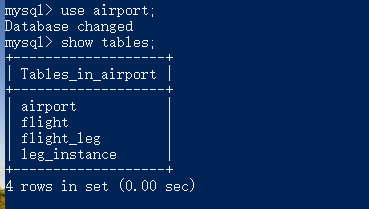
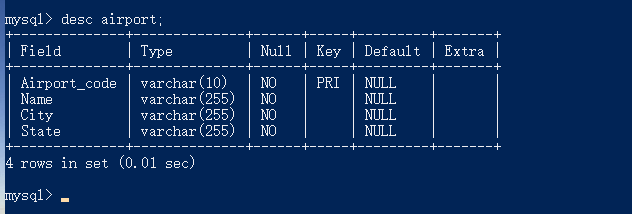
1. retrieving each individual table from the database and printing
2. Database

Script: show tables;



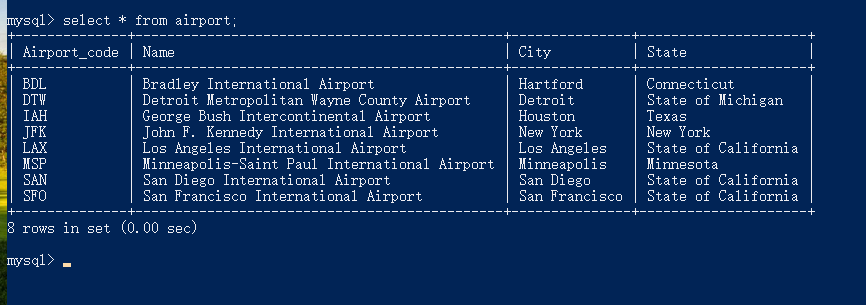
1. Tables
   1. airport
      1. Structure

Script: desc airport;



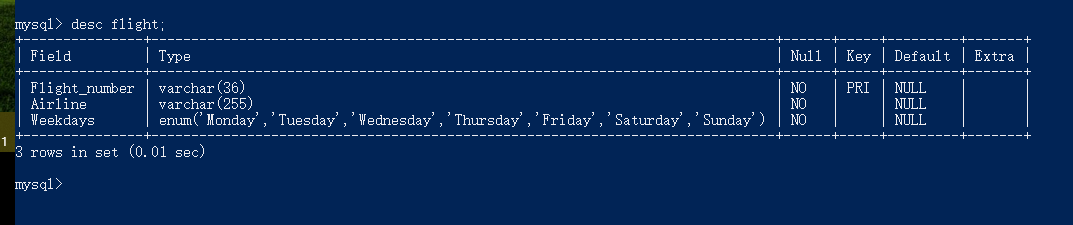
* + 1. Data

Script: select \* from airport;



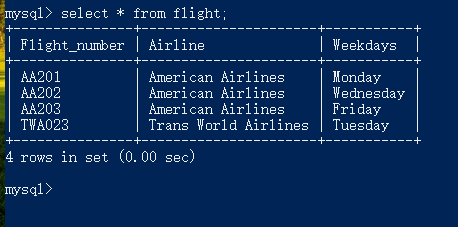
* 1. flight
     1. Structure

Script: desc flight;



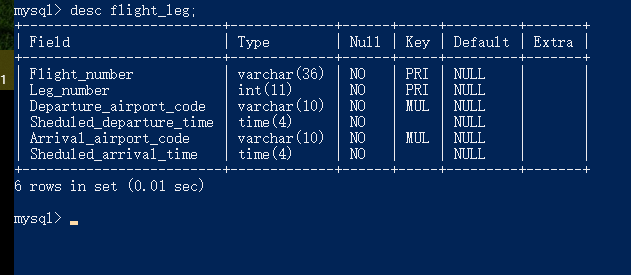
* + 1. Data

Script: select \* from flight;



