

# Software Engineering

Books or notes are **not** allowed.

Write only on these sheets. **Concise** and **readable** answers please.

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## *Trip sharing application*

New technologies allow transforming any car / driver in a taxi/ taxi driver.

Potential users access a web site (from mobile devices or PCs) and register in the system. When they need a taxi they log in, request for a ride (detailing start point and destination).

Potential drivers also access the web site and register once. Then, when they are willing to share their car for a ride, they log in, and describe the ride they are doing (or they plan to do).

The system then tries to match rides requested by users and rides offered by drivers. The match is evaluated basically on start point, start time, destination. In case the match is possible the system contacts the potential driver and asks him / her if he is available for the specific ride. If yes then the system puts in contact the user and the driver, establishing also a price for the ride.

At this point, always through the application, user and driver negotiate the final details (exact point for meeting, destination). If the negotiation succeeds, the driver picks up the user and performs the ride.

Both for security and for efficiency, each ride is tracked: start point and start time, path followed, end point and end time. This is also made through the app on the smartphones of both driver and user.

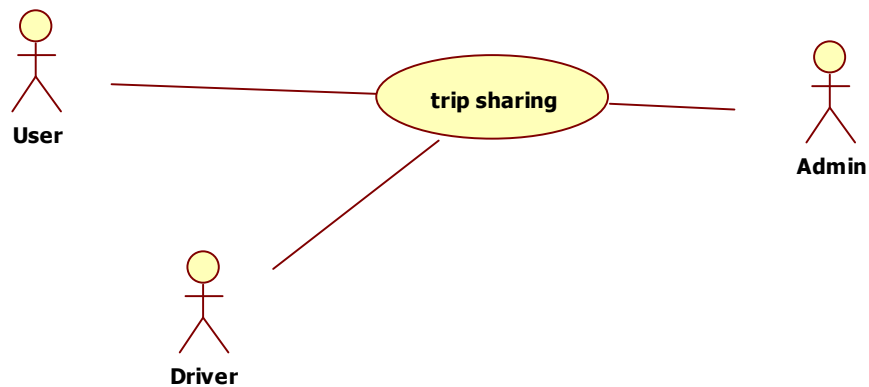
At the end of the ride, and if all is right, the user pays the ride. No money is exchanged directly between driver and user, the exchange is made on the accounts associated to driver and user and managed by the application. One percentage of the price goes to the company providing the sharing service.

The system supports also a peer evaluation system. At the end of the ride the user evaluates the driver, and viceversa.

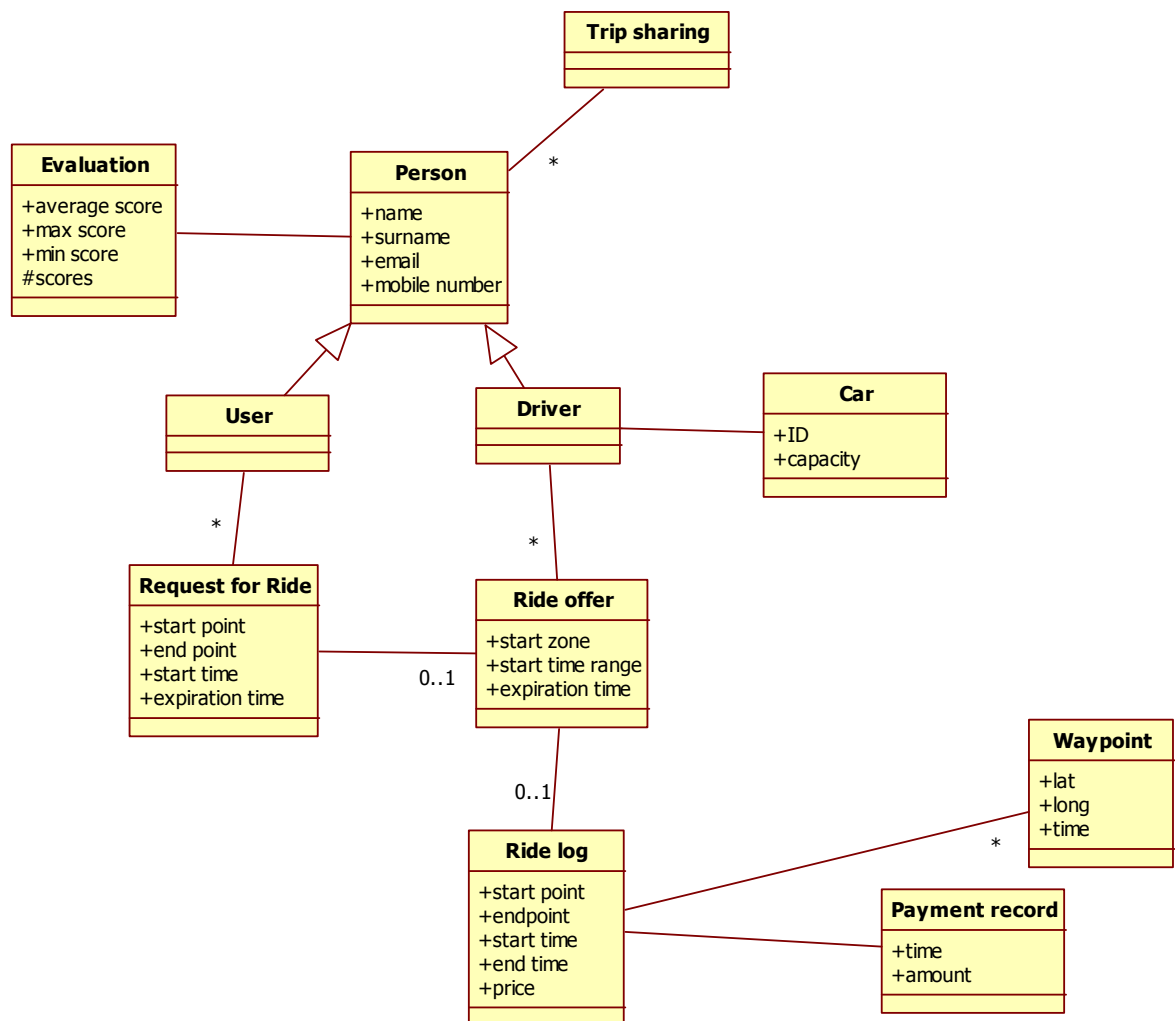
In the following you should analyze and model the trip sharing application. Consider at least three parts: app on smartphone for the driver, app on smartphone for the user, web site and back office functions.

