

# Challenge

Design a car rental service (CRS) system.

## In short:

- There are two types of customers: "gold" members (pay monthly subscription fee) and regular members (pay-as-you-go type). Both get CRS ID cards that vary in the ID number pattern.
- There are many types of vehicles.
- Each vehicle has a unique number.
- Money is paid in cash only.
- Only one vehicle per person could be given. Previously rented vehicles shall be returned in order to be able to rent another.
- There are two vehicles of each (sub) type in the park. So, it's: 2 x M1, 2 x M2, 2 x T, 2 x G and so on.
- When taking the vehicle, customers get information on vehicle location in the park (for instance, A-19 or Z-2) and the secret pin which shall be used to unlock the vehicle.

## Tips:

- Read the use-cases and scenarios thoroughly.
- Work out the details.
- Think of extendability.
- Think of readability.
- Think of testability.

## Requirements

- Should handle various vehicle types. See the [Vehicles](#) section.
- Should ask for advance pledge payment when taking the vehicle (for regular customers).
- Should check whether vehicle of the desired type is available.
- Should accept cash money, calculate accuracy (indicate current balance and display how much more shall still be paid) and give back the change. See [Payments, pledges cash-backs](#) section.
- Should handle both types of customers ("gold" members and regular). Authentication is simplified to validation of the ID card number.
- System should be persistent.

## Vehicles

### *Type L*

**Type L** - motor vehicles with less than four wheels.

Sub-types:

- L1: A two-wheeled vehicle with an engine cylinder capacity in the case of a thermic engine not exceeding 50 cm<sup>3</sup> and whatever the means of propulsion a maximum design speed not exceeding 50 km/h.
- L2: A three-wheeled vehicle of any wheel arrangement with an engine cylinder capacity in the case of a thermic engine not exceeding 50 cm<sup>3</sup> or 4kw and whatever the means of propulsion a maximum design speed not exceeding 50 km/h.

- L3: A two-wheeled vehicle with an engine cylinder capacity in the case of a thermic engine exceeding 50 cm<sup>3</sup> or 4kw and whatever the means of propulsion a maximum design speed exceeding 50 km/h.
- L4: A vehicle with three wheels asymmetrically arranged in relation to the longitudinal median plane with an engine cylinder capacity in the case of a thermic engine exceeding 50 cm<sup>3</sup> or whatever the means of propulsion a maximum design speed exceeding 50 km/h (motor cycles with sidecars).
- L5: A vehicle with three wheels symmetrically arranged in relation to the longitudinal median plane with an engine cylinder capacity in the case of a thermic engine exceeding 50 cm<sup>3</sup> or whatever the means of propulsion a maximum design speed exceeding 50 km/h.
- L6: A vehicle with four wheels whose unladen mass is not more than 350 kg, not including the mass of the batteries in case of electric vehicles, whose maximum design speed is not more than 45 km/h, and whose engine cylinder capacity does not exceed 50 cm<sup>3</sup> for spark (positive) ignition engines, or whose maximum net power output does not exceed 4 kW in the case of other internal combustion engines, or whose maximum continuous rated power does not exceed 4 kW in the case of electric engines.
- L7: A vehicle with four wheels, other than that classified for the category L6, whose unladen mass is not more than 400 kg<sup>[3]</sup> (550 kg<sup>[3]</sup> for vehicles intended for carrying goods), not including the mass of batteries in the case of electric vehicles and whose maximum continuous rated power does not exceed 15 kW.

## **Type M**

**Type M** - vehicles having at least four wheels and used for the carriage of passengers.

Sub-types:

- M1: Vehicles used for carriage of passengers, comprising not more than eight seats in addition to the driver's = 9. (Larger Than Standard Car eg: London Cab / E7 Type Vehicle 8 seat + Driver.)
- M2: Vehicles used for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass not exceeding 5 tonnes. (Bus)
- M3: Vehicles used for the carriage of passengers, comprising more than eight seats in addition to the driver's seat, and having a maximum mass exceeding 5 tonnes. (Bus)

## **Type N**

**Type N** - power-driven vehicles having at least four wheels and used for the carriage of goods.

Sub-types:

- N1: Vehicles used for the carriage of goods and having a maximum mass not exceeding 3.5 tonnes. (Pick-up Truck, Van)
- N2: Vehicles used for the carriage of goods and having a maximum mass exceeding 3.5 tonnes but not exceeding 12 tonnes. (Commercial Truck)
- N3: Vehicles used for the carriage of goods and having a maximum mass exceeding 12 tonnes. (Commercial Truck)

## **Type O**

**Type O** - trailers.

Sub-types:

- O1: Trailers with a maximum mass not exceeding 0.75 tonnes.
- O2: Trailers with a maximum mass exceeding 0.75 tonnes, but not exceeding 3.5 tonnes.
- O3: Trailers with a maximum mass exceeding 3.5 tonnes, but not exceeding 10 tonnes.

- O4: Trailers with a maximum mass exceeding 10 tonnes.

### ***Type T***

**Type T** - agricultural and Forestry tractors.

### ***Type G***

**Type G**: - off-road vehicles.

### ***Type S***

**Type S** - special purpose vehicles.

Sub-types:

- SA: Motor caravan.
- SB: Armoured vehicle.
- SC: Ambulance.
- SD: Hearse.

## **Customers**

### ***Gold***

Do pay monthly membership fee (out of scope). Do not pay the pledge fee when renting a vehicle. Have a right to up to 4 delays per month (with a maximum of 30 minutes delays per time).