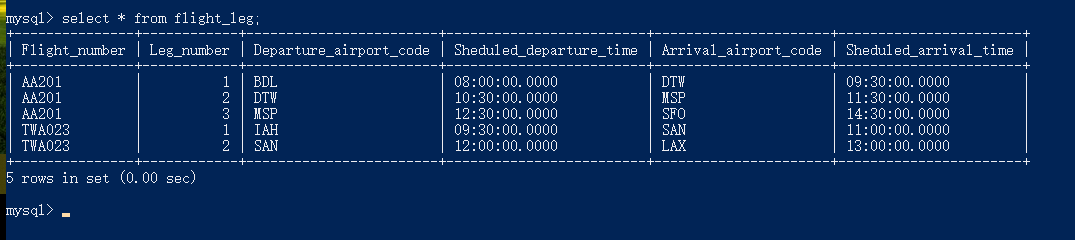
* 1. flight\_leg
     1. Structure

Script: desc flight\_leg;



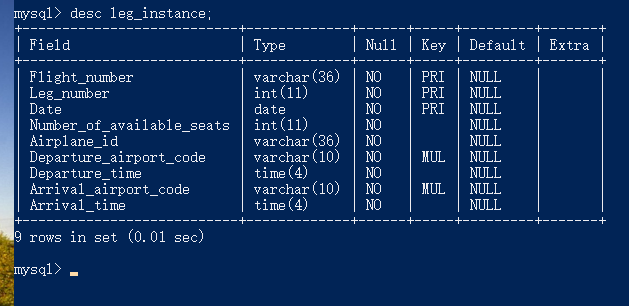
* + 1. Data

Script: select \* from flight\_leg;



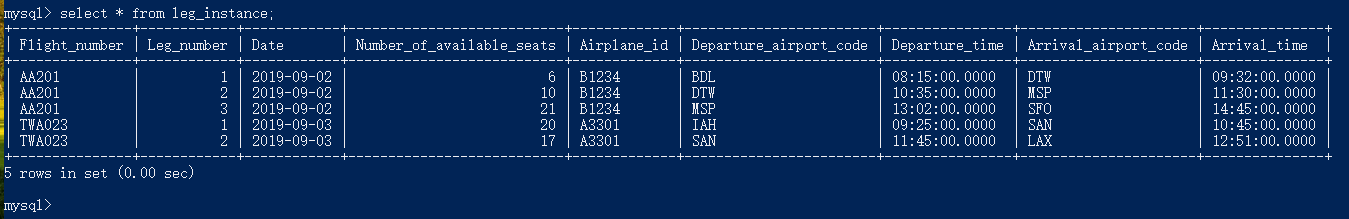
* 1. leg\_instance
     1. Structure

Script: desc leg\_instance;



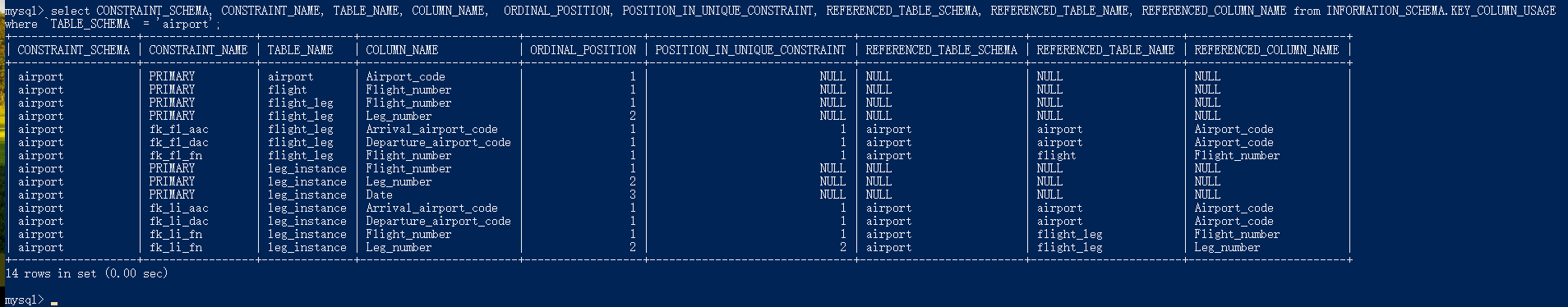
* + 1. Data

Script: select \* from leg\_instance;



