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Milestone #:4_	
Date: _Apr 02, 202	5
Group Number:	110

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By typing our names and student numbers in the above table, we certify that the work in the attached assignment was performed solely by those whose names and student IDs are included above. (In the case of Project Milestone 0, the main purpose of this page is for you to let us know your e-mail address, and then let us assign you to a TA for your project supervisor.)

In addition, we indicate that we are fully aware of the rules and consequences of plagiarism, as set forth by the Department of Computer Science and the University of British Columbia

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# **Description**

#### final project:

The project is a comprehensive Parking Management System designed to handle various aspects of residential and visitor parking operations. It features a robust database structure with multiple interconnected tables to manage users (residents and visitors), vehicles, parking lots, violation tickets, payments, and visitor passes. The system supports essential functionalities including user registration and authentication, vehicle registration and tracking, visitor pass management with different duration options (8-hour, 24-hour, and weekend passes), parking violation tracking and payment processing, and comprehensive reporting capabilities. The application implements all required database operations (INSERT, UPDATE, DELETE, SELECT) with proper foreign key relationships and cascading effects. It includes advanced query features such as JOIN operations, aggregations with GROUP BY and HAVING clauses, and nested aggregations. The system provides a user-friendly interface for both residents and administrators, allowing them to manage parking spaces, track violations, process payments, and generate various reports about parking usage, violations, and revenue. The implementation ensures data integrity through proper constraints and transaction management.

init.sql: see backend/init.sql

#### difference from schema:

Only key changes (e.g., type changes) and obvious changes are listed, case shifts (e.g., lotId becomes LOT ID) are not listed

#### 1.Parkinglot

a) from lotld: Integer to lotld: number

reason: get larger range

b) from address: Varchar(100) to address: Varchar2(200)

reason: get larger range

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c) from capacity to TOTAL\_SPACES

reason: easy to read

d) from currentOccupancy to AVALABLE SEATS

reason: easy to read

e) Delete currentRemain

reason: currentRemain can get from TOTAL\_SPACES - AVALABLE\_SEATS

f) Add key 'LOT\_NAME'

reason: improve information

#### 2. User

To make it easier for the back-end to call the sql code to process the matter, we merge User, Resident, and Visitor into a new table, User, and add new keys and constraints to implement the original functionality

a) from userId: Integer to ID: number

reason: get larger range

b) from phone: Integer to phone: varchar2(20)

reason: some phone number may begin with '0'. If we use Integer, we will lose this '0'

c) from name: varchar(20) to varchar2(200)

reason: get larger range

d) add key 'Password'

reason: improve appropriate information for "Log in" and "Register" function

e) add key 'Role' and constraint 'role must be user or admin'

reason: improve information, make sure whether or not a user is an admin

f) add key 'USER TYPE' and constraint 'USER TYPE must be resident or visitor'

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reason: after merge User, Resident, Visitor, we make this change to implement the original functionality

g) add key 'UNIT\_NUMBER' and 'HOST\_INFORMATION'

reason: after merge User, Resident, Visitor, we make this change to implement the original functionality

h) add key 'CREATED\_AT'

reason: easy to track the create time

#### 3. Vehicle

a) add key 'VEHICLE\_ID' as a primary key

reason: easy to track and use the corresponding sql codes

b) add key 'USER\_ID'

reason: easy to track the owner

c) from parkingUntil: datetime to parkingUntil: timestamp

reason: datetime can store information from year 1000 to 9999, we do not need such large range

d) add key 'CURRENT LOT ID'

reason: easy to track which parking lot does it park now

e) add key 'CREATED AT'

reason: easy to track the create time

#### 4. Staff

we change table name Admin to Staff for easier reading

a) from staffId: integer to staffId: number

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reason: get larger range

b) delete key 'name', and key 'USER\_ID'

reason: connect table Staff and User, enhanced database connectivity

c) add key 'CREATED\_AT'

reason: easy to track the create time

#### 5. Report

We deleted this table, because we found we could use table Violation and table Payments to directly get the violation records for a specified period of time

