**Before normalization**

Person

Fname, Mname, Lname, person\_id, gender, street, apt\_no, city, zip\_code

Person\_phone

Phn\_person\_id, phone\_no

A\_class\_passenger

A\_class\_id, ac\_person\_id, ac\_a\_star\_id

A\_star\_passenger

A\_star\_id

Employee

Employee\_id, emp\_person\_id, start\_date, emp\_type, e\_a\_star\_id

Bus\_driver

Driver\_id, d\_employee\_id

Ticket\_checker

Checker\_id, tc\_bus\_no, tc\_employee\_id

Staff

Staff\_id, s\_employee\_id

Bus

Lic\_plate\_no, bus\_no, bus\_route\_id, no\_of\_seats, bus\_type

Drives

D\_driver\_id, d\_bus\_no, date

Terminal

Terminal\_id, location

Parks

P\_terminal\_id, p\_bus\_no, time, date, duration

Route

Route\_id

Timetable

Tt\_id, day, start\_time, end\_time, interval

Follows

F\_bus\_no, f\_tt\_id

Bus\_stop

Stop\_no, stop\_route\_id, location

Ticket

Ticket\_id, t\_checker\_id, t\_staff\_id, t\_passenger\_id, date, t\_bus\_no

Pass

Pass\_id, p\_staff\_id, issue\_date, expiry\_date, price, p\_passenger\_id

Payment Details

Payment\_id, ticket\_id, pass\_id, amount, method

Checks\_pass

C\_checker\_id, c\_pass\_id

Can\_have

Ch\_pass\_id, ch\_a\_star\_id

Travel\_card

Card\_id, c\_a\_star\_id, issue\_date, expiry\_date

Contains

C\_card\_id, co\_a\_star\_id, c\_promo\_id

Promotional discount

Promo\_id, day, discount\_percent, description

Guest

Guest\_id, g\_a\_star\_id, f\_name, m\_name, l\_name, dob, gender, street, apt, city, zipcode

Guest\_phone

Ph\_guest\_id, phone\_no

**After normalization**

CREATE TABLE `a\_class\_passenger` (

`passenger\_id` varchar(5) NOT NULL,

`ac\_person\_id` varchar(5) NOT NULL,

PRIMARY KEY (`passenger\_id`,`ac\_person\_id`),

KEY `fk\_a\_class\_passenger\_1\_idx` (`ac\_person\_id`),

CONSTRAINT `fk\_a\_class\_passenger\_1` FOREIGN KEY (`ac\_person\_id`) REFERENCES `person` (`person\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `a\_star\_passenger` (

`a\_star\_id` varchar(5) NOT NULL,

PRIMARY KEY (`a\_star\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `bus` (

`license\_plate\_no` varchar(7) NOT NULL,

`bus\_no` varchar(5) NOT NULL,

`bus\_route\_id` varchar(5) NOT NULL,

`no\_of\_seats` int NOT NULL,

`bus\_type` varchar(5) NOT NULL,

PRIMARY KEY (`license\_plate\_no`,`bus\_no`),

KEY `fk\_bus\_2\_idx` (`bus\_route\_id`),

CONSTRAINT `fk\_bus\_2` FOREIGN KEY (`bus\_route\_id`) REFERENCES `route` (`route\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `bus\_driver` (

`driver\_id` varchar(5) NOT NULL,

`d\_employee\_id` varchar(5) NOT NULL,

PRIMARY KEY (`driver\_id`,`d\_employee\_id`),

KEY `fk\_bus\_driver\_1\_idx` (`d\_employee\_id`),

CONSTRAINT `fk\_bus\_driver\_1` FOREIGN KEY (`d\_employee\_id`) REFERENCES `employee` (`employee\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `bus\_stop` (

`stop\_no` varchar(5) NOT NULL,

`stop\_route\_id` varchar(5) NOT NULL,

`location` varchar(45) NOT NULL,

PRIMARY KEY (`stop\_no`),

KEY `fk\_bus\_stop\_1\_idx` (`stop\_route\_id`),

CONSTRAINT `fk\_bus\_stop\_1` FOREIGN KEY (`stop\_route\_id`) REFERENCES `route` (`route\_id`) ON DELETE RESTRICT ON UPDATE RESTRICT

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `can\_have\_a\_class` (

`ch\_pass\_id` varchar(5) NOT NULL,

`ch\_passenger\_id` varchar(5) NOT NULL,

`month` varchar(2) NOT NULL,

PRIMARY KEY (`ch\_pass\_id`,`ch\_passenger\_id`),

KEY `fk\_can\_have\_2\_idx` (`ch\_passenger\_id`),

CONSTRAINT `fk\_can\_have\_1` FOREIGN KEY (`ch\_pass\_id`) REFERENCES `pass` (`pass\_id`),