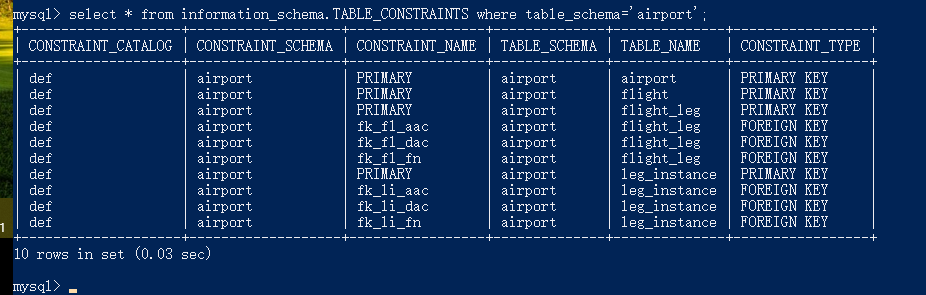
1. showing appropriate section of the system catalog
2. information\_schema.KEY\_COLUMN\_USAGE

Script: select CONSTRAINT\_SCHEMA, CONSTRAINT\_NAME, TABLE\_NAME, COLUMN\_NAME, ORDINAL\_POSITION, POSITION\_IN\_UNIQUE\_CONSTRAINT, REFERENCED\_TABLE\_SCHEMA, REFERENCED\_TABLE\_NAME, REFERENCED\_COLUMN\_NAME from INFORMATION\_SCHEMA.KEY\_COLUMN\_USAGE where `TABLE\_SCHEMA` = 'airport';



1. information\_schema.TABLE\_CONSTRAINTS

Script: select \* from information\_schema.TABLE\_CONSTRAINTS where table\_schema='airport';



1. problems
2. Check constraints

Since MySQL does not implement the check constraint function, I use enum and trigger to replace it. I used enum to limit the values of the weekdays column in the table “flight” to 'Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday', 'Saturday', or 'Sunday'.

I used triggers to check for “Sheduled\_departure\_time” and “Sheduled\_arrival\_time” in table “flight\_leg”, and “Departure\_time” and “Arrival\_time” in table “leg\_instance”, and restricted the former to be smaller than the latter, otherwise exceptions are thrown.

 Appendix I SQL Script to create database and tables and insert data

-- create database

DROP DATABASE IF EXISTS `airport`;

CREATE DATABASE `airport`;

USE `airport`;

-- create tables

DROP TABLE IF EXISTS `airport`;

CREATE TABLE `airport` (

`Airport\_code` varchar(10) NOT NULL,

`Name` varchar(255) NOT NULL,

`City` varchar(255) NOT NULL,

`State` varchar(255) NOT NULL,

PRIMARY KEY (`Airport\_code`)

);

DROP TABLE IF EXISTS `flight`;

CREATE TABLE `flight` (

`Flight\_number` varchar(36) NOT NULL,

`Airline` varchar(255) NOT NULL,

`Weekdays` enum('Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday', 'Saturday', 'Sunday') NOT NULL,

PRIMARY KEY (`Flight\_number`)

);

DROP TABLE IF EXISTS `flight\_leg`;

CREATE TABLE `flight\_leg` (

`Flight\_number` varchar(36) NOT NULL,

`Leg\_number` int(11) NOT NULL,

`Departure\_airport\_code` varchar(10) NOT NULL,

`Sheduled\_departure\_time` time(4) NOT NULL,

`Arrival\_airport\_code` varchar(10) NOT NULL,

`Sheduled\_arrival\_time` time(4) NOT NULL,

PRIMARY KEY (`Flight\_number`, `Leg\_number`),

CONSTRAINT `fk\_fl\_aac` FOREIGN KEY (`Arrival\_airport\_code`) REFERENCES `airport` (`Airport\_code`) ON DELETE CASCADE ON UPDATE CASCADE,

