SEOULTECH
Seoul National University of Science & Technology

Term Project – BPM with Process Mining

To be completed in teams of 6 members

Background

Dhana is a European bank providing a range of financial services, including home and business banking, checking and savings account, debit and credit cards, investment management and loans.

The Loan Application Process

One of the core services provided by Dhana is their loan services, provided via their loan application process. This process supports different types of loans:

Courtesy of Dhana, we have obtained an event log containing all loan applications filed with the bank in 2016. The event log has been given to you separately. The event log contains about 761K events pertaining to 20.3K loan applications, handled by 146 bank employees. For these applications, a total of 26.8K offers were created. There are three types of events: Application state changes (starting with "A"), Offer state changes (starting with "O") and Workflow activity instances (starting with "W"). The activity instances have start and end timestamps. The events corresponding to state changes only have one timestamp.

For each loan application, the following data is available in the log:

- Requested load amount (in euros),
- The application type,
- The reason the loan was applied for (LoanGoal),
- An application ID.

For each offer, the following data is available:

- An offer ID,
- The offered amount,
- The first withdrawal amount,
- The number of payback terms,

- The monthly repayment cost,
- The credit score of the customer,
- The employee who created the offer (Resource),
- Whether the offer was selected,
- Whether the offer was accepted by the customer.

There may be multiple offers per loan application but at most one offer is accepted per loan application.

A loan application goes through a lifecycle consisting of the following states:

- **Application Created:** a new application has been created via the website.
- **Submitted:** a customer has submitted the application via the website. If the new application is created directly by the bank, this state is skipped.
- **Concept:** the application is in the concept state, that means that the customer just submitted it (or the bank started it), and a first assessment has been done automatically. An employee calls the customer to complete the application.
- **Accepted:** after the call with the customer, the application is completed and assessed again. If there is a possibility to make an offer, the state is accepted. The employee now creates one or more offers.
- **Complete:** the offers have been sent to the customer and the bank waits for the customer to return a signed offer along with the rest of the documents (payslip, ID etc)
- **Validating:** the offer and documents are received and checked.
- **Incomplete:** if documents are not correct or some documents are still missing, the application state is set to 'incomplete', which means the customers need to send in further documents.
- **Pending:** if all documents are received and the assessment is positive, the loan is final, and the customer is paid.
- **Denied:** if somewhere in the process the loan cannot be offered to the customer, because the application does not fit the acceptance criteria, the application is declined, which results in the state 'denied'.
- **Cancelled:** if the customer never sends in their documents or calls to tell they do not need the loan anymore, the application is cancelled.

Tasks

Dhana has been experiencing a large number of complaints from their loan applicants due to long waiting times and non-uniform experience across the range of loan services the bank offers. Over time, this has led to a non-negligible churn rate, which has now obliged the bank to take remedial actions to avoid losing more clients.

Working in **groups of 6 members** as part of Dhana's Business Intelligence team, you are requested to analyse this event log in order to gain insights into the loan application process and produce a report which provides your employer with a clear understanding of where the problems are, and recommendations as to what interventions can be applied to improve the customer experience across different loan types. Specifically, the report should address the following points (tasks):

1. **SLA Compliance Analysis.** Are the bank's SLAs for handling loan applications met? If not, what's the frequency of SLA violations per loan type? The SLAs (from start to end) are as follows:
    - Car loans: 28 days
    - Home improvement: 21 days
    - Loan takeover: 14 days
    - All other loans: 28 days
2. **Cycle Time Analysis**. The *cycle time up to a milestone* is the average time between the moment a case starts and the moment it reaches a given milestone. Each of the above application states is a milestone. What are the cycle times at each of the milestones of this process? Some of the milestones in this process represent points where work needs to be done by the bank. Other milestones are points where an input is needed from the customer. How much of the cycle time of this process is being spent in work done inside the bank versus how much is being spent waiting for inputs from the loan applicants. In other words, to what extent the bank is responsible for the cycle time of the process, and to what extent the loan applicant is responsible for this cycle time.
3. **Rework Analysis:** Is there any rework loop in this process? If so, what is its impact of each rework loop on the cycle time (i.e. by how much does the occurrence of the rework

loop increases the process)? Note: here we define a rework as one or a sequence of activities that occurs twice or more in the same case.