#### 6. Violation

we change table name ViolationTicket to Violation for simplicity

a) from ticketId: integer to ticketId: number

reason: get larger range

b) from time: datetime to time: timestamp

reason: datetime can store information from year 1000 to 9999, we do not need such large range

c) add key 'STATUS' and a constraint that 'status must be pending, paid, or appealed'

reason: improve information

d) add key 'CREATED AT'

reason: easy to track the create time

#### 7. Payments

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a) from payld: integer to payld: number

reason: get larger range

b) from amount: integer to amount: number(10,2)

reason: having a fractional part makes the data closer to reality

c) from cardNumber: integer to cardNumber: varchar2(20)

reason: if some card number begin with '0', using integer will lose this '0'

d) add key 'TICKET\_ID'

reason: connect Payments to Violation, make it easier to track the corresponding violation ticket ( if ticket\_id is not null)

e) add key 'CREATED AT'

reason: easy to track the create time

#### 8. VisitorPasses

a) from visitorPassId: integer to visitorPassId: number

reason: get larger range

b) from validTime: datetime to validTime: number

reason: after change, we store duration in hour (8, 24, 48). It is easy to fix a valid time and make it close to reality

c) add key 'STATUS' and a constraint that 'status must be in active or expired'

reason: make it easier to track whether a visitor pass can be used

d) add key 'CREATED\_AT'

reason: easy to track the create time

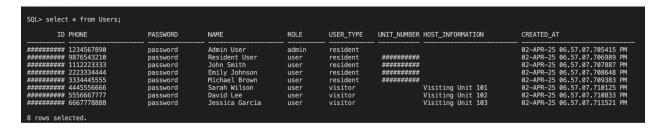
e) add key 'VISITOR PLATE'

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reason: make it easier to track whether a visitor pass can be used

#### schema and screenshots:

1) User(<u>ID</u>:number, PHONE: varchar2(20), PASSWORD: varchar2(100), NAME: varchar2(100), ROLE: varchar2(20), USER\_TYPE:varchar2(20), UNIT\_NUMBER: number, HOST\_INFORMATION:varchar2(200))

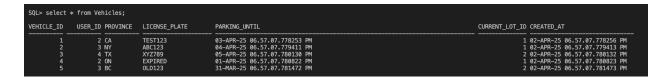


2) ParkingLot(<u>LOT\_ID</u>: number, TOTAL\_SPACES: number, AVAILABLE\_SPACES: number, ADDRESS: varchar2(200), LOT\_NAME: varchar2(100))

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<pre>SQL&gt; select * from ParkingLot;</pre>	
LOT_ID TOTAL_SPACES AVAILABLE_SP	ACES
ADDRESS	<b></b>
LOT_NAME	
1 100 123 Main St, Vancouver, BC Maple Grove Estates	100
2 80 456 Oak Ave, Vancouver, BC Oakwood Heights	80
3 120 789 Pine St, Vancouver, BC Pine Ridge Gardens	120
4 90 321 Maple Dr, Vancouver, BC Maplewood Village	90
5 150 654 Park Rd, Vancouver, BC Parkview Meadows	150
6 110 987 Waterfront Blvd, Vancouver, BC Harbourview Residences	110
7 95 147 Mountain View Dr, Vancouver, BC Mountainview Heights	95
8 130 258 Ocean Park Ave, Vancouver, BC Oceanview Estates	130
8 rows selected.	

3) Vehicles(<u>VEHICLE\_ID</u>: number, **USER\_ID**: number, PROVINCE: varchar2(10), LICENSE\_PLATE: varchar2(20), PARKING\_UNTIL: timestamp, **CURRENT\_LOT\_ID**: number, CREATED\_AT: timestamp)



4) VisitorPasses(<u>PASS\_ID</u>:number, **USER\_ID**: number, VALID\_TIME: number, STATUS: varchar2(20), CREATED\_AT: timestamp, VISITOR\_PLATE: varchar2(30))

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SQL> select * from VisitorPasses;					
PASS_ID	USER_ID	VALID_TIME	STATUS	CREATED_AT VISITOR_PLATE	
1	2	 8	active	02-APR-25 06.57.07.819464 PM BC-AB123CD	
2	2	24	active	02-APR-25 06.57.07.820569 PM WA-KDA1233	
3	2	48	active	02-APR-25 06.57.07.821256 PM CA-FSD1234	
4	2	0	expired	02-APR-25 06.57.07.822000 PM	
5	3	8	active	02-APR-25 06.57.07.822820 PM NY-FAB7680	
6	3	24	active	02-APR-25 06.57.07.823484 PM AB-CD123AD	
7	4	48	active	02-APR-25 06.57.07.824169 PM SK-FA123DF	
8	4	0	expired	02-APR-25 06.57.07.824839 PM M0-1A3489	

5) Violations(<u>TICKET\_ID</u>: number, **LOT\_ID**:number, PROVINCE: varchar2(10), LICENSE\_PLATE:varchar2(20), REASON: varchar2(200), TIME: timestamp, STATUS:varchar2(20), CREATED\_AT: timestamp)

