Distributed Algorithms
Jacobs University Bremen
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Course: CA-CS-803
February 18th, 2021

Homework 1

- Submit one ZIP file per homework sheet which contains one PDF file (including pictures, computations, formulas, explanations, etc.) and other files if needed.

Problem 1.1 *Asynchronous and Synchronous Message Passing* (3 points)

The send, receive, and reply operations may be synchronous or asynchronous. A synchronous operation blocks a process till the operation completes (as mentioned in slide 25, Lecture 3 – B cannnot be busy or down). An asynchronous operation is non-blocking and only initiates the operation. Interestingly, synchronous/asynchronous implies blocking/not blocking but not vice versa, meaning that not every blocking operation is synchronous and not every non-blocking operation is asynchronous. Explain why. You can use examples in your explanation.

Problem 1.2 *Always True vs. Invariant* (3 points)

Give an example transition system S and an assertion P such that P is always true in S, but is not an invariant of S. Why is this possible?

Problem 1.3 * *Reachable Configuration* (4 points)

Configuration δ is reachable if it is reachable from an initial configuration. To check whether each state is reachable naively we need to send a query for each (S, D), i.e., every pair source-destination. However, an obvious reason for the limited efficiency of this approach, is that this approach does not exploit the assumption that not all pairs in $S \times D$ are reachable. Consequently, this approach can also not reuse any intermediate computations and thus likely performs many redundant computations. Briefly propose an alternative algorithm to check for reachability more efficiently. The answer does not need to describe the algorithm to the smallest details.

** Problems with a star are more difficult and not to be directly related to the requirements/final exam of the course.*

How to submit your solutions

You can submit your solutions via *Grader* at **`https://grader.eecs.jacobs-university.de`** as one generated ZIP file containing one PDF file and other files if needed.
If there are problems with *Grader* (but only then), you can submit the file by sending mail to `k.lipskoch@jacobs-university.de` **with a subject line that starts with CA-CS-803**.

Please note, that after the deadline it will not be possible to submit solutions. It is useless to send solutions by mail, because they will not be graded.

This homework is due by Wednesdays, February 24th, 23:00.