Written Examination of the Lecture
Smart Process Analytics (SPA)
Prof. Dr. Patrick Delfmann
Summer Term 2020, 2020-06-08, 12:30h, M001

Matriculation number: _____

Program of study: _____

Forename and surname: _____

Exam regulations version: _____

Please note your name on **each** page.

Duration: 60 minutes
Maximum points: 60

Contents

Task		Points
Task 1: Process Mining with the alpha+-Algorithm	(15 Points)	
Task 2: Process Mining with the Multiphase Miner	(15 Points)	
Task 3: Process Mining with the Genetic Miner	(13 Points)	
Task 4: Predictive Process Monitoring with RegPFA	(9 Points)	
Task 5: Predictive Process Monitoring with N-Grams	(8 Points)	
Total	**(60 Points)**	

Grade of the examination: _____

Case study grade: _____

Total grade: _____

Name: _____

Please note that you can choose whether to answer the tasks in **English** or in **German**.

Task 1: Process Mining with the alpha+-Algorithm (15 Points)

Consider the following event log, which was already rewritten to distinguish the different event traces. Use the alpha+-algorithm to mine a petri net from it. You should provide the following results: *preprocessing result*, *at least one matrix*, *the clusters of transitions causing each other*, and *the petri net*. Explain your results!

Trace #	Event sequence
1	A D D E F G H
2	A D D B C D E G F H
3	A B C B C E G F H
4	A E F G H

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Task 2: Process Mining with the Multiphase Miner (15 Points)

Consider again the event log from Task (1). Use the Multiphase Miner to mine an EPC from it. To identify tasks that must be performed in parallel, you can reuse your results from Task (1). You should at least provide the following results: *The folded instance graphs*, *the folded total graph*, and *the EPC*. Explain your results! *Hint: You do NOT need to transform the EPC into a Petri Net.*

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Task 3: Process Mining with the Genetic Miner (13 Points)

The Genetic Miner walks through the following steps to produce a process model that fits a given log best:

1. Read the event log
2. Build the initial population of process models
3. Calculate fitness of the individuals in the population
4. Stop and return the fittest individuals?
5. Create next population – use elitism and genetic operators

a) To represent process models, the Genetic Miner makes use of so-called causal matrices. Please build such a matrix that represents the Petri Net from Task (1). (8 Points)

b) In the figure below you can see two exemplary individuals of a population of the Genetic Miner that were selected to be crossed-over to create new individuals for the next population. Perform an exemplary crossover in the way the Genetic Miner does it using the crossover operations *new*, *merge*, and *complement/add*. (5 Points)

ACTIVITY	I(ACTIVITY)	O(ACTIVITY)
A	{}	{{F,B,E},{E,C},{G}}
B	{{A}}	{{D}}
C	{{A}}	{{D}}
D	{{F,B,E},{E,C},{G}}	{}
E	{{A}}	{{D}}
F	{{A}}	{{D}}
G	{{A}}	{{D}}

Model 1

ACTIVITY	I(ACTIVITY)	O(ACTIVITY)
A	{}	{{F,B,E},{E,C},{G}}
B	{{A}}	{{D}}
C	{{A}}	{{D}}
D	{{F,B,E},{E,C},{G}}	{}
E	{{A}}	{{D}}
F	{{A}}	{{D}}
G	{{A}}	{{D}}

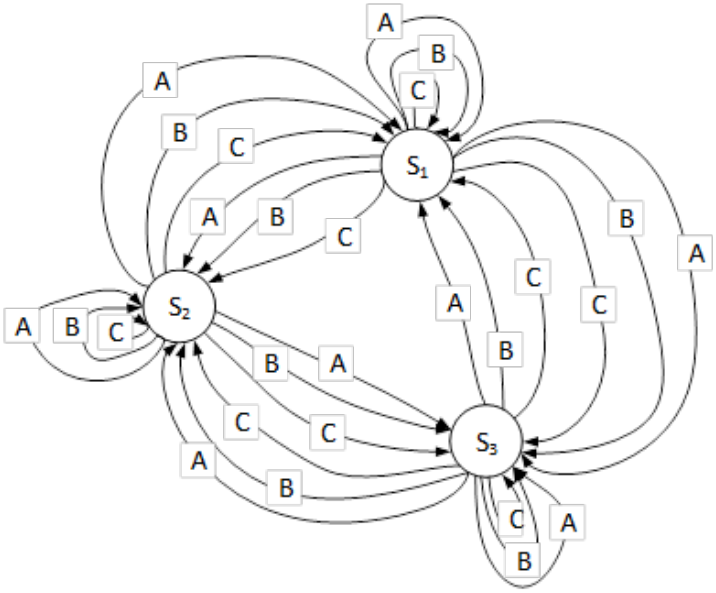
Model 2

Name: _____

Task 4: Predictive Process Mining with RegPFA (9 Points)

The RegPFA Miner makes use of probabilistic finite automatons (PFA) to represent process models. Such an automaton is trained using the EM Algorithm and an event log.

a) In the figure below you find an exemplary PFA. How does this PFA represent a process model? What are the concepts named S_1, S_2 and S_3? What are the events? How would a process instance pass through the PFA? (5 Points)



b) Consider again the PFA in the figure. Why is it probabilistic? How could we predict how a process instance would behave in the future? (4 Points)

Name: _____

Task 4: Predictive Process Monitoring with N-Grams (8 Points)

What is an N-Gram? How can we use it to predictively monitor business processes? How are N-Grams calculated?

Good speed!