

Object-Oriented Analysis & Design:

Specification of Car Management System (CMS)

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1. You need to design a (Hire) **Car Management System (CMS)** for Bhraman Rent-a-Car – a company that passengers use for renting cars with drivers when they need to travel from one city to another. **CMS** should conform to the following:

Requirements for Car Management System (CMS)

- (a) Bhraman Rent-a-Car has four types of cars maintained in respective *Units*:

Unit	Comfort	Passengers	Luggage	Rate
<i>Hatchback</i>	Low	3	Small	Lowest
<i>SUV</i>	Medium	5	Small	Medium
		3	Medium	
<i>Sedan</i>	High	3	Small	Same as <i>SUV</i>
<i>Limousine</i>	Luxury	3	Large	Most expensive

Note:

- The *Vehicles* in a *Unit* are all of the same type (though the model and make may differ). Every *Vehicle* is known by its MAKE, MODEL, and COLOR and is identified by its REGISTRATION NUMBER.
- (b) The following types of *Passengers* use cars from Bhraman Rent-a-Car:
- Weekly*. Who use the service every week. They use round-trips that are pre-booked every week on specific days (at given times) unless explicitly canceled. Bhraman Rent-a-Car guarantees these bookings every week.
 - Regular*. Who use the service regularly but may not be on a specific periodicity.
 - Occasional*. Who use the service sporadically.

Note:

- Every *Passenger* needs to be registered with **CMS**. *Weekly* and *Regular Passengers* enjoy 10% discount on their bookings. Every *Passenger* is known by HER / HIS NAME, MOBILE NUMBER, DEFAULT CHOICE OF TYPE OF CAR and DEFAULT PICKUP LOCATION and is identified by a PASSENGER ID.
 - *Passengers* are not pre-designated with the above types. **CMS** assigns the types to them from their use pattern of hiring services. Naturally, the assignment of types can change every month based on a strategy that the designer of **CMS** (you!) can decide.
- (c) Most *Trips* as taken up by passengers from Bhraman Rent-a-Car are for plying between Kharagpur and Kolkata. Four types of *Trips* can be booked:
- Round Trip*. Going from Kharagpur to Kolkata and back with a maximum waiting time of 12 hours. Extra retention charge to be paid for additional waiting time between trips.
 - Drop Trip*. Going from Kharagpur to Kolkata.
 - Pickup Trip*. Going from Kolkata to Kharagpur.

- iv. *Custom Trip*. Trips to any destination other than Kolkata must start from Kharagpur and also end back in Kharagpur.

Note:

- Every *Round Trip* is charged on the kilometers traveled at a rate suitable for a type of car.
- Further, every *Drop Trip* (*Pickup Trip*) is charged for double the kilometers traveled unless adjusted against another *Pickup Trip* (*Drop Trip*).
- A vehicle retention charge (that depends on the type of car) is added for a night stay and for an additional day. Retention beyond one day is not allowed.
- Toll fees are charged on actual for every trip.

(d) The *Staff* structure of Bhraman Rent-a-Car is as follows:

- i. *Owner*. The *Owner* owns the business and manages *Bhraman Rent-a-Car*. He is responsible to set the per kilometer rate and the rates for retention for different types of cars.
- ii. *Manager*. The *Manager* is responsible for the operations. He receives the request for a trip from the passenger and allocates the same suitably to the *Overseer* of the unit. *Overseers* report to the *Manager*. The *Manager* reports to the *Owner*.
- iii. *Overseers*. Every *Overseer* is responsible for a unit of cars and reports to the *Manager*. He manages the trips allocated for his unit.
- iv. *Drivers*. Every *Driver* can drive a car of one designated type (of a unit). He reports to the *Overseer* of the corresponding unit. Every *Driver* is assigned a trip by his *Overseer* and is responsible to ferry the passenger on the trip.

Note:

- Every *Staff* is identified by an EMPLOYEE CODE, and has NAME, ADDRESS, and MOBILE NUMBER. In addition, the *Owner*, the *Manager*, and *Overseers* have EMAIL; DRIVERS have DRIVING LICENSE NUMBER with valid duration and given car type; and the *Owner* has PAN No.
- *Drivers* are contractual and paid on trip basis – Rs. 600/= for first 8 hours, Rs. 120/= for every extra hour (maximum up to 4 hours) and Rs. 300/= for overnight stay. Other *Staffs* (with the exception of the *Owner*) draw monthly salary.

(e) The *Bookings* are handled as follows:

- To Request a *Booking* for a *Trip*, a *Passenger* needs to specify TRIP TYPE, TYPE OF CAR, DATE AND TIME OF FORWARD JOURNEY, DESTINATION (for *Custom Trip*), DATE AND TIME OF RETURN JOURNEY (if applicable), ADDRESS FOR PICKUP, NAME OF PASSENGER, and MOBILE NUMBER of passenger. Some of these may be optional if those can be obtained from the profile of the *Passenger*.
- A *Booking* request for a *Trip* is first analyzed by the *Manager*. If the requested type of car is available (for the requested duration), he *Reserves* the same with the corresponding *Unit* and *Confirms* the booking to the *Passenger*. If no vehicle of the requested type of car is available, *Manager* sends a *Change* request to the *Passenger* specifying the availability of the types of cars (on the requested trip date and time). The *Passenger* would select the type of car from the suggestions and *Accept* the change request or *Cancel* the booking. If the change request is accepted, the *Manager* *Reserves* the type of car and *Confirms* the booking to the *Passenger*.
- Once a type of car is reserved, the *Overseer* of the *Unit*, *Assigns* a *Vehicle* and a *Driver* for the *Trip* and generates a *Duty Slip* with details of *Passenger*, *Trip*, *Driver* and *Vehicle*. The *Duty Slip* is sent to the *Driver* and an SMS is sent to the *Passenger* with the mobile number of the *Driver*. The *Vehicle* and the *Driver* assigned for a *Trip* needs to be blocked from other *Booking* requests for the duration of the *Trip* with a buffer of one-hour ahead of the *Trip* and two-hours beyond expected completion.
- The *Driver* *Reports* to the passenger half-an-hour before the start of the *Trip* at the designated place of pickup. The *Driver* *Conducts* the trip as planned and on completion (when he has dropped the passenger to the final destination) gets the *Duty Slip* signed by her / him after filling in the place of drop, date / time and kilometers traveled. He then sends the *Duty Slip* (along with toll tokens) to his *Overseer*. This completes a *Trip*. On receipt of signed *Duty Slip*, the *Overseer* *Closes* the *Booking*. With this the *Driver* and the *Vehicle* are released and become available for further allocation.

- The *Passenger* may **Modify** or **Cancel** any booking for a *Trip* till four hours before the start of the trip. On cancellation, the reserved vehicle and assigned driver may need to be released (made available) as the case may be. On a request to modification, the process of cancellation and re-booking would be performed by the respective staffs. A modification request that cannot be honored is canceled.
 - A set of *Round Trips* are pre-booked every week for *Weekly* passengers. These bookings are managed by the respective *Overseers*. A *Weekly* passenger may **Cancel** such a pre-bookings one week in advance.
- (f) The *Payments* are handled as follows:
- On the closure of a *Booking* the *Manager* proceeds to **Raise** the invoice for it to the *Passenger* from the *Duty Slip* using the kilometer and retention rates as set already by the *Owner*.
 - The *Owner* Collects the payment on an invoice and also makes payments to the *Driver*.