CONSTRAINT `fk\_fl\_dac` FOREIGN KEY (`Departure\_airport\_code`) REFERENCES `airport` (`Airport\_code`) ON DELETE CASCADE ON UPDATE CASCADE,

CONSTRAINT `fk\_fl\_fn` FOREIGN KEY (`Flight\_number`) REFERENCES `flight` (`Flight\_number`) ON DELETE CASCADE ON UPDATE CASCADE,

CONSTRAINT `ck\_fl\_sdsa` CHECK(Sheduled\_departure\_time <= Sheduled\_arrival\_time)

);

DROP TABLE IF EXISTS `leg\_instance`;

CREATE TABLE `leg\_instance` (

`Flight\_number` varchar(36) NOT NULL,

`Leg\_number` int(11) NOT NULL,

`Date` date NOT NULL,

`Number\_of\_available\_seats` int(11) NOT NULL,

`Airplane\_id` varchar(36) NOT NULL,

`Departure\_airport\_code` varchar(10) NOT NULL,

`Departure\_time` time(4) NOT NULL,

`Arrival\_airport\_code` varchar(10) NOT NULL,

`Arrival\_time` time(4) NOT NULL,

PRIMARY KEY (`Flight\_number`, `Leg\_number`, `Date`),

CONSTRAINT `fk\_li\_aac` FOREIGN KEY (`Arrival\_airport\_code`) REFERENCES `airport` (`Airport\_code`) ON DELETE CASCADE ON UPDATE CASCADE,

CONSTRAINT `fk\_li\_dac` FOREIGN KEY (`Departure\_airport\_code`) REFERENCES `airport` (`Airport\_code`) ON DELETE CASCADE ON UPDATE CASCADE,

CONSTRAINT `fk\_li\_fn` FOREIGN KEY (`Flight\_number`, `Leg\_number`) REFERENCES `flight\_leg` (`Flight\_number`, `Leg\_number`) ON DELETE CASCADE ON UPDATE CASCADE,

CONSTRAINT `ck\_li\_da` CHECK(Departure\_time <= Arrival\_time)

);

-- Use triggers instead of check constraints

DROP TRIGGER IF EXISTS `tri\_fl\_before\_insert\_time`;

CREATE TRIGGER `tri\_fl\_before\_insert\_time` BEFORE INSERT ON flight\_leg FOR EACH ROW

BEGIN

DECLARE msg VARCHAR(200);

IF new.Sheduled\_departure\_time > new.Sheduled\_arrival\_time

THEN

SET msg = CONCAT('Invalid Time: ', NEW.Sheduled\_departure\_time, '>', NEW.Sheduled\_arrival\_time);

SIGNAL SQLSTATE 'HY000' SET MESSAGE\_TEXT = msg;

END IF;

END;

DROP TRIGGER IF EXISTS `tri\_fl\_before\_update\_time`;

CREATE TRIGGER `tri\_fl\_before\_update\_time` BEFORE UPDATE ON flight\_leg FOR EACH ROW

BEGIN

DECLARE msg VARCHAR(200);

IF new.Sheduled\_departure\_time > new.Sheduled\_arrival\_time

THEN

SET msg = CONCAT('Invalid Time: ', NEW.Sheduled\_departure\_time, '>', NEW.Sheduled\_arrival\_time);

SIGNAL SQLSTATE 'HY000' SET MESSAGE\_TEXT = msg;

END IF;

END;

DROP TRIGGER IF EXISTS `tri\_li\_before\_insert\_time`;

CREATE TRIGGER `tri\_li\_before\_insert\_time` BEFORE INSERT ON leg\_instance FOR EACH ROW

