Management of Data Science and Business Workflows
INFO-H420

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Assigment 2

Authors:

Isakova, Dilbar
Tejada Gargate, Gian Carlo

Professor:Dimitri Sacharidis

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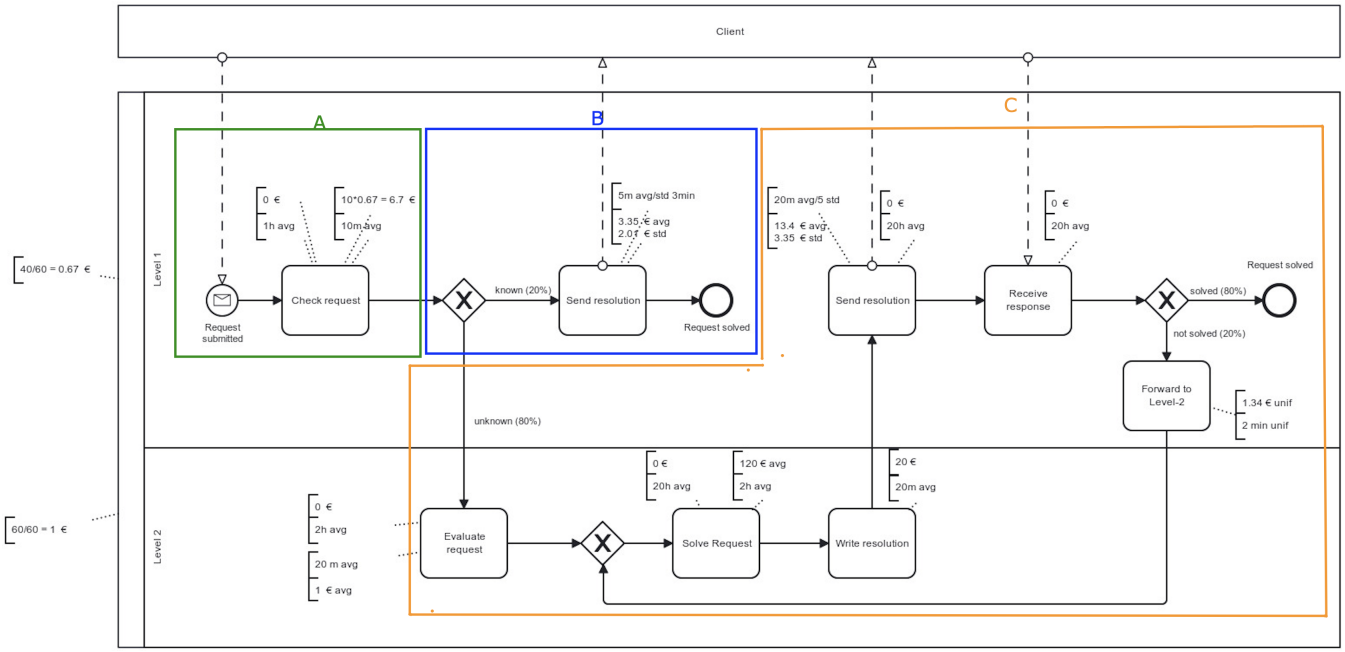
Exercise 1



There are three sections to the process: A, B, and C. Therefore, the metric that we attempt to compute should be made as follows:

$$Metric = A + 0.2 * B + 0.8 * C$$

There parameters 20% and 80% were give in the text.

$$\textbf{Cycle Time Efficiency} = \frac{\textbf{Processing Time}}{\textbf{Cycle Time}} \tag{1.1}$$

$$CycleTime = A + 0.2 * B + 0.8 * C$$
$$A = 60min + 10min$$
$$A = 70min$$

$$B = 5min$$

$$C = 2h + 20m + \frac{20h + 2h + 20m + 20h + 20m + 20h + 2m}{0.8} - 2m$$

$$C = 120m + 20m + \frac{1200m + 120m + 20m + 1200m + 20m + 1200m + 2m}{0.8} - 2m$$

$$C = 140m + \frac{1200m + 120m + 20m + 1200m + 20m + 1200m + 2m}{0.8} - 2m$$

$$C = 140m + \frac{3762}{0.8} - 2m$$

$$C = 4840.5m$$

$$CycleTime = A + 0.2 * B + 0.8 * C$$

$$CycleTime = 70 + 0.2 * 5 + 0.8 * 4840.5$$

$$CycleTime = 3943.4minutes$$

$$ProcessingTime = A + 0.2 * B + 0.8 * C$$

The Processing Time does not take in consideration the waiting time.

$$A = 10min$$

$$B = 5min$$

$$C = 20m + \frac{2h + 20m + 20m + 2m}{0.8} - 2m$$

$$C = 20m + \frac{120m + 20m + 20m + 2m}{0.8} - 2m$$

$$C = 20m + \frac{182}{0.8} - 2m$$

$$C = 245.5m$$

$$ProcessingTime = A + 0.2 * B + 0.8 * C$$

$$ProcessingTime = 10 + 0.2 * 5 + 0.8 * 245.5$$

$$ProcessingTime = 187.4minutes$$

Therefore,

$$\textbf{Cycle Time Efficiency} = \frac{\textbf{Processing Time}}{\textbf{Cycle Time}}$$

$$\textbf{Cycle Time Efficiency} = \frac{187.4}{3943.4}$$

$$\textbf{Cycle Time Efficiency} = 0.0475 \approx 4.8\%$$

We will proceed to calculate the Cost-per-Excecution, for this we will follow the steps done for the Processing Time (not take in consideration the waiting time).

