENCES  "AIRCRAFT" ("AIRCRAFT_FLIGHTNUM") ENABLE
/
```

CABIN TABLE:

```
CREATE TABLE  "CABIN"
  (       "CABIN_CLASS" VARCHAR2(30) NOT NULL ENABLE,
          "CABIN_SEATS" NUMBER(3,0) NOT NULL ENABLE,
           CONSTRAINT "CABIN_PK" PRIMARY KEY ("CABIN_CLASS")
 USING INDEX  ENABLE
  )
/
```

CABIN_AIRLINER TABLE:

```
CREATE TABLE  "CABIN_AIRLINER"
  (       "AIRCRAFT_FLIGHTNUM" VARCHAR2(7),
          "CABIN_CLASS" VARCHAR2(30),
           CONSTRAINT "CAB_AIRLINER_PK" PRIMARY KEY ("AIRCRAFT_FLIGHTNUM",
"CABIN_CLASS")
 USING INDEX  ENABLE
  )
/
ALTER TABLE  "CABIN_AIRLINER" ADD CONSTRAINT "CABIN_AIRLINER_FK"
FOREIGN KEY ("AIRCRAFT_FLIGHTNUM")
```

```
        REFERENCES  "AIRLINER" ("AIRCRAFT_FLIGHTNUM") ENABLE
/
ALTER TABLE  "CABIN_AIRLINER" ADD CONSTRAINT "CA_CABIN_CLASS_FK"
FOREIGN KEY ("CABIN_CLASS")
        REFERENCES  "CABIN" ("CABIN_CLASS") ENABLE
/
```

CARGO TABLE:

```
CREATE TABLE  "CARGO"
  (       "AIRCRAFT_FLIGHTNUM" VARCHAR2(7),
          "CARGO_DIMENSION" NUMBER(5,2) NOT NULL ENABLE,
           CONSTRAINT "CARGO_PK" PRIMARY KEY ("AIRCRAFT_FLIGHTNUM")
  USING INDEX  ENABLE
   )
/
ALTER TABLE  "CARGO" ADD CONSTRAINT "AIRCRAFT_CARGO_FK" FOREIGN KEY
("AIRCRAFT_FLIGHTNUM")
        REFERENCES  "AIRCRAFT" ("AIRCRAFT_FLIGHTNUM") ENABLE
/
COMPARTMENT TABLE:
CREATE TABLE  "COMPARTMENT"
  (       "AIRCRAFT_FLIGHTNUM" VARCHAR2(7),
          "COMPARTMENT_ID" VARCHAR2(30),
          "WEIGHT_COMPART" NUMBER(7,2),
          "SPACE_COMPART" NUMBER(7,0),
           CONSTRAINT "COMPARTMENT_PK" PRIMARY KEY ("AIRCRAFT_FLIGHTNUM",
"COMPARTMENT_ID")
  USING INDEX  ENABLE
   )
/
ALTER TABLE  "COMPARTMENT" ADD CONSTRAINT "COMPARTMENT_CON_FK"
FOREIGN KEY ("AIRCRAFT_FLIGHTNUM")
        REFERENCES  "CARGO" ("AIRCRAFT_FLIGHTNUM") ENABLE
/
```

```
CREATE OR REPLACE EDITIONABLE TRIGGER  "VALIDATE_SPACE"
BEFORE INSERT OR UPDATE ON COMPARTMENT
FOR EACH ROW
DECLARE
l_space CARGO.CARGO_DIMENSION%type;
BEGIN
  SELECT CARGO_DIMENSION INTO l_space
  FROM CARGO
```

```
   where AIRCRAFT_FLIGHTNUM = :new.AIRCRAFT_FLIGHTNUM;
   IF : new.SPACE_COMPART> l_space then
      raise_application_error(-20000, 'Exceeded Limit');
   end if;
   END;

/
ALTER TRIGGER  "VALIDATE_SPACE" ENABLE
/
```

COMPONENT TABLE:

```
CREATE TABLE  "COMPONENT"
   (       "COMPONENT_ID" VARCHAR2(30),
           "COMPONENT_DESCRIPTION" VARCHAR2(100),
           "SECTION_ID" VARCHAR2(30),
           "COMPONENT_NAME" VARCHAR2(100) NOT NULL ENABLE,
            CONSTRAINT "COMPO_PK" PRIMARY KEY ("COMPONENT_ID")
  USING INDEX  ENABLE
   )
/
ALTER TABLE  "COMPONENT" ADD CONSTRAINT "SECTION_FK" FOREIGN KEY
("SECTION_ID")
            REFERENCES  "SECTION" ("SECTION_ID") ENABLE
/
```

SECTION TABLE:

```
CREATE TABLE  "SECTION"
   (       "SECTION_ID" VARCHAR2(30),
           "SECTION_NAME" VARCHAR2(30),
           "SECTION_DESCRIPTION" VARCHAR2(100),
           "AIRCRAFT_FLIGHTNUM" VARCHAR2(30),
            CONSTRAINT "SECTION_PK" PRIMARY KEY ("SECTION_ID")
  USING INDEX  ENABLE
   )
/
ALTER TABLE  "SECTION" ADD CONSTRAINT "AIRCRAFTFLIGHT_FK" FOREIGN KEY
("AIRCRAFT_FLIGHTNUM")
            REFERENCES  "AIRCRAFT" ("AIRCRAFT_FLIGHTNUM") ENABLE
/
```

Module 3: [Maintenance Information – Mohammed Hammad]

REPLACEMENT table:

```
CREATE TABLE  "REPLACEMENT"
   (    "REPLACEMENT_ID" VARCHAR2(8) NOT NULL ENABLE,
        "REPLACEMENT_DATE" DATE NOT NULL ENABLE,
        "REPLACEMENT_COST" NUMBER(9,2) NOT NULL ENABLE,
        "REPLACEMENT_ADDNOTE" VARCHAR2(100) NOT NULL ENABLE,
        "MAINT_ID" VARCHAR2(8) NOT NULL ENABLE,
        "COMPONENT_ID" VARCHAR2(30) NOT NULL ENABLE,
        "SUPPLIER_ID" VARCHAR2(8) NOT NULL ENABLE,
         CONSTRAINT "REPLACEMENT_ID_PK" PRIMARY KEY ("REPLACEMENT_ID")
  USING INDEX  ENABLE
   )
/
ALTER TABLE  "REPLACEMENT" ADD CONSTRAINT "COMPONENT_ID_FK" FOREIGN KEY ("COMPONENT_ID"
          REFERENCES  "COMPONENT" ("COMPONENT_ID") ENABLE
/
ALTER TABLE  "REPLACEMENT" ADD CONSTRAINT "MAINT_ID_FK" FOREIGN KEY ("MAINT_ID")
          REFERENCES  "MAINTENANCE" ("MAINT_ID") ENABLE
/
ALTER TABLE  "REPLACEMENT" ADD CONSTRAINT "SUPPLIER_ID_FK" FOREIGN KEY ("SUPPLIER_ID")
          REFERENCES  "SUPPLIER" ("SUPPLIER_ID") ENABLE
/
```

SUPPLIER table:

```
CREATE TABLE  "SUPPLIER"
   (    "SUPPLIER_ID" VARCHAR2(8) NOT NULL ENABLE,
        "SUPPLIER_NAME" VARCHAR2(30) NOT NULL ENABLE,
        "SUPPLIER_EMAIL" VARCHAR2(40) NOT NULL ENABLE,
        "SUPPLIER_PHONENUM" VARCHAR2(15) NOT NULL ENABLE,
        "SUPPLIER_TYPEOFSUPPLY" VARCHAR2(30) NOT NULL ENABLE,
        "SUPPLIER_ADDRESS" VARCHAR2(100) NOT NULL ENABLE,
         CONSTRAINT "SUPPLIER_PK" PRIMARY KEY ("SUPPLIER_ID")
  USING INDEX  ENABLE
   )
/
```

MAINTENANCE_MECH table:

```
CREATE TABLE  "MAINTENANCE_MECH"
   (    "MAINT_ID" VARCHAR2(8) NOT NULL ENABLE,
        "MECHA_ID" VARCHAR2(8) NOT NULL ENABLE,
         CONSTRAINT "MAINTENANCE_MECH_PK" PRIMARY KEY ("MAINT_ID", "MECHA_ID")
  USING INDEX  ENABLE
   )
/
ALTER TABLE  "MAINTENANCE_MECH" ADD CONSTRAINT "MAINTENANCE_MECH_FK1" FOREIGN KEY ("MAINT_ID")
          REFERENCES  "MAINTENANCE" ("MAINT_ID") ENABLE
/
ALTER TABLE  "MAINTENANCE_MECH" ADD CONSTRAINT "MAINTENANCE_MECH_FK2" FOREIGN KEY ("MECHA_ID")
          REFERENCES  "MECHANIC" ("MECHA_ID") ENABLE
/
```

MAINTENANCE table:

```
CREATE TABLE  "MAINTENANCE"
   (    "MAINT_ID" VARCHAR2(8) NOT NULL ENABLE,
        "MAINT_NAME" VARCHAR2(30) NOT NULL ENABLE,
        "MAINT_TYPE" VARCHAR2(30) NOT NULL ENABLE,
        "MAINT_DESC" VARCHAR2(100) NOT NULL ENABLE,
        "MAINT_FEE" NUMBER(9,2) NOT NULL ENABLE,
        "MAINT_DATE" DATE NOT NULL ENABLE,
        "AIRCRAFT_FLIGHTNUM" VARCHAR2(7) NOT NULL ENABLE,
         CONSTRAINT "MAINTENANCE_PK" PRIMARY KEY ("MAINT_ID")
  USING INDEX  ENABLE
   )
/
ALTER TABLE  "MAINTENANCE" ADD CONSTRAINT "AIRCRAFT_FLIGHTNUM_FK" FOREIGN KEY ("AIRCRAFT_FLIGHTNUM")
          REFERENCES  "AIRCRAFT" ("AIRCRAFT_FLIGHTNUM") ENABLE
/
```

MECHANIC table:

```
CREATE TABLE  "MECHANIC"
   (    "MECHA_ID" VARCHAR2(8) NOT NULL ENABLE,
        "MECHA_NAME" VARCHAR2(30) NOT NULL ENABLE,
        "MECHA_PHONE" VARCHAR2(10) NOT NULL ENABLE,
        "MECHA_WORKEXP" NUMBER(3,0) NOT NULL ENABLE,
        "MECHA_LICENSE" VARCHAR2(8) NOT NULL ENABLE,
         CONSTRAINT "MECHANIC_PK" PRIMARY KEY ("MECHA_ID")
  USING INDEX  ENABLE
   )
/
```

Module 4: [Flight Information – Azri Zamrud bin Kimin]
FLIGHT table:

```
CREATE TABLE  "FLIGHT"
   (    "FLIGHT_ID" VARCHAR2(7),
        "AIRPORT_ABBR" CHAR(3) NOT NULL ENABLE,
        "DEPARTURE_TIME" TIMESTAMP (6),
        "ARRIVAL_TIME" TIMESTAMP (6),
        "STATUS" VARCHAR2(20),
         CONSTRAINT "PK_FLIGHT" PRIMARY KEY ("FLIGHT_ID")
  USING INDEX  ENABLE
   )
/
ALTER TABLE  "FLIGHT" ADD CONSTRAINT "FK_FLIGHT" FOREIGN KEY ("AIRPORT_ABBR")
          REFERENCES  "AIRPORT" ("AIRPORT_ABBR") ENABLE
/
```

BOOKING table:

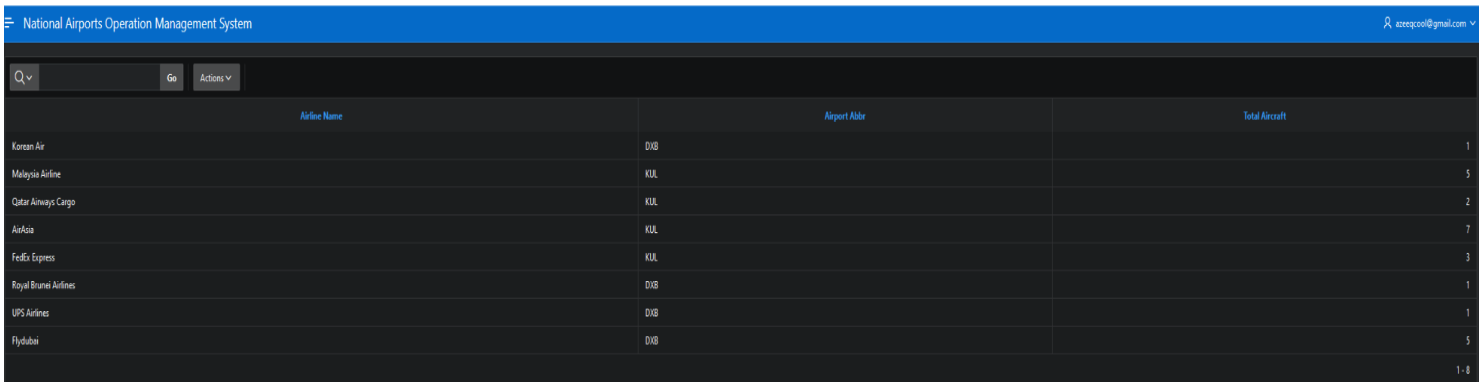
```
CREATE TABLE  "BOOKING"
   (    "BOOKING_ID" VARCHAR2(7),
        "FLIGHT_ID" VARCHAR2(7),
        "BOOKING_TICKET_PRICE" NUMBER(6,0),
        "CABIN_CLASS" VARCHAR2(20),
        "BOOKING_SEAT" VARCHAR2(10),
         CONSTRAINT "PK_BOOKING" PRIMARY KEY ("BOOKING_ID")
  USING INDEX  ENABLE
   )
/
ALTER TABLE  "BOOKING" ADD CONSTRAINT "FK_BOOKING" FOREIGN KEY ("FLIGHT_ID")
          REFERENCES  "FLIGHT" ("FLIGHT_ID") ENABLE
/
```

LUGGAGE_PACKAGE table:

