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Exercises for
Cyber-Physical Systems Fundamentals
Summer Semester 19

Exercise Sheet 4

(18 Points)

Please note: Solutions to theory assignments must be submitted (individually or in pairs) until 11.06.2019 at 12:00 AM (post box in OH16, ground floor, in front of room E16). Submitting solutions via mail is *not* possible. Discussion: 12-13.06.2019.

1 Specification and Modeling Languages - Theory (2 Points)

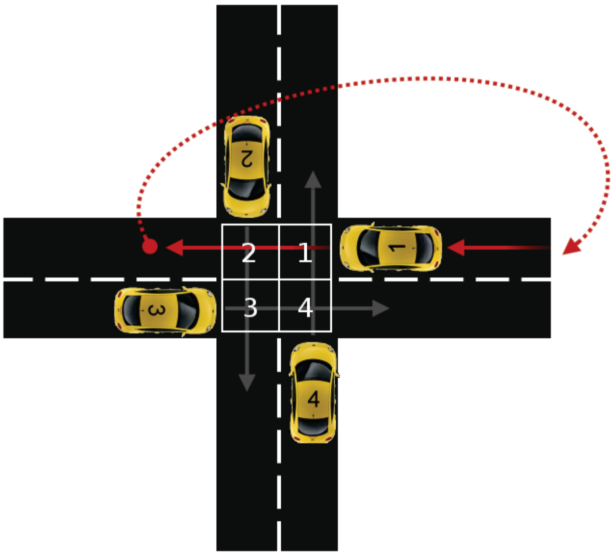
Name at least two requirements for specification and modeling languages for embedded systems.

2 Imperative Programming Languages - Theory (2 Points)

Mr. Smart wants to use Java as the programming language for his design of real-time embedded systems. What are the problems and issues that he may face? Explain the problems with imperative languages and shared memories. What is your conclusion about such models?

3 Petri Nets - Theory (4 Points)

Model the following traffic situation using a Petri Net: For simplification, the crossroads are divided into four allocable quadrants. Initially, each car is in the state *approaching*. Thereon, it may switch to the state *waiting*, i.e., it occupies the quadrant in front of it. If the quadrant on its right side is empty, i.e., if no car is approaching from the right side, it may cross the crossroads in the state *driving*. In consequence, the previously occupied quadrants are empty.



Please note:

- Cars approaching from the right side always have the right of way.
- Cars are not allowed to turn, but can only drive straight ahead.
- The petri net should be modeled in such a way that cars return to the crossroads after having passed it.

4 Preparation - Practice (3 Points)

Please note: The solution to this assignment must be submitted!

Previous to the exercise session, read chapter 7 and 13.5 in the OSEK manual. Please answer the following questions:

a.) Name the unique identification characteristics of an event.

b.) Which system services can only be executed by the task that owns the event?

c.) Why can only an extended task own an event?

5 OSEK Events (7 Points)

In the CI-Lab, choose the virtual machine `es` and log on. Download the folders `ev3osek` and `04` from the course website in case they are not located in your home directory. Copy the folder `ev3osek` to your home directory and the content of the folder `04` into the folder `example`, which is located in `ev3osek`. Switch to the folder `../example/AdvancedCollisionDetect` and open the file `adv_collision.c`.

Complete the .c file so that the robot makes a turn if an obstacle is in front of it. For this purpose, use the event `DistanceEvent`, which is owned by the task `Motors`. The task `CheckDistance` has priority 2 and is executed twice per second. The task `Motors` has priority 1 and is also executed twice per second. Both tasks can be active only once. Please note that the LED flashes in green if the robot makes a turn.