CONSTRAINT `fk\_can\_have\_2` FOREIGN KEY (`ch\_passenger\_id`) REFERENCES `a\_class\_passenger` (`passenger\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `can\_have\_a\_star` (

`ch\_pass\_id` varchar(5) NOT NULL,

`ch\_a\_star\_id` varchar(5) NOT NULL,

`month` varchar(2) NOT NULL,

PRIMARY KEY (`ch\_pass\_id`,`ch\_a\_star\_id`,`month`),

KEY `fk\_can\_have\_a\_star\_2\_idx` (`ch\_a\_star\_id`),

CONSTRAINT `fk\_can\_have\_a\_star\_1` FOREIGN KEY (`ch\_pass\_id`) REFERENCES `pass` (`pass\_id`),

CONSTRAINT `fk\_can\_have\_a\_star\_2` FOREIGN KEY (`ch\_a\_star\_id`) REFERENCES `a\_star\_passenger` (`a\_star\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `contains` (

`c\_card\_id` varchar(5) NOT NULL,

`c\_promo\_id` varchar(5) NOT NULL,

`c\_a\_star\_id` varchar(5) NOT NULL,

PRIMARY KEY (`c\_card\_id`,`c\_promo\_id`,`c\_a\_star\_id`),

KEY `fk\_contains\_2\_idx` (`c\_promo\_id`),

KEY `fk\_contains\_3\_idx` (`c\_a\_star\_id`),

CONSTRAINT `fk\_contains\_1` FOREIGN KEY (`c\_card\_id`) REFERENCES `travel\_card` (`card\_id`),

CONSTRAINT `fk\_contains\_2` FOREIGN KEY (`c\_promo\_id`) REFERENCES `promotional\_discount` (`promo\_id`),

CONSTRAINT `fk\_contains\_3` FOREIGN KEY (`c\_a\_star\_id`) REFERENCES `a\_star\_passenger` (`a\_star\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `drives` (

`d\_driver\_id` varchar(5) NOT NULL,

`d\_bus\_no` varchar(7) NOT NULL,

`date` date NOT NULL,

PRIMARY KEY (`d\_driver\_id`,`d\_bus\_no`,`date`),

KEY `fk\_drives\_2\_idx` (`d\_bus\_no`),

CONSTRAINT `fk\_drives\_1` FOREIGN KEY (`d\_driver\_id`) REFERENCES `bus\_driver` (`driver\_id`),

CONSTRAINT `fk\_drives\_2` FOREIGN KEY (`d\_bus\_no`) REFERENCES `bus` (`license\_plate\_no`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `employee` (

`employee\_id` varchar(5) NOT NULL,

`emp\_person\_id` varchar(5) NOT NULL,

`start\_date` date NOT NULL,

`e\_type` varchar(45) NOT NULL,

PRIMARY KEY (`employee\_id`,`emp\_person\_id`),

KEY `emp\_person\_id` (`emp\_person\_id`),

CONSTRAINT `employee\_ibfk\_1` FOREIGN KEY (`emp\_person\_id`) REFERENCES `person` (`person\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `follows` (

`f\_bus\_no` varchar(7) NOT NULL,

`f\_tt\_id` varchar(5) NOT NULL,

PRIMARY KEY (`f\_bus\_no`,`f\_tt\_id`),

KEY `fk\_follows\_1\_idx` (`f\_tt\_id`),

CONSTRAINT `fk\_follows\_1` FOREIGN KEY (`f\_tt\_id`) REFERENCES `timetable` (`tt\_id`),

CONSTRAINT `fk\_follows\_2` FOREIGN KEY (`f\_bus\_no`) REFERENCES `bus` (`license\_plate\_no`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `guest` (

`guest\_id` varchar(5) NOT NULL,

`g\_a\_star\_id` varchar(5) NOT NULL,

`f\_name` varchar(45) NOT NULL,

`m\_name` varchar(45) DEFAULT NULL,

`l\_name` varchar(45) NOT NULL,

`street` varchar(45) NOT NULL,

`apt\_no` varchar(5) NOT NULL,

`zip\_code` varchar(5) NOT NULL,

`date` date NOT NULL,

`month` varchar(2) NOT NULL,

PRIMARY KEY (`guest\_id`,`g\_a\_star\_id`,`date`),

KEY `fk\_guest\_1\_idx` (`g\_a\_star\_id`),

KEY `fk\_guest\_2\_idx` (`zip\_code`),

CONSTRAINT `fk\_guest\_1` FOREIGN KEY (`g\_a\_star\_id`) REFERENCES `a\_star\_passenger` (`a\_star\_id`),

