Topics for seminar on process analysis (CS 719 & SM 457, HWS 2021)

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The following topics are suggested for the literature study you shall conduct. The questions after each topic are included to provide a bit more information of what the topic entails and can serve as inspiration for the research question that you will aim to answer in your literature study.

Develop your own: You are also free to propose your own topic by looking at publications at key venues such as the international conferences on *Business Process Management* (BPM), *Advanced Information Systems Engineering* (CAiSE), and *Process Mining* (ICPM), as well as journals such as *Information Systems* and *Decision Support Systems*. Topics can relate to research areas such as process analysis, process mining, stream processing, and robotic process automation.

Process modeling and analysis:

- 1. **Process model quality.** *"All models are wrong, but some are useful"* definitely also applies to business process models. In that regard, what factors influence the usefulness and understandability of process models?
- 2. Business process simulation. The execution of a business process can be simulated in order to gain insights about the process' as-is or to-be states. What role does simulation play in the context of business process analysis? What are the existing techniques, capabilities, and limitations?
- 3. **Hybrid process modeling.** Process modeling notations can be roughly divided into imperative (describing exactly what can happen) and declarative ones (describing the bounds of what is permissible); Hybrid modeling notations combine both paradigms in an attempt to leverage their respective strengths. What modeling languages, approaches, and analysis techniques exist for this purpose?
- 4. **Process model querying.** Process model querying can be used to retrieve relevant process models from repositories, which commonly contain hundreds or even thousands of different models. For what purposes is such querying useful and what approaches exist to perform it?
- 5. Process model abstraction vs event abstraction. Process model abstraction techniques aim to simplify complex process models by grouping together tasks and omitting certain details. Which techniques exist for this purpose and which of these could also be used in order adapted to the context of event log abstraction?

Process mining:

- 6. **Process mining in manufacturing.** While process mining can be used to analyze processes in a broad range of domains, its particular benefits and limitations may differ per context. As such, how is process mining used to analyze manufacturing processes and what are specific challenges that ought to be considered?
- 7. **Event data extraction.** One of the inhibitors of process mining in practice is to obtain the right data for further analysis. From which sources does this data typically stem and which approaches exist that can support the extraction task?
- 8. **Uncertainty in process mining.** Event logs used for process mining can suffer from a broad range of data quality issues, which can lead to situations in which it is no longer clear what exactly happened, i.e., to uncertainty. What methods exist to represent and deal with uncertain data in process mining?
- 9. Novelty detection in business processes. Techniques for anomaly detection aim to identify undesired process behavior by looking for abnormalities. Yet, behavior that is unseen is not necessarily problematic, but may just be new. Therefore, how do novelty detection techniques differentiate between an anomaly and a novelty? What are the possibilities and limitations of existing techniques?
- 10. **Prescriptive process monitoring.** Techniques for prescriptive monitoring use predictions to make recommendations about what should be done for on-going process instances. What are the current capabilities of these techniques and how will this area develop?
- 11. Low-dimensional representations of event data. Real-life event logs can contain broad ranges of trace variants and have a large variety in terms of their event and case attributes. Therefore, a key problem for process mining is the high dimensionality of its input data. To overcome this issue, what representation methods and approaches can be employed when dealing with event logs?
- 12. **Causality detection in process mining.** *"Correlation does not imply causation"* needs to be kept in mind when analyzing recorded data about a process. Yet, understanding causes can be highly important for process analysis. What are existing techniques in process mining that can discover causal relationships from event data?

Beyond traditional process mining:

- 13. **Complex event processing and process analysis.** Complex Event Processing (CEP) analyzes streams of low-level event data in order to recognize important patterns. How can concepts from CEP be employed in the context of business process analysis?
- 14. **Object-centric process mining.** Traditional process mining requires that each process instance can be captured in a flat representation, assuming that all events in a process instance have a one-to-one relation to each other. Object-centric process mining tries to move away from this assumption by allowing for the representation of one-to-many and

many-to-many inter-relations. What process mining methods and analysis techniques currently exist for this paradigm?

15. Online pre-processing of event data. Recently, the notion of online process mining received an increasing amount of attention, whereby techniques are applied on ongoing event streams rather than post-hoc, on event logs. However, these techniques assume the input stream to be free of noise and other data quality issues, which is often not realistic. Which techniques exist to pre-process event streams for process mining in real-time and which techniques for offline pre-processing could be adapted or moved to an online setting?