4. **Analysis of Cancellations:** How many loan applications are cancelled? What are the characteristics of the loan applications being cancelled? Is there any common pattern among them?
5. **Impact of Application Incompleteness:** Does the frequency of incompleteness influence the final outcome? The bank's hypothesis is that if applicants are confronted with more requests for completion, they are more likely not to accept the final loan offer.
6. **Impact of Fraud Assessments:** Is there a difference in cycle time between the cases that include a fraud investigation and those that do not?
7. **Analysis of Multiple Offers:** How many customers ask for more than one offer? Are these offers asked as part of a single conversation or multiple conversations? Does the number of offers matters in terms of conversion rate? In other words, does the number of offers impact on the likelihood of the applicant accepting a loan offer?
8. **WIP Analysis:** Is the WIP of the process constant over the timeframe of the log. If not, what factors can explain the change(s) in WIP?
9. **Free-Form Analysis:** Any other interesting insights about factors that affect waiting times, cycle times, or the outcome of the process (the acceptance of a loan offer)? This last part of the project is a creative exercise: you decide what do you want to put here. This item is graded subjectively based on the level of creativity of your analysis approach, and how insightful are your findings. You can suggest some process redesign based on the principles and methods that we learned in class.

What to submit?

You must submit through e-class a slide deck or a report (your choice) in PDF, PPTX or DOCX format, containing one section (or one or more slides) for each of the tasks enumerated above. For each task, you should report your solution method and your findings. For tasks 1 to 8, you should ensure that you answer the questions posed for each task, your findings should be supported by adequate evidence in the form of screenshots of analytical outputs (e.g., process maps, dashboards, filters applied, snapshots of log animations, etc.).

The report should include a title slide with the names of the members of the team.

The report will be graded as follows:

- Task 1 to Task 8: 1.5 points for each task
- Task 9: 3 points
- Total: 15 points

The aspects to be evaluated for each task are:

Level /Points	Poor (20%)	Fair (50%)	Good (80%)	Excellent (100%)
Effectiveness in Process Mining (25%)	Minimal use of process mining tools; little to no understanding of the underlying process model.	Basic use of process mining tools; some understanding of the process model but significant gaps or inaccuracies.	Competent use of process mining tools; a clear understanding of the process model with minor gaps.	Expert use of process mining tools; comprehensive and accurate understanding of the underlying process model.
Depth of Analysis (30%)	Superficial analysis; lacks depth in evaluating the required task.	Basic analysis; some evaluation of the required task, but lacking in thoroughness and detail.	Comprehensive analysis; thorough evaluation covering all key aspects of the required task with minor omissions.	Exceptional, detailed analysis; in-depth and insightful evaluation of all aspects, providing a nuanced understanding of the required tasks, and other factors.
Insights and Recommendations (30%)	Few or irrelevant insights; impractical or vague recommendations.	Some useful insights: recommendations are somewhat practical but lack specificity or depth.	Clear, relevant insights; practical and well-considered recommendations.	Exceptional, deep insights; highly practical, detailed, and innovative recommendations that clearly improve the process.
Clarity of Communication (15%)	Communication is unclear or disorganized; findings and insights are poorly conveyed.	Basic communication: some clear points but overall lacking in organization or effectiveness.	Clear and organized communication; findings and insights are well-presented but may lack some engagement or clarity in places.	Exceptional clarity and organization; findings and insights are communicated effectively, engagingly, and persuasively.

Your team should give an oral presentation. Each team will have 12 minutes to present (plus 5 minutes for questions). The presentation should cover all the selected tasks. You do not need to introduce the problem because all the groups are working with the same problem. All team members must be present and participate in the presentation.

Acknowledgments

The scenario and the event log upon which this project is based are based on the 2017 Business Process Intelligence Challenge (BPIC'2017). However, the dataset and questions are not the same as those of the above challenge.