

MTAT.03.231 – Business Process Management

Final Exam – 4 June 2009

Answers may be given in English or Estonian.

QUESTION 1 [5 points]

A fast-food restaurant receives on average 1200 customers per day (between 10:00 and 22:00). During peak times (12:00-15:00 and 18:00-21:00), the restaurant receives around 900 customers in total, and 90 customers can be found in the restaurant (on average) at a given point in time. At non-peak times, the restaurant receives 300 customers in total, and 30 customers can be found in the restaurant (on average) at a given point in time.

- a) What is the average time that a customer spends in the restaurant during peak times? [2 points]
- b) What is the average time that a customer spends in the restaurant during non-peak times? [1 point]
- c) Because the restaurant's parking and building have limited capacity, it is inconvenient when there are more than 100 customers at once. What can the restaurant do to address this issue without investing in extending its building? [2 points]

QUESTION 2 [5 points]

This question comes in two "versions". Choose the version that applies to you.

Version for Masters of ETM students

Consider the following scenario (taken from an article by Paul Harmon).

A restaurant has recently lost many customers due to poor customer service. The management team has decided to address this problem first of all by focusing on the delivery of meals. The team gathered data by asking customers about how quickly they liked to receive their meals and what they considered an unacceptable wait. The data suggested that half of the customers would prefer their meals in 15 minutes or less. All the customers agreed, however that meals should arrive within 30 minutes. If a meal was delivered after 30 minutes, all of the customers were unhappy.

Task: Write a Goal-Objective-Measurement-Target-Initiative table for this scenario. Show at least one row in the table containing a goal related to the customer perspective of the balanced scorecard. Apply the principles of Six Sigma to choose the goals/objectives/targets.

Version for Masters of IT students

Consider the following sets of workflow traces:

W1 = {ABCDE, ABDCE, ACDBE, ADCBE}

W2 = {ABCDE, ABDCE, ACBDE, ACDBE, ADBCE, ADCBE}

Task: Using the alpha algorithm, derive two YAWL nets corresponding to these two logs (one YAWL net for W1 and another for W2).

QUESTION 3 [10 points]

Draw a BPMN diagram for the following “as is” process.

When a claim is received, it is first registered. After registration, the claim is classified leading to two possible outcomes: simple or complex. If the claim is simple, the insurance is checked. For complex claims, both the insurance and the damage are checked independently. After the check(s), an assessment is performed which may lead to two possible outcomes: positive or negative. If the assessment is positive, the garage is phoned to authorize the repairs and the payment is scheduled (in this order). In any case (whether the outcome is positive or negative), a letter is sent to the customer and the process ends. At any moment after the registration and before the end of the process, the customer may call to modify the details of the claim. If a modification occurs before the payment is scheduled, then the claim is classified again (simple or complex), and the process is repeated. If a request to modify the claim is received after the payment is scheduled then the request is rejected.

QUESTION 4 [10 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.

- a) Assume that the call centre can handle 70 calls per hour using 7 call centre agents. Is this enough to meet the 1-minute constraint set in the customer service charter? Please explain your answer by showing how you calculate the average length of the queue and the average waiting time.
- b) What happens if the call centre’s capacity is increased so that it can handle 80 calls per hour (using 8 call centre agents)?
- c) The call centre manager has been given a mandate to cut costs by at least 20%. Give at least two ideas to achieve this cut without reducing the salaries of the call centre agents and while keeping an average waiting time below or close to one minute.

Strictly speaking, we should analyse this problem using an $M/M/c$ queuing model (with c agents). However, as a simplification, we will assume that the entire call centre behaves as a single monolithic team, so that we can use an $M/M/1$ queuing model to analyse the problem (knowing that the results will not be exact). For

convenience, below are some notations and equations that apply for $M/M/1$ queuing models.

- λ – arrival rate (average)
- μ – calls served per time unit (on average)
- $\rho = \lambda/\mu$ – occupation rate
- $L_q = \rho^2/(1-\rho)$ – average number of customers in the queue
- $W_q = L_q/\lambda$ – average time in the queue
- $W = W_q + (1/\mu)$ – average time in the system (i.e. cycle time)
- $L = \lambda W$ – average number of customers in the system (i.e. Work-in-Progress)

QUESTION 5 [30 points]

Consider the following process for admission of international students at a university. Students fill in an online form including personal details, contact details, curriculum to which they are applying and some details about their educational background. The online applications are recorded in an information system and all staff members involved in the admissions process have access to all online applications. However, students do not submit documents electronically. Instead, they have to print the online form (a PDF document is generated after they complete the form). Students then sign the application form, and send it by post together with the required documents which include:

- Certified copies of their degrees and their academic transcripts
- Results of their official English language test (two types of English language tests are accepted: IELTS or TOEFL)
- Curriculum vitae

It takes on average 2 weeks for the documents to arrive to the students service by post.

When the documents are physically received by the students service, they are checked for completeness. This check takes about 10 minutes. Sometimes some documents are missing. An e-mail is then sent to the student and the student has to send the missing or incorrect documents by postal service (this happens in about 20% of the cases). The students service then sends the certified copies of the degrees to a specialized agency (ENIC) which checks the degrees and gives an assessment of their validity and equivalence in terms the local education standards. This agency requires that all documents be sent to it physically (by post), and all documents must be certified copies of the originals. This is a hard constraint and the university cannot do anything to change it. The agency sends back its assessment to the university by post as well. The time it takes to send the degrees/transcripts to the ENIC agency and receive back a response is 2 weeks on average. About 10% of applications are rejected after this check. Notifications of rejection are sent by e-mail. The university pays a fee to the ENIC agency of EEK 500 per check.

After the ENIC check, the English language test results are checked online by an officer at the students service. This is done by entering a verification number that comes at the top of the test results sheet. If the validity of the English language test results is put into question after this check, the application is rejected. Checking the

English language test results takes 10 minutes on average and is free. About 10% of applications are rejected at this stage. Notifications of rejection are sent by e-mail.

Once all documents of a given student are complete and validated as described above, the applications are assessed by a committee composed of three academic staff members. Since the committee only meets from times to times, it takes on average 2 weeks between the time students service sends the copy of an application to the committee members (by internal mail) and the moment that the committee makes a decision (accept or reject). The committee takes its decision based on the academic transcripts and the CV. The committee takes on average 10 minutes to assess each application. About 50% of the applications received by the committee are accepted.

Once the committee has made a decision, it notifies it to students service by e-mail. Then, student service notifies the outcome to the students. It takes about 2 days for the notifications to be sent (after the committee has notified their decision). Notifications are sent by e-mail and successful candidates are sent a confirmation letter by post.

About 800 applications are processed per year.

One of the problems faced by the university is that students have to wait too long to know the outcome of the application (especially for successful outcomes). It often happens that by the time a student is admitted, he/she has decided to go to another university instead (students send multiple applications in parallel to many universities).

Not surprisingly, the manager of the students service has decided that enough is enough and starts an initiative to improve this process.

Tasks:

- a) Model the “as is” process using BPMN. **[6 points]**
- b) Classify the activities in the process into “value-adding”, “business value-adding” and “non-value-adding activities”. **[6 points]**
- c) Calculate the cycle time of the “as is” process. **[6 points]**
- d) Calculate the cycle time efficiency of the “as is” process. **[3 points]**
- e) Do you think it is advisable to automate this process “as is” using workflow technology? Why or why not? **[3 points]**
- f) Propose a “to be” model for this process and explain the changes you propose with respect to the “as is” model. **[6 points]**