CONSTRAINT `fk\_guest\_2` FOREIGN KEY (`zip\_code`) REFERENCES `zip\_code` (`zip\_code`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `guest\_phone` (

`phn\_guest\_id` varchar(5) NOT NULL,

`phone\_no` varchar(10) NOT NULL,

PRIMARY KEY (`phn\_guest\_id`,`phone\_no`),

CONSTRAINT `fk\_guest\_phone\_1` FOREIGN KEY (`phn\_guest\_id`) REFERENCES `guest` (`guest\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `is\_a\_class\_a\_star` (

`aa\_passenger\_id` varchar(5) NOT NULL,

`aa\_a\_star\_id` varchar(5) NOT NULL,

PRIMARY KEY (`aa\_passenger\_id`),

KEY `fk\_is\_a\_class\_a\_star\_2\_idx` (`aa\_a\_star\_id`),

CONSTRAINT `fk\_is\_a\_class\_a\_star\_1` FOREIGN KEY (`aa\_passenger\_id`) REFERENCES `a\_class\_passenger` (`passenger\_id`),

CONSTRAINT `fk\_is\_a\_class\_a\_star\_2` FOREIGN KEY (`aa\_a\_star\_id`) REFERENCES `a\_star\_passenger` (`a\_star\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `is\_emp\_a\_star` (

`ea\_employee\_id` varchar(5) NOT NULL,

`ea\_a\_star\_id` varchar(5) NOT NULL,

PRIMARY KEY (`ea\_employee\_id`),

KEY `fk\_is\_emp\_a\_star\_2\_idx` (`ea\_a\_star\_id`),

CONSTRAINT `fk\_is\_emp\_a\_star\_1` FOREIGN KEY (`ea\_employee\_id`) REFERENCES `employee` (`employee\_id`),

CONSTRAINT `fk\_is\_emp\_a\_star\_2` FOREIGN KEY (`ea\_a\_star\_id`) REFERENCES `a\_star\_passenger` (`a\_star\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `parks` (

`p\_terminal\_id` varchar(5) NOT NULL,

`p\_bus\_no` varchar(7) NOT NULL,

`time` time NOT NULL,

`date` date NOT NULL,

`duration` int NOT NULL,

PRIMARY KEY (`p\_terminal\_id`,`p\_bus\_no`),

KEY `fk\_parks\_2\_idx` (`p\_bus\_no`),

CONSTRAINT `fk\_parks\_1` FOREIGN KEY (`p\_terminal\_id`) REFERENCES `terminal` (`terminal\_id`),

CONSTRAINT `fk\_parks\_2` FOREIGN KEY (`p\_bus\_no`) REFERENCES `bus` (`license\_plate\_no`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `pass` (

`pass\_id` varchar(5) NOT NULL,

`issue\_date` date NOT NULL,

`expiry\_date` date NOT NULL,

`p\_staff\_id` varchar(5) NOT NULL,

`p\_payment\_id` varchar(5) NOT NULL,

PRIMARY KEY (`pass\_id`),

KEY `fk\_pass\_1\_idx` (`p\_staff\_id`),

KEY `fk\_pass\_3\_idx` (`p\_payment\_id`),

CONSTRAINT `fk\_pass\_1` FOREIGN KEY (`p\_staff\_id`) REFERENCES `staff` (`staff\_id`) ON DELETE RESTRICT ON UPDATE RESTRICT,

CONSTRAINT `fk\_pass\_3` FOREIGN KEY (`p\_payment\_id`) REFERENCES `payment\_details` (`payment\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `payment\_details` (

`payment\_id` varchar(5) NOT NULL,

`amount` float NOT NULL,

`method` varchar(5) NOT NULL,

PRIMARY KEY (`payment\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `person` (

`person\_id` varchar(4) NOT NULL,

`f\_name` varchar(45) NOT NULL,

`m\_name` varchar(45) DEFAULT NULL,

`l\_name` varchar(45) NOT NULL,

`gender` varchar(1) NOT NULL,

`dob` date NOT NULL,

`street` varchar(45) NOT NULL,

`apt\_no` varchar(5) NOT NULL,

`zip\_code` varchar(5) NOT NULL,

PRIMARY KEY (`person\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `person\_phone` (

`phn\_person\_id` varchar(4) NOT NULL,

`phone\_no` varchar(10) NOT NULL,

PRIMARY KEY (`phn\_person\_id`,`phone\_no`),

CONSTRAINT `fk\_person\_phone\_1` FOREIGN KEY (`phn\_person\_id`) REFERENCES `person` (`person\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `promotional\_discount` (

