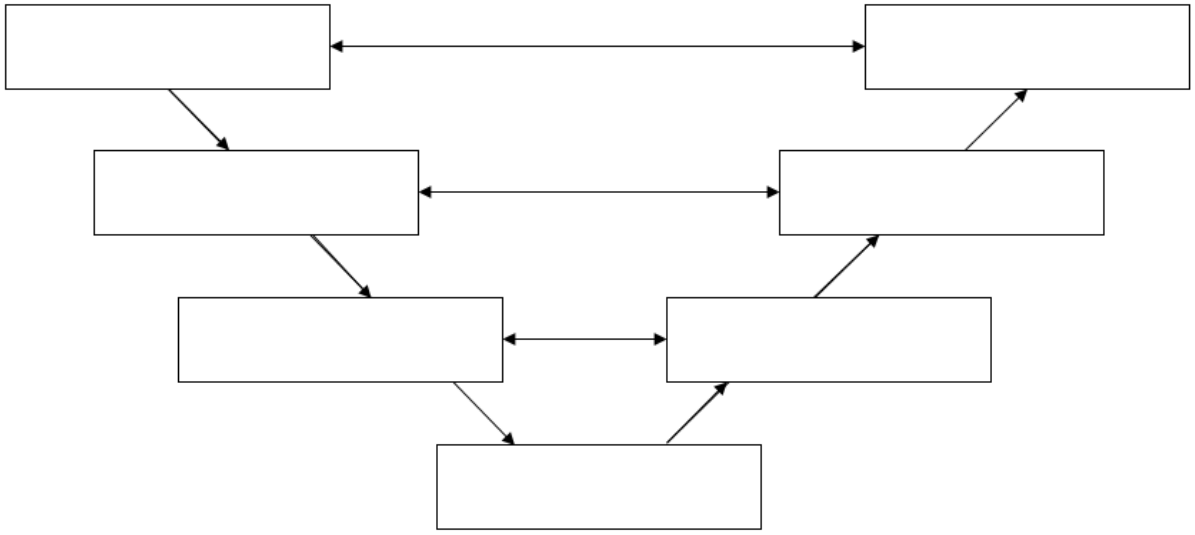
ICM – Toolbox Engineering and Interoperability of Software Systems – Course unit on Software Engineering and M1 Cyber Physical and Social Systems – Course unit on System Modeling
Fall 2021

Exam (1h30)

Do fill your name on ALL page footers!
USE THESE COPIES TO ANSWER TO THE EXAMINATION
You are allowed to use a A4 sheet of paper, hand-written, both side. You are not allowed to use any computer or electronic device (including mobile phone) during the test.

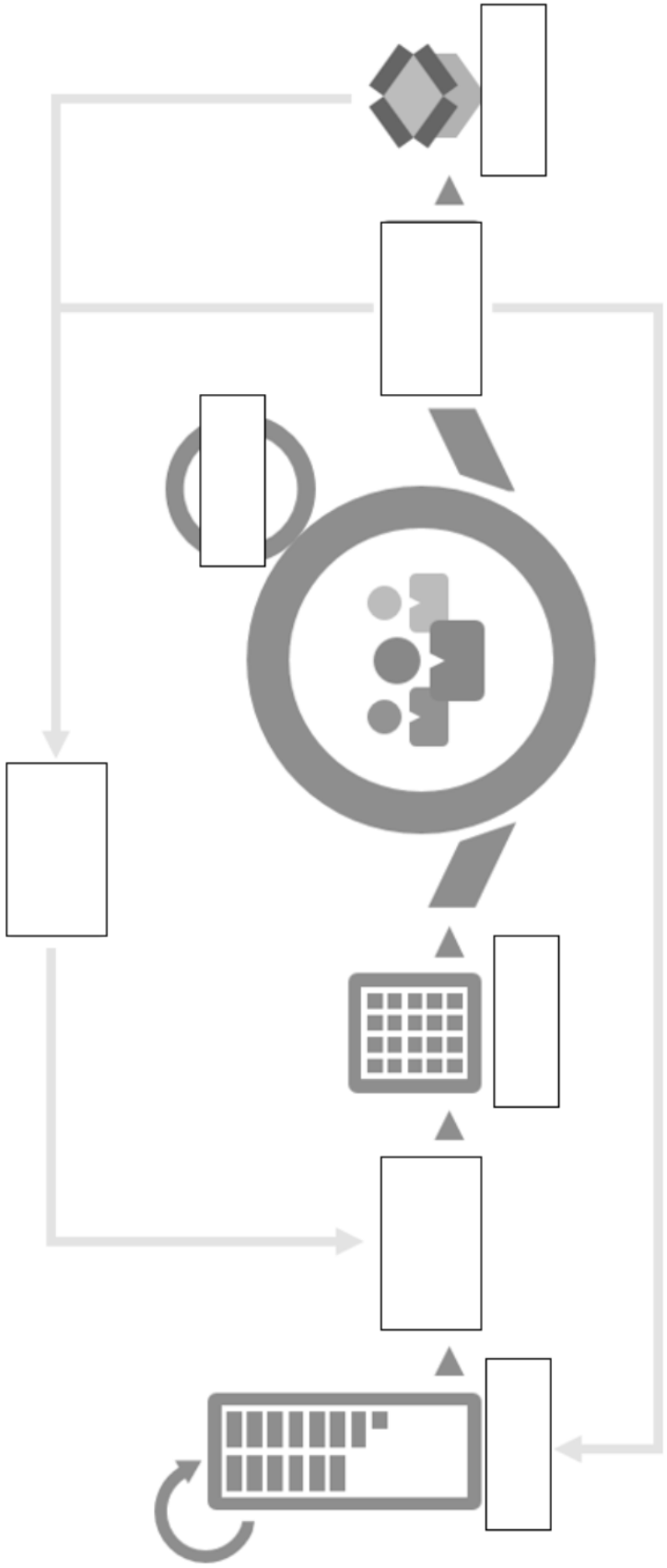
Question 1 (/2)

