Final Exam Distributed Systems and Network Communication

Bachelor Robotics (IRO)

21st of July 2022, 12:00–13:30

Name and Matr.-No.: _____

Authorized aids:

- lecture notes
- personal notes
- standard pocket calculator

Important remarks:

- The examination is to be done independently and without any help. Cheating and attempted cheating is sanctioned according to §19(1) RaPO.
- Mobile phones, smartwatches, notebooks or programmable calculators are not permitted. Mobile phones must be switched off.
- Write down your name and matriculation number on the cover sheet.
- Write your solutions in the prepared empty boxes ☐ or on the blank pages.
- Only if your approach to a solution/answer is written down comprehensibly and transparently, it is graded.
- Hand back all task sheets.
- Do not remove the staple.
- Do not use a red pen.

Good luck!

Task:	1	2	3	$\sum$
Points:	15	15	15	45
Scored points:				

Task 1: Concurrent Programming

15 points

Implement a concurrent program in Java: implement a class `ExamThread` that prints an arbitrary text to the command line. The text should be repeated every n milliseconds. The text and the waiting time n is defined at the creation of the thread object. `ExamThread` should be prepared for future use in an inheritance hierarchy. In addition, all `ExamThread` objects should be stoppable in a consistent way.

Implement also a `main()` method that creates two objects of your `ExamThread` class and starts them concurrently.

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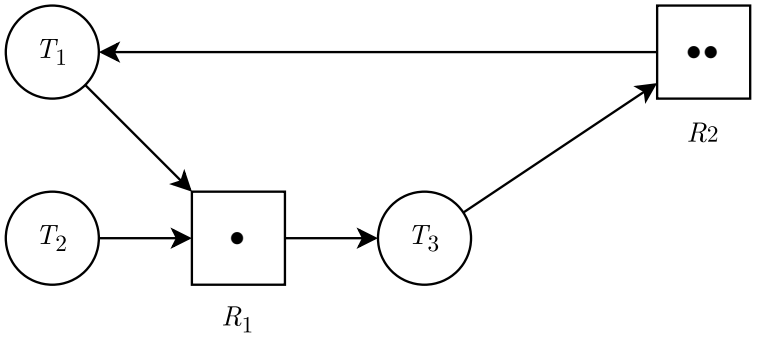
Task 2: Request-Allocation-Graph 15 points

Given is the following request-allocation-graph with three threads T_1, T_2, T_3 and two resources R_1, R_2.



Which of the following statements is correct. Tick the correct answers!

- ◯ There are two exemplars of resource R_1 and one exemplar of resource R_2.
- ◯ T_1 uses one exemplar of resource R_2.
- ◯ T_1 and T_2 can be executed.
- ◯ T_1 and T_2 must wait for release of R_1.
- ◯ T_3 cannot be executed.
- ◯ R_1 is the bottleneck in this system.
- ◯ In this graph a deadlock is possible.
- ◯ The graph states that T_3 is executed before T_1 and T_2. In which sequence T_1 and T_2 are executed is not defined.
- ◯ The request-allocation-graph describes the dependencies between threads and resources and the timing of execution.
- ◯ In this graph a deadlock is not possible.

Task 3: Design Principles of Client/Server-Software

15 points

In a sequence, a server receives three client requests R_1, R_2 and R_3. Let R_1 have a processing time of $3t$, let R_2 have a processing time of $1t$, and let R_3 have a processing time of $2t$.

The server is implemented two times with different design principles: firstly, a connection-less, iterative server with first-come-first-served is used; secondly, a connection-oriented, parallel server with round-robin is used.

a) Draw a sketch in which sequence the requests are processed for both design principles.

b) Calculate for both design principles the average processing time t_{avg}! What did you notice?

c) Which of the two servers in this special case performs better?

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