SQL> select * from Violati	ons;		
TICKET_ID LOT_ID PROV	INCE LICENSE_PLATE		
REASON			
TIME		STATUS	CREATED_AT
1 1 BC No Valid Visitor Pass 05-JAN-25 10.30.00.000000	ABC123 AM	pending	02-APR-25 06.57.07.864364 PM
2 1 0N Expired Pass 12-JAN-25 02.45.00.000000	DEF456 PM	paid	02-APR-25 06.57.07.865626 PM
3 2 AB Unauthorized Parking Area 18-JAN-25 09.15.00.000000	GHI789 AM	pending	02-APR-25 06.57.07.866414 PM
4 1 QC Blocked Access 23-JAN-25 04.20.00.000000	JKL012 PM	appealed	02-APR-25 06.57.07.867142 PM
5 3 BC No Valid Visitor Pass 02-FEB-25 11.10.00.000000	MN0345 AM	pending	02-APR-25 06.57.07.867886 PM
6 2 AB Expired Pass 08-FEB-25 01.25.00.000000	PQR678 PM	paid	02-APR-25 06.57.07.868571 PM
7 1 ON Unauthorized Parking Area 15-FEB-25 08.40.00.000000	STU901 AM	pending	02-APR-25 06.57.07.869301 PM
8 3 BC Blocked Access 21-FEB-25 05.55.00.000000	VWX234 PM	paid	02-APR-25 06.57.07.869997 PM
9 2 QC Other 03-MAR-25 10.05.00.000000	YZA567 AM	pending	02-APR-25 06.57.07.870654 PM

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10 1 BC No Valid Visitor Pass 09-MAR-25 03.30.00.000000 PM	BCD890	paid	02-APR-25 06.57.07.871348 PM
11 3 ON Expired Pass 14-MAR-25 09.45.00.000000 AM	EFG123	pending	02-APR-25 06.57.07.872054 PM
TICKET_ID LOT_ID PROVINCE	LICENSE_PLATE		
REASON			
TIME		STATUS	CREATED_AT
12 2 AB	1173456		
Unauthorized Parking Area 20-MAR-25 12.15.00.000000 PM	HIJ456	appealed	02-APR-25 06.57.07.872740 PM
Unauthorized Parking Area	KLM789	appealed	02-APR-25 06.57.07.872740 PM 02-APR-25 06.57.07.873524 PM

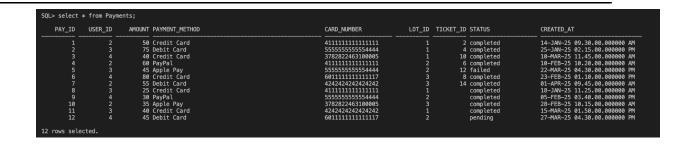
## Staff(STAFF\_ID: number, USER\_ID: number, LOT\_ID: number, CREATED\_AT: timestamp)

SQL> select * from Staff;	
STAFF_ID USER_ID	LOT_ID
CREATED_AT	
1 1	1
02-APR-25 07.40.32.261652	PM
2	2
02-APR-25 07.40.32.263221	PM
3 3	3
02-APR-25 07.40.32.264267	PM
4 4	4
02-APR-25 07.40.32.265288	PM
5 5	5
02-APR-25 07.40.32.266329	PM

Payments(<u>PAY\_ID</u>:number, **USER\_ID**:number, AMOUNT: number(10,2), PAYMENT\_METHOD: varchar(50), CARD\_NUMBER: varchar2(20), **LOT\_ID**: number,

**TICKET\_ID**: number, STATUS: varchar2(20), CREATED\_AT: timestamp)

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# **Repository link**

https://github.students.cs.ubc.ca/CPSC304-2024W-T2/project\_c5i2r\_j6l4t\_z9y5k

# List of all SQL queries

1. INSERT: registerVehicle() in backend/appService.js 404

for checking whether the userId exist: backend/appService.js: line 388

```
`INSERT INTO Vehicles(USER_ID, PROVINCE, LICENSE_PLATE,

CURRENT_LOT_ID,PARKING_UNTIL)

VALUES(:userId, :province, :licensePlate,:lotId

,TO_TIMESTAMP(:parkingUntil, 'YYYY-MM-DD HH24:MI:SS'))`,
```

2. UPDATE: createPayment() in backend/appService.js: 1022

```
`UPDATE Violations SET STATUS = 'paid' WHERE TICKET_ID = :1`,
```

