

**Examples of exam questions  
for the timed open-book take-home exam  
“Modeling and control of hybrid systems” (SC42075)**

1. Give a new example (i.e., one that has not been discussed in the lecture notes, the slides, the lectures, the assignment of this and previous years) and that illustrates a concept/definition (e.g. hybrid automaton, timed automaton, Petri net, PWA model, sliding mode, bisimulation, generalized gradient, . . . ) and use the example to explain the given concept/definition in your own words.
2. Give an example of a hybrid system that satisfies a certain property (e.g., a non-deterministic hybrid automaton) that has not been discussed in the lecture notes, the slides, the lectures, the assignment of this and previous years and motivate your answer.
3. Given a simple PWA, MLD, ELC, LC, or MMPS system, transform it into an equivalent MLD, ELC, LC, MMPS, or PWA system; what are the conditions under which this is possible? Motivate your answers.
4. Given a drawing of the switching curve a switched system with 2 regions, a point on that curve, and the vector fields for each region in that point, describe which trajectory or trajectories can result. Motivate your answer.
5. What are the main strengths and weaknesses of a particular hybrid systems approach or method (e.g., a Lyapunov function approach to stability of switched systems)? Motivate your answer.
6. Think of an example of a hybrid system in your own neighborhood (e.g., related to one of your hobbies). Briefly describe the system and model it as a hybrid automaton.
7. Is it possible to claim that a certain property holds (e.g., all MMPS models are deterministic)? Motivate your answer.

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