```
CREATE TABLE  "LUGGAGE_PACKAGE"
   (    "PACKAGE_NAME" VARCHAR2(30),
        "ADDON_WEIGHT" NUMBER(2,0),
        "PACKAGE_PRICE" NUMBER(5,0),
         CONSTRAINT "PK_LUGGAGE_PACKAGE" PRIMARY KEY ("PACKAGE_NAME")
  USING INDEX  ENABLE
    )
/
```

5.2 DML

```
select count(AIRCRAFT.AIRCRAFT_TYPE) as TOTAL_AIRCRAFT,
   AIRLINES.AIRLINE_NAME as AIRLINE_NAME,
   AIRPORT.AIRPORT_ABBR as AIRPORT_ABBR
 from TERMINAL TERMINAL,
   AIRPORT AIRPORT,
   AIRLINES AIRLINES,
   AIRCRAFT AIRCRAFT
 where AIRCRAFT.AIRLINE_ID=AIRLINES.AIRLINE_ID
   and AIRLINES.TERMINAL_ID=TERMINAL.TERMINAL_ID
   and TERMINAL.AIRPORT_ABBR=AIRPORT.AIRPORT_ABBR
 group by AIRLINES.AIRLINE_NAME, AIRPORT.AIRPORT_ABBR
```



6.0 Reflection

The making of this project has been a journey of complication, problem-solving, and a continuous learning process. When the project started, none of us knew each other as we are still in online classes. Although it took time for someone to initiate the conversation, the discussion for the assignment goes well and we can divide the task perfectly. As we do the work on each deliverable, it feels like the difficulty of each of it increases significantly when we move from each part of the project. The System Demo (last deliverable) is going to be the hardest part of the whole project. Not only do we need to fix our mistakes from the previous deliverable, but we also need to make database applications implemented using Oracle APEX. At first glance, this feels like a great leap of the task to do since none of us have the experience or the knowledge to do it. We decided to work on the application after we finished the rest of the report. There is some obstacle to the report as we did not understand some of the questions given and don't know how to work at it. But eventually, we figured it out after asking our mentor, Heng Yew Ken, and other friends that are working on the same project. The app development, however, got a bit of a rough start. It took us a lot of videos to watch from YouTube, reference, question-asking, and try-and-error to start working on it.

We can say for sure that this project has brought us hardship, long hours of problem-solving, and mistakes were made. But as a Computer Science student. This project is a meaningful use of time to do. To work in the computer science field, there is surely a much harder task to do, not alone, but as a team of developers. So, in hindsight, not only does this project supply us with experience, but also the knowledge and the ability to work on it as a team. It is also making us realise the importance of database programming as it is used everywhere, from managing coffee shops to storing aircraft data information.

7.0 System Demo

Short Demo URL: https://youtu.be/fMj0btxpOMo