#### **ID pattern**

Always starts with a letter G, followed by six digits and two capital letters at the end.

- G-123456-SK
- G-678912-DD

### ***Regular***

Do not pay membership fee. Are required to pay a pledge when taking a vehicle.

#### **ID pattern**

Always starts with a letter N, followed by eight digits.

- N-12345678
- N-54389289

## **Payments, pledges cash-backs**

For all customers only cash payments are accepted (monthly subscription fee is out of scope). Consider it to be a cash/bank-automat, which takes coupons or coins (see the list below for available/supported options).

### ***Supported banknotes and coins***

#### **Banknotes**

- 50 euro
- 20 euro
- 10 euro

- 5 euro

### **Coins**

- 2 euro
- 1 euro
- 50 cents
- 20 cents

### ***Pledges***

For every type of vehicle a certain pledge amount is specified. "Gold" members are considered pledge-free. All others do have to pay pledge which is fully refunded if car is returned in time (we do not consider possible damage calculation).

### ***Cash-backs***

All amounts are rounded up as follows:

- 0-19 cents are rounded to 20 cents.
- 21-39 cents are rounded to 40 cents.
- 41-49 cents are rounded to 50 cents.
- 51-59 cents are rounded to 60 cents.
- 61-69 cents are rounded to 70 cents.
- 71-79 cents are rounded to 80 cents.
- 81-89 cents are rounded to 90 cents.
- 91-99 cents are rounded to 1 euro.

#### **Cash-back example for "gold" members**

For instance, if the price of a vehicle rental ([Type M](#)) is 8.75 euro an hour and customer wants to rent it for 5 hours, he shall pay 43.75 euro.

Customer pays 50 euro (1 x 50 euro or 2 x 20 euro + 1 x 10 euro). Cash-backs shall be always calculated in an optimal way. In the given case, system shall return:

- 2 euro: 1 x 2 euro.
- 60 cents: 3 x 20 cents.

#### **Cash-back example for regular members**

For instance, if the price of a vehicle rental ([Type M](#)) is 9.45 euro an hour and customer wants to rent it for 5 hours, he shall pay 47.25 euro (for the rental) + 100 euro pledge.

Customer pays 150 euro (3 x 50 euro). Cash-backs shall be always calculated in an optimal way (which means that the least amount of banknotes/coins shall be used). In the given case, system shall return:

- 100 euro: 2 x 50 euro.
- 5 euro: 1 x 5 euro.
- 1 euro: 1 x 1 euro.
- 20 cents: 1 x 20 cents.

## Rent time

Vehicle rent is calculated on per hour basis with a minimum of 4 hours. Late returns are billed (1 minute delay is billed as an hour delay). "Gold" members are permitted to have up-to 4 delays a month (with a maximum of 30 minutes delays). Remaining time is billed accordingly.

## Prices

Prices are listed in the table below.

### Types L, M, N

|         | Type L |      |      |      |      |      |      | Type M |      |      | Type N |      |      |
|---------|--------|------|------|------|------|------|------|--------|------|------|--------|------|------|
|         | L1     | L2   | L3   | L4   | L5   | L6   | L7   | M1     | M2   | M3   | N1     | N2   | N3   |
| Gold    | 3.75   | 3.85 | 3.95 | 3.95 | 3.95 | 3.95 | 3.95 | 8.75   | 8.85 | 8.95 | 2.95   | 2.95 | 2.95 |
| Regular | 5.05   | 5.15 | 5.25 | 5.35 | 5.35 | 5.35 | 5.35 | 9.45   | 9.55 | 9.65 | 3.15   | 3.15 | 3.15 |

Pledge for Type L, Type M and Type N vehicles is 100 euro.

### Types O, T, G, S

|         | Type O |      |      |      | Type T | Type G | Type S |    |      |    |
|---------|--------|------|------|------|--------|--------|--------|----|------|----|
|         | O1     | O2   | O3   | O4   |        |        | SA     | SB | SC   | SD |
| Gold    | 17.5   | 17.5 | 17.5 | 17.5 | 25     | 25     | 25     | 55 | 19.5 | 35 |
| Regular | 19     | 19   | 19   | 19   | 30     | 30.05  | 30     | 64 | 23.5 | 40 |

Pledge for Type O, Type T, Type G and Type S vehicles is 300 euro.

## Use-cases

### Scenarios

- A regular member rents a *M1* type vehicle for a 17 hours. Vehicle is returned in time. Customer pays 100 euro (as a pledge to rent a car), then 100 euro + 50 euro + 20 euro when returning it.
- A "gold" member rents a *O2* type vehicle for 43 hours. Vehicle is returned with a delay of 2 hours and 21 minute. This is his 3rd delay this month. Customer pays with 8 bank notes of 100 euro each.
- A regular member rents a *M1* type vehicle for 5 hours. Vehicle is returned in time. Customer pays 100 euro (as a pledge to rent a car), then 50 euro.
- A "gold" member rents a *M1* vehicle for 55 hours. Vehicle is returned in time. Customer pays with 5 bank notes of 100 euro each.

Edge cases will be tested.

## Interface

Interface (console, API, traditional web page, native UI, etc) is totally up to the candidate.

## **Programming language, frameworks and third-party libraries**

Everything is totally up to the candidate. It is necessary, though, to indicate which versions to use (so that working environment could be reproduced). Due to time limitations, usage of Docker (or other container systems) is not required.

## **Time given**

From 2 to 8 hours (totally up to the candidate).