**Institute of Computer Science**

**MTAT.03.231 – Business Process Management**

**Final Exam – 9 June 2020**

*Notes:*

- *The exam is online, open-book, open-laptop, open-Internet. You can consult any course material during this part of the exam and you can browse the Web. Part B can be submitted on paper or electronically using the "Submit" button (as a single zip file or a single PDF file)*

- *You are not allowed to share information with anyone during the exam except with the lecturer. Your answers to this exam questions should be the output of your own intellectual effort.*

# Part A. Short-Answer Questions (20 points)

**A.1. [5 points]** An insurance company receives 220 calls daily from customers who want to lodge an insurance claim. The call centre is open from 8:00 to 17:00. The arrival of calls follows a Poisson process. Looking at the intensity of arrival of calls, we can distinguish three periods during the day: the period 8:00 to 11:00, the period 11:00 to 14:00 and the period 14:00 to 17:00. During the first period, around 60 calls are received. During the 11:00-14:00 period, 120 calls are received, and during the period 14:00 to 17:00, 40 calls are received. A customer survey has shown that customers tend to call between 11:00 and 14:00 because during this time they have a break at work and they take advantage of their break to make their personal calls.

Statistical analysis shows that the durations of calls follow an exponential distribution.

According to the company's customer service charter, customers should wait no more than one minute on average for their call to be answered.

The call centre has 6 call centre agents. On average the duration of a call is 6 minutes.

The call centre manager would like to ensure that the average waiting time is below one minute, even during peaks times.

*Task: Given the above information, are customers waiting for less than one minute on average, during peak times? In addition to answering this yes/no question you must include one or two screenshots showing the parameters you gave as input to the queueing theory tool, and the output you obtained.*

**A.2. [5 points]** The following BPMN model captures a fragment of a process for rental of construction equipment at a construction company. Each task is annotated with the corresponding processing time. The process model is also annotated with branching probabilities (not all branching probabilities are shown, but the missing ones can be inferred). On average, there are 40 equipment rental requests per week.
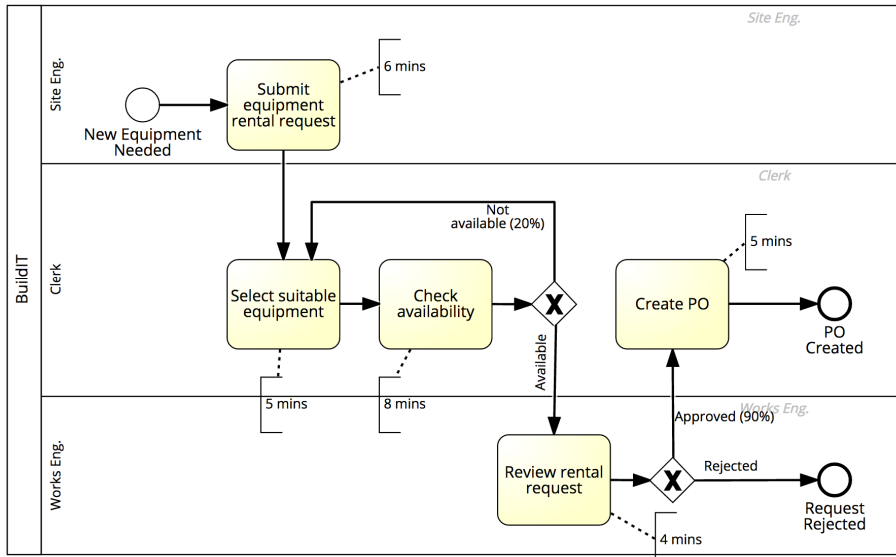
**Task:** *Write an arithmetic expression to calculate the theoretical cycle time of this process. You don't need to calculate the theoretical cycle time, but just to write an arithmetic expression. To give you an idea, this is an example of an arithmetic expression: 3 + 0.8\*(2+2)*

**A.3 [6 points]** A travel agency has recently lost several customers due to complaints about poor customer service. The management team of the travel agency decided to appoint a team of analysts to address this problem. The team gathered data by conducting interviews and surveys with current and past corporate customers and also by gathering customer feedback data that the travel agency has recorded over time. About 2% of customers complained about errors that had been made in their bookings. In one occasion, a customer had requested a change to a flight booking. The travel agent wrote an email to the customer suggesting that the change had been made and attached a modified travel itinerary. However, it later turned out that the modified booking had not been confirmed in the flight reservation system. As a result, the customer was not allowed to board the flight and this led to a series of severe inconveniences for the customer. Similar problems had occurred when booking a flight initially: the customer had asked for certain dates, but the flight tickets had been issued for different dates. Additionally, customers complained of the long times it took to get responses to their requests for quotes and itineraries. In most cases, employees of the travel agency replied to requests for quotes within 2–4 working hours, but in the case of some complicated itinerary requests (about 10% of the requests), it took them up to 2 days. Finally, about 5% of customers also complained that the travel agents did not find the best flight connections and prices for them. Several customers reported that they had found better itineraries and prices on the Web by searching by themselves.

