Institute of Computer Science

MTAT.03.231 – Business Process Management

Regular Exam – 5 June 2018

Notes:
- Part A is “closed book”. It will be distributed only on paper and must be completed on paper. You must return part A before proceeding with parts B-C.
- Parts B and C are open-book, open-laptop, open-Internet. You can consult any course material during the exam and you can browse the Web. Parts B and C should be submitted using the “Submit” button (as a single zip file).
- You are not allowed to share information with anyone during the exam except with the lecturer.

Part A. Foundational Knowledge (20 points)

Distributed separately on paper

Part B. Process Modelling and Analysis (24 points)

We consider the following prescription fulfilment process at CVS pharmacy (as of 2002).

Customers drop off their prescriptions either in the drive-through counter or in the front counter of the pharmacy. Customers can request that their prescription be filled immediately. In this case, they have to wait 15-60 minutes depending on the workload. Most customers are not willing to wait that long, so they opt to nominate a pick-up time at a later point during the day. Generally, customers drop their prescriptions in the morning before going to work (or at lunchtime) and they come back to pick up the drugs after work, typically between 5pm and 6pm. When dropping their prescription, a technician asks the customer for the pick-up time and puts the prescription in a box labelled with the hour preceding the pick-up time. For example, if the customer asks to have the prescription be ready at 5pm, the technician will drop it in the box with the label 4pm (there is one box for each hour of the day).

Every hour, a pharmacy technician picks up the prescriptions due to be filled in the current hour. The technician enters the details of each prescription (e.g. doctor details, patient details and medication details) into the pharmacy system. As soon as the details of a prescription are entered, the pharmacy system performs an automated check called Drug Utilization Review (DUR). This check is meant to determine if the prescription contains any drugs that may be incompatible with other drugs that had been dispensed to the same customer in the past, or drugs that may be inappropriate for the customer taking into account the customer data maintained in the system. Any alarms raised during the automated DUR are reviewed by a pharmacist who performs
a more thorough check. In some cases, the pharmacist even has to call the doctor who issued the prescription in order to confirm it.

After the DUR, the system performs an insurance check in order to determine whether the customer’s insurance policy will pay for part or for the whole cost of the drugs. In most cases, the output of this check is that the insurance company would pay for a certain percentage of the costs, while the customer has to pay for the remaining part (also called the co-payment). The rules for determining how much the insurance company will pay and how much the customer has to pay are very complicated. Every insurance company has different rules. In some cases, the insurance policy does not cover one or several drugs in a prescription, but the drug in question can be replaced by another drug that is covered by the insurance policy. When such cases are detected, the pharmacist need to determine if it is possible to perform the drug replacement.

Once the prescription passes the insurance check, it is assigned to a technician who collects the drugs from the shelves and puts them in a bag with the prescription stapled to it. After the technician has filled a given prescription, the bag is passed to the pharmacist who double-checks that the prescription has been filled correctly. After this quality check, the pharmacist seals the bag and puts it in the pick-up area. When a customer arrives to pick up a prescription, a technician retrieves the prescription and asks the customer for payment in case the drugs in the prescription are not (fully) covered by the customer’s insurance.

Task 1. [10 points] Capture the above process using BPMN. Make sure you follow the modelling guidelines introduced in the course, but you are allowed to draw a single flat BPMN diagram (we do not require a value chain).

Task 2. [8 points] A typical store handles on average 200 prescriptions in a given workday, out of which 90 are dropped off between 8am and 9am, and 120 prescriptions are picked up between 5pm and 7pm. These are the peak times. The remaining prescriptions are dropped off and picked up more or less uniformly throughout the day. A drop-off takes 90 seconds of a technician’s time. A pick-up takes 150 seconds. There are three technicians at a pharmacy and during the above “peak times”, they are fully dedicated to serving customers at the counter.

- What is the resource utilization of the technicians during the above peak drop-off hour and peak pick-up hours? Explain your answer by computing first the arrival rate (lambda - \( \lambda \)) and the service rate (mu - \( \mu \)) and showing how you calculate the resource utilization using these two parameters and the number of technicians.
- Use queueing theory to determine what is the waiting time of customers during peak drop-off hours and during peak pick-up hours.

Task 3. [6 points] Calculate the theoretical cycle time of the above process using the following data. If you need to make additional assumptions because some necessary data is not provided, please write down your assumptions.

- Drop-off takes 90 seconds (of processing time); pick-up 150 seconds;
- Data entry 150 seconds
- Collection of drugs from the shelves: 180 seconds
- Quality check: 60 seconds (in 5% of cases the collection of drugs and the quality check need to be repeated due to issues detected by the pharmacist)
• Manual resolution of a problem arising during automated insurance check takes 240 seconds

• Manual resolution of a DUR hard stop is 120 seconds when the pharmacist can resolve it without involving the prescribing doctor, and 10 minutes when involvement from the doctor is required.

• Automated tasks (e.g. auto-DUR check take a negligible amount of time).

• A manual insurance check is required in 17% of cases.

• A DUR hard stop occurs in 20% of cases. 90% of DUR hard stops are resolved by the pharmacist alone. Only in 10% of hard stops, it is necessary to call the doctor.

Important: You need to show the formula you use to calculate the processing time. The formula is more important than the actual result. You can even omit the result if you wish, but write the formula.

Part C. Process Mining (6 points)

Using Disco, answer the questions listed below using the following event log: https://tinyurl.com/bpic2017

1. In how many cases it has happened that both O_Accepted and O_Cancelled have occurred in the same case? What is the mean cycle time for those cases where this has happened? What is the most frequent “LoanGoal” for those cases where this has happened?

2. In how many cases it has happened that “W_Assess Potential Fraud” has happened multiple times in the same case? What is the mean cycle time for those cases where this has happened? What is the most frequent “LoanGoal” for those cases where this has happened?

Important: It is not enough to write the answer to each question. You need to explain the steps you followed in Disco to obtain your answer.