BEGIN

DECLARE msg VARCHAR(200);

IF new.Departure\_time > new.Arrival\_time

THEN

SET msg = CONCAT('Invalid Time: ', NEW.Departure\_time, '>', NEW.Arrival\_time);

SIGNAL SQLSTATE 'HY000' SET MESSAGE\_TEXT = msg;

END IF;

END;

DROP TRIGGER IF EXISTS `tri\_li\_before\_update\_time`;

CREATE TRIGGER `tri\_li\_before\_update\_time` BEFORE UPDATE ON leg\_instance FOR EACH ROW

BEGIN

DECLARE msg VARCHAR(200);

IF new.Departure\_time > new.Arrival\_time

THEN

SET msg = CONCAT('Invalid Time: ', NEW.Departure\_time, '>', NEW.Arrival\_time);

SIGNAL SQLSTATE 'HY000' SET MESSAGE\_TEXT = msg;

END IF;

END;

-- insert data

INSERT INTO `airport` VALUES ('BDL', 'Bradley International Airport', 'Hartford', 'Connecticut');

INSERT INTO `airport` VALUES ('IAH', 'George Bush Intercontinental Airport', 'Houston', 'Texas');

INSERT INTO `airport` VALUES ('JFK', 'John F. Kennedy International Airport', 'New York', 'New York');

INSERT INTO `airport` VALUES ('DTW', 'Detroit Metropolitan Wayne County Airport', 'Detroit', 'State of Michigan');

INSERT INTO `airport` VALUES ('MSP', 'Minneapolis-Saint Paul International Airport', 'Minneapolis', 'Minnesota');

INSERT INTO `airport` VALUES ('SFO', 'San Francisco International Airport', 'San Francisco', 'State of California');

INSERT INTO `airport` VALUES ('SAN', 'San Diego International Airport', 'San Diego', 'State of California');

INSERT INTO `airport` VALUES ('LAX', 'Los Angeles International Airport', 'Los Angeles', 'State of California');

INSERT INTO `flight` VALUES ('AA201', 'American Airlines', 'Monday');

INSERT INTO `flight` VALUES ('AA202', 'American Airlines', 'Wednesday');

INSERT INTO `flight` VALUES ('AA203', 'American Airlines', 'Friday');

INSERT INTO `flight` VALUES ('TWA023', 'Trans World Airlines', 'Tuesday');

INSERT INTO `flight\_leg` VALUES ('AA201', 1, 'BDL', '08:00', 'DTW', '09:30');

INSERT INTO `flight\_leg` VALUES ('AA201', 2, 'DTW', '10:30', 'MSP', '11:30');

INSERT INTO `flight\_leg` VALUES ('AA201', 3, 'MSP', '12:30', 'SFO', '14:30');

INSERT INTO `flight\_leg` VALUES ('TWA023', 1, 'IAH', '09:30', 'SAN', '11:00');

INSERT INTO `flight\_leg` VALUES ('TWA023', 2, 'SAN', '12:00', 'LAX', '13:00');

INSERT INTO `leg\_instance` VALUES ('AA201', 1, '2019-09-02', 6, 'B1234', 'BDL', '08:15', 'DTW', '09:32');

INSERT INTO `leg\_instance` VALUES ('AA201', 2, '2019-09-02', 10, 'B1234', 'DTW', '10:35', 'MSP', '11:30');

INSERT INTO `leg\_instance` VALUES ('AA201', 3, '2019-09-02', 21, 'B1234', 'MSP', '13:02', 'SFO', '14:45');

INSERT INTO `leg\_instance` VALUES ('TWA023', 1, '2019-09-03', 20, 'A3301', 'IAH', '09:25', 'SAN', '10:45');

INSERT INTO `leg\_instance` VALUES ('TWA023', 2, '2019-09-03', 17, 'A3301', 'SAN', '11:45', 'LAX', '12:51');