**Task:** *Write an issue register for this process. You should assume that the travel agency receives around 100 itinerary requests per day and that the agency makes 50 bookings per day. Each booking brings a gross profit of 100 to the agency. On average, every two complaints lead to a customer churning (to "churn" means to switch to another service provider in future dealings).*

**A.4 [4 points]** We consider again the same process described in the previous task. *Draw a why-why diagram for each of the issues in your issue register.*

# Part B. Process Modelling, Analysis & Redesign (20 points)

We consider the following process performed by an IT helpdesk that handles requests from clients. The clients are employees of a company. There are about 1000 employees in total. A request may be an IT-related problem that a client has, or an access request (e.g. requesting rights to access an IT system). Requests need to be handled according to their type and their priority. There are three priority levels: "critical", "urgent" or "normal".

The current process works as follows. A client calls the help desk or sends an e-mail in order to make a request. The help desk is staffed with five "Level-1" support staff who typically are junior people with less than 12 months experience, but are capable of resolving known problems and simple requests. The hourly cost of a Level-1 staff member is EUR 40.

When the Level-1 employee does not know the resolution to a request, the request is forwarded to a more experienced "Level-2" support staff. There are three Level-2 staff members and their hourly cost is EUR 60. When a Level-2 employee receives a request, she evaluates it and assigns it a priority level. The job tracking system will later assign the request to the same or another Level-2 staff depending on the assigned priority level and the backlog of requests.

Once the request is assigned to a Level-2 staff member, the request is researched by the Level-2 employee and a resolution is developed and sent back to the Level-1 employee. Eventually, the Level-1 employee forwards the resolution to the client who tests the resolution. The client notifies the outcome of the test to the Level-1 employee via e-mail. If the client states that the request is fixed, it is marked as complete and the process ends. If the request is not fixed, it is resent to Level-2 support for further action and goes through the process again.

Requests are registered in a job tracking system. The job tracking system allows help desk employees to record the details of the request, the priority level and the name of the client who generated the request. When a request is registered, it is marked as "open". When it is moved to level 2, it is marked as "forwarded to level 2" and when the resolution is sent back to "Level 1' the request is marked as "returned to level 1". Finally, when a request is resolved, it is marked as "closed". Every request has a unique identifier. When a request is registered, the job tracking system sends an e-mail to the client. The e-mail includes a "request reference number" that the client needs to quote when asking questions about the request.

The helpdesk receives approximately 50 new requests per working day.

The current process is known to be error-prone. The most frequent types of errors include:

- Many requests take too long to be processed. Clients need to call often to remind the helpdesk that their requests are still unresolved

- When the client asks what is the status of a given request, oftentimes the helpdesk gives an incorrect answer. In other words, the Level-1 helpdesk staff are unable to accurately determine what is the status of every request.

- When reviewing the list of open requests, the Level-1 staff often find many requests marked as "open", but these requests are in fact already resolved.

**Task B1 [8 points].** Draw a BPMN diagram of the above process.

**Task B2 [6 points].** Calculate the cycle time efficiency of this process assuming that:

- Submitting and registering a new request takes 5 minutes on average.

- Requests spend on average 1 hour waiting for a Level-1 staff to check them. This applies both to new requests and to re-submitted requests.

- Checking if a new request is "known" takes on average 10 minutes. In 20% of cases the request is known. In this case, it takes about 5 minutes for the Level-1 staff to communicate the resolution to the client. Once this is done, the request is marked as "closed". On the other hand, if the request is not "known", the request is automatically forwarded to Level 2.

- New requests spend on average 2 hours waiting for a Level-2 staff to evaluate them. Level-2 staff take on average 20 minutes to evaluate a new request.

- Level-2 staff take 5 minutes to prioritize a request.

- The time between the moment a request has been prioritized, and the moment the request is picked-up by a Level-2 staff member is 20 hours.

- The time required to research and resolve a request is on average 2 hours.

- The time to write the resolution to a request is on average of 20 minutes.

- Once a Level-2 staff has written the resolution of a request, it takes on average 20 hours before a the request is fetched from the job tracking system by a Level-1 staff.

- It takes on average 20 minutes for a Level-1 staff to send to the client a problem resolution previously written by a Level-2 staff.

- It takes on average 20 hours between the moment a resolution is sent by the Level-1 staff , and the moment the resolution is tested by the client.

- It takes the client around 10 minutes to e-mail the test results to the Level-1 staff.

- In 20% of cases the request is not resolved, and it needs to be forwarded to Level-2 again. In this latter case, it takes about 2 minutes for the Level-1 to forward the request to the Level-2 staff. Unresolved requests that are forwarded in this way are automatically marked as "prioritized since they have already been prioritized in the previous iteration.

**Task B3 [6 points].** Propose two or three changes to address the issues raised in the above description. Give a justification for each change.

## Part C. Process Mining (10 points)

We consider two event logs of a process for handling health insurance claims (L1 and L2). Log L1 contains all the cases executed in 2011, while L2 contains all cases executed in 2012. The logs can be found here: http://tinyurl.com/InsuranceLogs

Based on these logs, answer the following questions using Apromore (the logs are available in the Apromore Tartu node).

**C.1. [3 points]** Describe the differences between the frequency of tasks in these two logs?

**C.2. [3 points]** Describe the differences in the ordering of activities between these two logs?

**C.3. [4 points]** From a waste analysis perspective, the main difference between log L1 and log L2 is the fact that in L2, there is less overprocessing. Explain why there is overprocessing in L1, and how this overprocessing is avoided in L2?

*Hint: Set the abstraction slider to around 60%.*