1 (15 points) – a. Define the context diagram (including relevant interfaces)

Actor	Physical interface	Logical interface
User	Smartphone / PC	GUI
Driver	Smartphone / PC	GUI
admin	PC	GUI



Define the key concepts and entities and their relationships (UML class diagram) for the application



Also possible to represent User and Driver as roles. It is important to represent separately Ride request, ride offer and actual ride (Ride log). On top of them some algorithm will try to match offers and requests. Offers and requests have a time range (expiration time), after which they become invalid and are canceled.

List the requirements in tabular form (do not forget to list important NF requirements)

ID	Type (Functional Non Functional)	Description
1	F	CRUD Person (user, driver)
2	F	Ride management: CRUD request for drive, offer for drive, attach them to user / driver, match request to offer, CRUD ride log
3	F	Evaluation management: ask and store score for User / driver, compute averages
4	F	Authorization authentication: log in log out, authorize, CRUD accounts and passwords
5	NF	Privacy: information on user /driver / rides only accessible to owner
6	NF	Efficiency: all functions should complete in less than .5sec

Define one scenario describing a user who asks for a ride from location A to B (describe until the driver picks up the user).

Precondition:

Postcondition:

Step	Description	Req ID
1		
2		
3		
4		
5		

2 (7 points) -Define black box tests for the following class, using equivalence classes and boundary conditions.

```
int luggageCost( int nPieces, double weight)
```

This function computes the cost of sending luggage in a flight. nPieces is the number of pieces of luggage to be checked. Weight is the total weight of all pieces of luggage, in kilograms.

The cost rules are:

- No more than 2 pieces of luggage (if exceeding, return -1)
- Total weight allowed 64 kilograms (if exceeding, return -1)
- First 22kilograms free, then 10 euros per Kg

Ex. luggageCost ( 1, 19.0) → 0  
 luggageCost ( 2, 21.0) → 0  
 luggageCost ( 3, 21.0) → -1  
 luggageCost ( 2, 23.0) → 10

nPieces	weight	Valid / invalid	Test cases
[minint, 0[	[minDouble, 0[	I	
	[0, 22.0]	I	
	]22.0, 64]	I	
	]64.0, maxDouble]	I	
[0,2]	[minDouble, 0[	I	
	[0, 22.0]	V	
	]22.0, 64]	V	
	]64.0, maxDouble]	V	
[3, maxint]	[minDouble, 0[	I	
	[0, 22.0]	V	
	]22.0, 64]	V	
	]64.0, maxDouble]	V	

3 (7 points) – For the following function define the control flow graph, and define test cases to obtain the highest possible node coverage, edge coverage, multiple condition coverage, loop coverage, path coverage.

For the test cases, **write only the input value**.

**WRITE control flow graph here**

```

1 void sort(int[] array){
2   int temp;
3   for (int i=0; i<array.length-1; i++){
4     for (int j=i; j<array.length-1; j++){
5       if (array[i] > array[i+1]) {
6         temp = array[i]; // swap elements
7         array[i] = array[i+1];
8         array[i+1] = temp;
9       }
10    }
11 }

```

Coverage type	Number of test cases needed to obtain 100% coverage	Coverage obtained with test cases defined (%)	Test cases defined
Node	1	100	T1
Edge	1	100	T1
Multiple condition	NA		
Loop	Line 3	100	T1 enters many times T2 enters once T3, no enter
	Line 4	2/3	T1 enters many times T2 enters once No enter un feasible
Path	unfeasible		

Write test case ID (t1, T2 ..) in the rightmost column, and test cases here

T1: {8,7,6, 5}

T2: {4,5}

T3: {4}

4 (1 points) – The size of a project is estimated to be 600 FP. The project is developed in Java, past figures from the company tell that one FP is worth 20 to 30 LOC, and that productivity is 10-15 LOC per person days. How many person days would be required for the project? (show steps followed to compute your answer).

600 FP → 12000 to 18000 LOC

Min effort  $12.000 / 15 = 800$  PD, max effort  $18.000 / 10 = 1800$  PD

5 (1 points) – A software product is developed custom for a bank. Development takes 18 months, operation and maintenance 10 years. Where do you expect to have the larger part of costs?

maintenance

6 (1 points) – What are pros and cons of the ‘lock modify unlock’ approach to change control?

7 (1 points) – Describe shortly the ‘SCRUM’ software process

8 (1 points) – Describe shortly the ‘MVC’ Design pattern