`promo\_id` varchar(5) NOT NULL,

`discount\_percent` int NOT NULL,

`description` varchar(45) NOT NULL,

PRIMARY KEY (`promo\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `route` (

`route\_id` varchar(5) NOT NULL,

PRIMARY KEY (`route\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;CREATE TABLE `route` (

`route\_id` varchar(5) NOT NULL,

PRIMARY KEY (`route\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `staff` (

`staff\_id` varchar(5) NOT NULL,

`s\_employee\_id` varchar(5) NOT NULL,

PRIMARY KEY (`staff\_id`,`s\_employee\_id`),

KEY `fk\_staff\_1\_idx` (`s\_employee\_id`),

CONSTRAINT `fk\_staff\_1` FOREIGN KEY (`s\_employee\_id`) REFERENCES `employee` (`employee\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `terminal` (

`terminal\_id` varchar(5) NOT NULL,

`location` varchar(45) NOT NULL,

PRIMARY KEY (`terminal\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `ticket` (

`ticket\_id` varchar(5) NOT NULL,

`t\_bus\_no` varchar(7) NOT NULL,

`t\_seat\_no` int NOT NULL,

`t\_checker\_id` varchar(5) NOT NULL,

`t\_staff\_id` varchar(5) NOT NULL,

`t\_person\_id` varchar(4) NOT NULL,

`t\_payment\_id` varchar(5) NOT NULL,

`date` date NOT NULL,

PRIMARY KEY (`ticket\_id`),

KEY `fk\_ticket\_1\_idx` (`t\_bus\_no`),

KEY `fk\_ticket\_2\_idx` (`t\_checker\_id`),

KEY `fk\_ticket\_3\_idx` (`t\_staff\_id`),

KEY `fk\_ticket\_4\_idx` (`t\_person\_id`),

KEY `fk\_ticket\_5\_idx` (`t\_payment\_id`),

CONSTRAINT `fk\_ticket\_1` FOREIGN KEY (`t\_bus\_no`) REFERENCES `bus` (`license\_plate\_no`),

CONSTRAINT `fk\_ticket\_2` FOREIGN KEY (`t\_checker\_id`) REFERENCES `ticket\_checker` (`checker\_id`),

CONSTRAINT `fk\_ticket\_3` FOREIGN KEY (`t\_staff\_id`) REFERENCES `staff` (`staff\_id`),

CONSTRAINT `fk\_ticket\_4` FOREIGN KEY (`t\_person\_id`) REFERENCES `person` (`person\_id`),

CONSTRAINT `fk\_ticket\_5` FOREIGN KEY (`t\_payment\_id`) REFERENCES `payment\_details` (`payment\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `ticket\_checker` (

`checker\_id` varchar(5) NOT NULL,

`tc\_bus\_no` varchar(7) NOT NULL,

`tc\_employee\_id` varchar(5) NOT NULL,

PRIMARY KEY (`checker\_id`,`tc\_bus\_no`,`tc\_employee\_id`),

KEY `fk\_ticket\_checker\_1\_idx` (`tc\_employee\_id`),

KEY `fk\_ticket\_checker\_2\_idx` (`tc\_bus\_no`),

CONSTRAINT `fk\_ticket\_checker\_1` FOREIGN KEY (`tc\_employee\_id`) REFERENCES `employee` (`employee\_id`),

CONSTRAINT `fk\_ticket\_checker\_2` FOREIGN KEY (`tc\_bus\_no`) REFERENCES `bus` (`license\_plate\_no`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `timetable` (

`tt\_id` varchar(4) NOT NULL,

`day` varchar(3) NOT NULL,

`start\_time` time NOT NULL,

`end\_time` time NOT NULL,

`interval` int NOT NULL,

PRIMARY KEY (`tt\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `travel\_card` (

`card\_id` varchar(5) NOT NULL,

`card\_a\_star\_id` varchar(5) NOT NULL,

`issue\_date` date NOT NULL,

`expiry\_date` date NOT NULL,

PRIMARY KEY (`card\_id`,`card\_a\_star\_id`),

KEY `fk\_travel\_card\_1\_idx` (`card\_a\_star\_id`),

CONSTRAINT `fk\_travel\_card\_1` FOREIGN KEY (`card\_a\_star\_id`) REFERENCES `a\_star\_passenger` (`a\_star\_id`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;

CREATE TABLE `zip\_code` (

`zip\_code` varchar(5) NOT NULL,

`city` varchar(45) NOT NULL,

PRIMARY KEY (`zip\_code`)

) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4\_0900\_ai\_ci;