Winter 2019
Instructors: Tatjana Petrov, Stefano Tognazzi
(lecture+exercise) **Probabilistic Modelling for Computer Scientists**

(this document is complementary to the official information in ZEuS, will be uploaded on ILIAS)

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Participants:

Sessions:
Each session will be either a lecture or exercise session. Homeworks will be due in either one or two weeks (see the class schedule for details). One student will be assigned a 'scribe duty'.

Record of assessment:
50% points HW
40% exam
10% overall participation

A total of
1.3 (95-100%)
1.7 (85-95%)
2. (75-85%)
2.3 (65-75%)
2.7 (55-65%)
fail (<=50%)
(grade 1 is given in exceptional cases)

Perspective:
Particularly interested students can attend the seminar on advanced topics in probabilistic modelling which will take place in summer semester 2020, and are very welcome to suggest a Master's project and/or thesis work. The list of papers discussed in last year's seminars and possible project topics will be disseminated in class.

Class schedule:

Class	Date	Presenter	Contents	Scribe
1	22.10.19	Lecture/T	General info	
2	29.10.19	Lecture/T	Probability Refresher: Probability spaces Random variables Stochastic processes **HW1 assigned (Lecture Week 2)**	
		Exercise/S	Example HW1 solved	
3	05.11.19	Lecture/T	Discrete-time Markov chains (DTMCs): Geometric Distributions DTMC Transient Probability Distribution Long-Run Probability Distribution **HW2 assigned (Lecture Week 3)**	
		Exercise/S	**HW1 due** HW1 solved	
4	12.11.19	No class		
		Exercise/S	Example HW2 shown	
5	19.11.19	Lecture/T	DTMC: Reachability events A measurable space on infinite paths Reachability probabilities as linear equation solution **HW3 assigned (Lecture Week 5)**	
		Exercise/S	**HW2 due** HW2 solved	
6	26.11.19	Lecture/T	Probabilistic Computational Tree Logic (PCTL): PCTL Syntax PCTL Semantics PCTL Model Checking Complexity	
		Exercise/ Lecture	Example HW3 shown Qualitative properties DBA	

7	03.12.19	Lecture/T	Continuous-Time Markov Chains(CTMC): Exponential Distributions CTMC Semantics **HW4 assigned (Lecture Week 6)**	
		Exercise/S	**HW3 due** HW3 solved Example HW4 shown	
8	10.12.19	Lecture/T	CTMC: Transient distribution Uniformisation Strong and weak bisimulation Computing transient probabilities **HW5 big homework assigned (Lecture Week 7 and 8)**	
		Exercise/S	**HW4 due** HW4 solved	
9	17.12.19			
		Exercise/S	Example HW5 solved General questions	
10	24.12.19			
11	31.12.19			
12	07.01.20			
		Exercise/S	**HW5 due** HW5 solutions	
13	14.01.20	Lecture/T	Qualitative properties Fairness Almost Sure probability Omega-regular languages Deterministic Buechi automata **BONUS HW assigned (Lecture Week 13)**	
		Exercise/Lectures	Bonus HW discussed General recap HW1-HW5	

14	21.01.20	Lecture/T	Statistics Refresher **HW6 assigned (Lecture Week 14)**	
		Exercise/S	Example HW6 solutions	
15	28.01.20	Lecture/T	Parameter inference for Markov chains **HW7 assigned (Lecture Week 15)**	
		Exercise/S	**HW6 due** HW6 solutions Bonus HW solutions (if any submissions)	
16	04.02.20	Lecture/T	Other probabilistic models of computation: Markov decision process (MDP)/Stochastic games Graphical models - Bayesian networks: hidden Markov models, neural networks, variable-order Markov models - Markov random fields	
		Exercise/S	**HW7 due** HW7 solutions Exam preparation	
17	11.02.20	**EXAM**	DTMC, CTMC, parameter inference	