3. DELETE: deleteVehicle() in backend/appService.js :459

```
`DELETE FROM Vehicles WHERE PROVINCE = :province AND LICENSE_PLATE = :licensePlate`,

{ province, licensePlate },

{ outFormat: oracledb.OUT_FORMAT_OBJECT }
```

4. SELECTION: registerUser(name, phone, password, userType, unitNumber, hostInformation, role) in backend/appService.js:199

```
`SELECT * FROM Users WHERE phone = :phone AND password = :password`
```

5. Projection getAllVehiclesWithProjection() in backend/appService.js: 1780

```
SELECT ${selectedCols.join(', ')}

FROM Vehicles v

JOIN Users u ON v.USER_ID = u.ID

ORDER BY v.VEHICLE_ID
```

6. Join: adminLogin() in backend/appService.js:1088

```
s.STAFF_ID as staffId,

u.NAME,

s.LOT_ID as lotId

FROM Staff s

JOIN Users u ON s.USER_ID = u.ID

WHERE s.STAFF_ID = :1 AND u.PASSWORD = :2 = :1
```

7. AGGREGATION with GROUP BY: getUserVisitorPassQuota(userId) in backend/appService.js: 715

Counts the number of active visitor passes grouped by their validity duration (VALID\_TIME) for a specific user.

```
VALID_TIME,

COUNT(*) AS active_count

FROM VisitorPasses vp

WHERE vp.USER_ID = :userId

AND vp.STATUS = 'active'

AND CURRENT_TIMESTAMP < vp.CREATED_AT +

NUMTODSINTERVAL(vp.VALID_TIME, 'HOUR')

GROUP BY VALID_TIME`
```

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8. AGGREGATION with HAVING: getAllParkingLots() in backend/appService.js: 809

Retrieves details of all parking lots, including their total capacity, available spaces, current occupancy, and the number of parked vehicles.

```
p.LOT_ID as lotId,

p.TOTAL_SPACES as capacity,

p.AVAILABLE_SPACES as currentRemain,

(p.TOTAL_SPACES - p.AVAILABLE_SPACES) as currentOccupancy,

COUNT(DISTINCT v.VEHICLE_ID) as currentVehicles

FROM ParkingLot p

LEFT JOIN Vehicles v ON v.CURRENT_LOT_ID = p.LOT_ID

GROUP BY p.LOT_ID, p.TOTAL_SPACES, p.AVAILABLE_SPACES

HAVING MAX(p.TOTAL_SPACES) >= MIN(p.TOTAL_SPACES)

ORDER BY p.LOT_ID
```

 Nested AGGREGATION with GROUP BY: getParkingLotById(lotId) in backend/appService.js: 835

Fetches detailed information for a specific parking lot, including total capacity, current occupancy, and all vehicles currently parked there, using a nested aggregation.

```
sub.lotId,
sub.capacity,
sub.currentRemain,
sub.currentOccupancy,
```

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```
v.PROVINCE,
    v.LICENSE_PLATE,
   v.PARKING_UNTIL
FROM (
    SELECT
       p.LOT_ID AS lotId,
        p. TOTAL SPACES AS capacity,
        p.AVAILABLE_SPACES AS currentRemain,
        (p.TOTAL_SPACES - p.AVAILABLE_SPACES) AS currentOccupancy,
        COUNT(*) AS count1
    FROM ParkingLot p
    WHERE p.LOT_ID = :1
    GROUP BY p.LOT_ID, p.TOTAL_SPACES, p.AVAILABLE_SPACES
) sub
LEFT JOIN Vehicles v
   ON v.CURRENT LOT ID = sub.lotId
```

10. Division getUserViolations(userId, startDate, endDate) in backend/appService.js: 882

Retrieves all violation tickets for a specific user and period, ensuring the user has violations related to every one of their vehicles.

```
SELECT
v.TICKET_ID as ticketId,
v.REASON,
```

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```
v.TIME,
   v.LOT_ID as lotId,
   v.LICENSE_PLATE,
   v.STATUS
FROM Violations v
JOIN Vehicles ve ON v.PROVINCE = ve.PROVINCE
               AND v.LICENSE_PLATE = ve.LICENSE_PLATE
WHERE ve.USER_ID = :1
AND NOT EXISTS (
   SELECT ve2.VEHICLE_ID
    WHERE ve2.USER_ID = ve.USER_ID
    SELECT ve3.VEHICLE_ID
    FROM Vehicles ve3
    WHERE ve3.USER_ID = ve.USER_ID
ORDER BY v.TIME DESC
```