Fill-in the life cycle model below, and explain briefly what it represents.



Question 2 (/3)

Fill in the figure below, and explain briefly what it represents.



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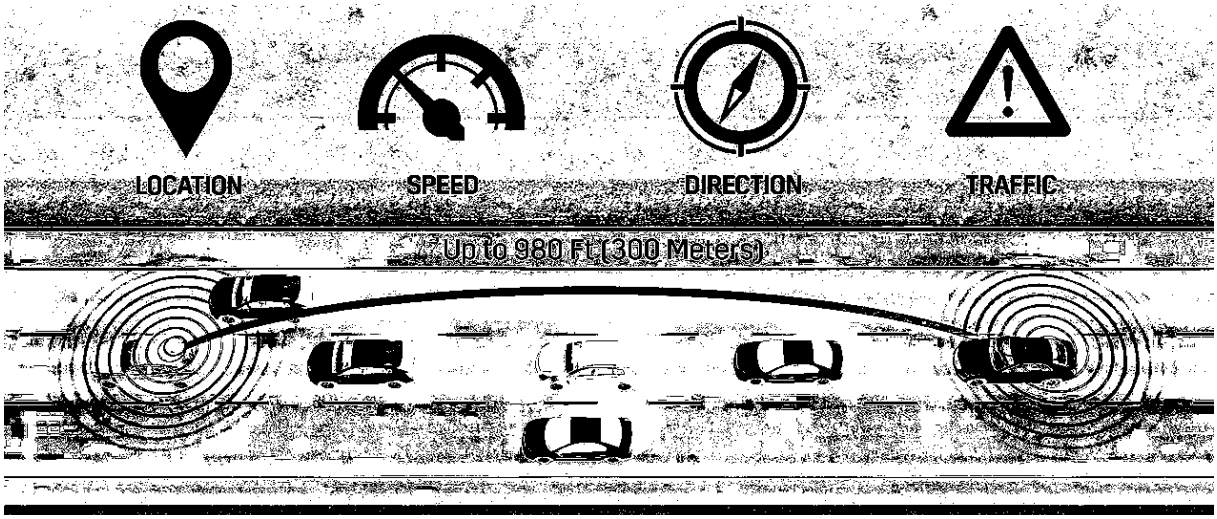
Name : _____

We consider the development of a **vehicle-to-vehicle communication system** with the general goal to optimize traffic and reduce the pollutant emissions when in traffic jams. This system uses the collection of sensed variables such as the car position, speed, acceleration, warning state; uses some AI technique to compute an optimized speed for each car; and advertises this speed to the drivers. Drivers can rate other drivers based on their driving attitude.



Question 3 (/4)

1. List the most important actors
2. Provide up to 3 functional requirements
3. Provide up to 5 non-functional requirements (see ISO/IEC 25010:2011 in Appendix A)

- **Exercise 4 (/3)**

Draw a UML Use Case diagram with up to 10 use cases. Use at least one <<import>> and one <<extends>>. Include at least the following use cases:

- UC1: compute and advertise optimal speed
- UC2: rate a driver

- **Exercise 5 (/4)**

Draw an UML Activity Diagram for the nominal scenario of the following use case

- UC1: compute and advertise optimal speed

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- **Exercise 6 (/4)**

Consider the following situation:
« *Paul Lenoir* and *Marie Lebrun* are driving their Rinault Fluo AB-001-XZ and Pigeot Mangoo AB-002-XZ at the optimal speed of 61 km/h on a congested highway, with inter-vehicle distance of 20 m. Their cars have a "behavior rating" of 7.5 and 8.2, respectively. Suddenly, they are passed by at high speed (162 km/h) on the right shoulder side of the highway, by a car with matriculation plate AB-003-XZ. *Marie* gets frightened and brakes. Her car broadcasts the alert, then a few milliseconds later *Paul*'s car receives the alert and brakes as well. A few seconds later, both register this car's driver as potentially dangerous.»

Draw below a UML Class diagram that supports the above specification:

- **Exercise 7 (/3)**

A simplified alarm clock is considered:

- The alarm can be switched on or off.
- When the current time becomes equal to the alarm time, the alarm sounds (without stopping, at first).
- You can interrupt the ringing.

Give a UML State Chart diagram of this system. Complete this diagram by taking into account the fact that the wake-up call stops by itself after a certain time.

Appendix A

Below is the ISO/IEC 25010:2011 classification of functional and non-functional software quality criteria.

ISO/IEC 25010:2011 classification of functional and non-functional software quality criteria.