Exam

"UML for Embedded Systems" Course

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Duration: 2h

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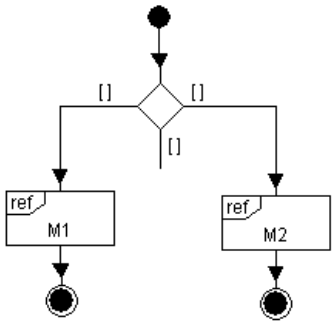
Authorized documents: course slides and notes you've taken during course and lab sessions.

A mark is provided for each question. An additional point is given as a general appreciation, including the written quality and skill.

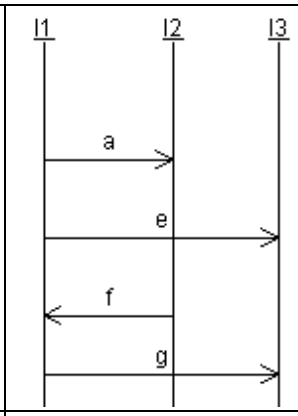
I. Scenario implementability (4 points)

For each of the following scenarios, explain whether they are implementable, or not.

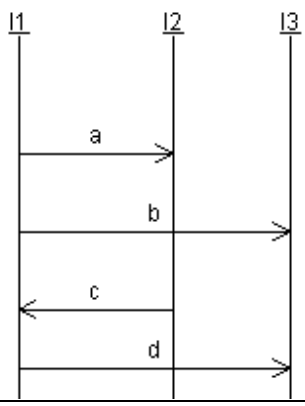
1)



IOD

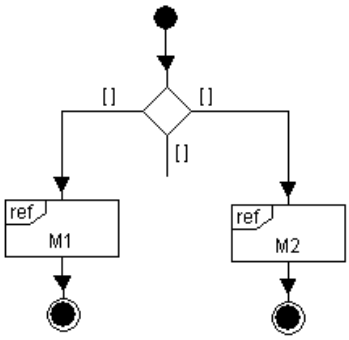


M1



M2

2)



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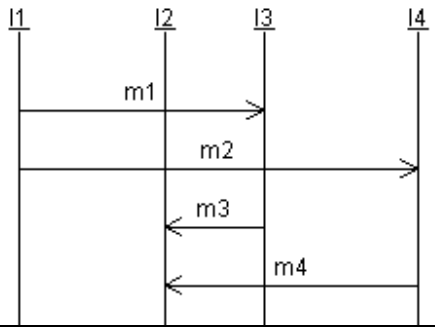
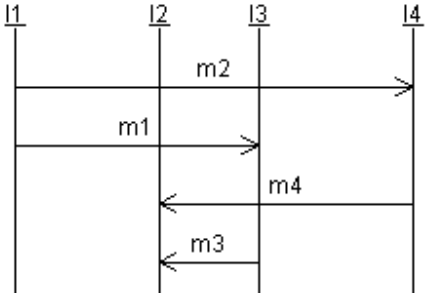


M1



M2

II. Modeling exercise (14 points)

The goal of this exercise is to model the software part of a railroad crossing system. The time being short to perform this modeling, you may omit a few modeling details as long as you explicitly mention which details you have omitted and why you have omitted these ones. At last, don't forget to comment your diagrams, grading takes into account at the same level comments and diagrams.

The railroad crossing system manages three sensors, a 3-color light (green, amber, red), and a barrier. This system manages a one-way road, with only one lane. The three sensors are:

- ***approach***. *Signals that a train is getting towards the crossing. The light is set to amber for 2 seconds, then to red. At that moment, barriers are lowered. This process takes 5 seconds.*
- ***in***. *Signals that a train is about to enter the crossing. If the barriers are not yet at their most down position, an error message is sent to the crossing's maintenance headquarters, and a special blinking red light is lit on a panel visible from the train.*
- ***leave***. *Signals that a train has just left the crossing. The barriers are opened (this process also takes 5 seconds) and the 3-color light is set to green.*

Moreover, the system should take the safest decision in all circumstances. This means that if a decision needs to be taken, we assume the system selects the one with maximal safety.

1) Analysis

a) Make the use case diagram of this machine. (1.5 point)

b) Make two scenarios, one for the nominal case, and one for a non-regular case. (1.5 point)

c) Using the technique of "words in the text", propose a collection of classes and objects for this system. (2 points)

d) Refine the two previously performed scenarios. Note that these scenarios should clearly express time constraints. (2 points)

2) Design

a) From your analysis diagrams, propose a class diagram containing class relations such as associations, aggregations and so on, and also multiplicity. (1.5 points)

b) Perform the composite structure diagram of this system. Your diagram should model communication channels between system entities. (1.5 points)

c) Make the state diagram of the most important / complex class of your system. (2 points)

3) Modeling advanced real-time constraints

a) We now assume that the barriers take between 4 and 6 seconds to be lowered, and the same to go to their open position. What are the TURTLE operators that you would have used to model this behavior, both at analysis and design steps? You may provide subparts of relevant diagrams if necessary (2 points)