$$\textbf{Cost-per-Excecution} = A + 0.2 * B + 0.8 * C \tag{1.2}$$

$$A = 6.67 euro$$

$$B = 3.35 euro$$

$$C = 20 + \frac{120 + 20 + 13.34 + 1.34}{0.8} - 1.34$$

$$C = 20 + \frac{154.68}{0.8} - 1.34$$

$$C = 212.01 euro$$

Therefore,

$$\textbf{Cost-per-Excecution} = A + 0.2 * B + 0.8 * C$$

$$\textbf{Cost-per-Excecution} = 6.67 + 0.2 * 3.35 + 0.8 * 212.01$$

$$\textbf{Cost-per-Excecution} = 176.948 euro$$

Exercise 2

Number of requests reaching Level- 2 = 1 per hour:

$$\lambda = 1 \text{ instance x hour}$$

From the diagram we infer theorethical capacity of the server:

$$\mu = \frac{1}{20m + \frac{120m+20m}{0.8}} = \frac{1}{192m}$$

$$\mu = 0.308 \text{ instance x hour}$$

Having these parameters we can use them to calculate the average waiting time based on the M/M/c parameters. We proceed to use an M/M/C calculator, this can be find in `https://erlang.chwyean.com/erlang/erlangC.html`

Figure 2.1: M/M//c Graph

According to chapter 2, we can conclude that we need at least 5 Level-2 staff members to guarantee that the average waiting time for a request is shorter than two working hours (120 minutes).

Exercise 3

We will simulated the business process, with an arrival time of 4 request per hour and **120 min** for the waiting time for receiving the response from the client.

$$\text{LvL 1 (40 €/h)} = \begin{cases} \text{Check Request} & \text{exp 10m avg} \\ \text{Send Resolution} & \text{norm 5m avg 3m std} \\ \text{Send Resolution (from LvL 2)} & \text{norm 20m 5m std} \\ \text{Forward to LvL 2} & \text{fixed 2m} \end{cases}$$

$$\text{LvL 2 (60 €/h)} = \begin{cases} \text{Evaluate Request} & \text{exp 20m avg} \\ \text{Solve Request} & \text{exp 120m avg} \\ \text{Write Resolution} & \text{exp 20 min} \end{cases}$$

$$\text{Client} \quad \text{(0 €/h)} = \{\text{Receive Response} \quad \text{fixed 120m}$$

We are going to simulate 3 scenarios, as the table below shows:

Resource	**Scenario 1**	**Scenario 2**	**Scenario 3**
LvL 1	5	1	7
LvL 2	3	5	1
Client	500	500	500

Table 3.1: Resources Scenarios

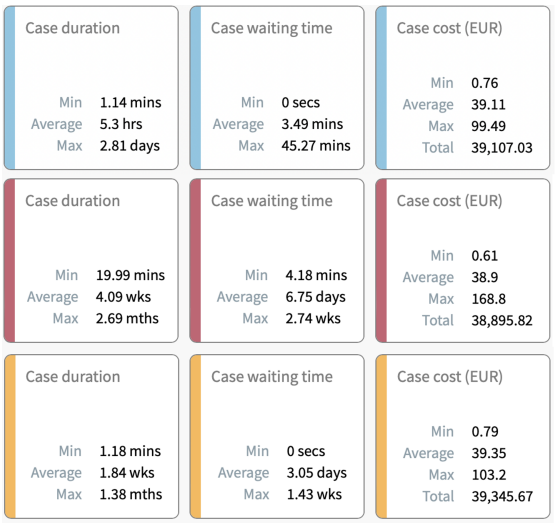


Figure 3.1: Simulation scenarios 1,2 and 3

The three situations given in the table Table 3.1 are summarised in the Figure 3.1. The present cycle, according to the AS-IS scenario (scenario 1), is 5.3 hours. While the result increases to about 4 weeks if we decrease level 1 staff and increase level 2 staff (scenario 2), the outcome decreases to around 2 weeks if we perform the opposite operation, raising level 1 staff and decreasing level 2 staff (scenario 3). In scenario 3, we only have one level 1 worker who checks the request at the beginning of the process; in scenario 3, we only have one level 2 worker. This condition repeats itself over the waiting period, plainly demonstrating that there are bottlenecks.

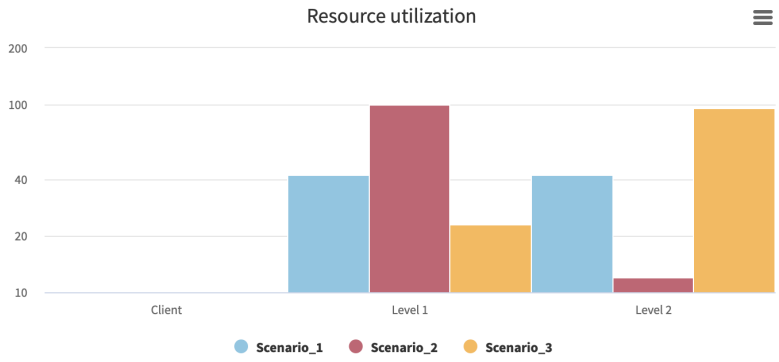


Figure 3.2: Resource utilization - Scenarios 1,2 and 3

We are able to see how the employees use their resources. First off, the client was created for the purpose of receiving the response; they are not a resource of the business. In the second scenario, we see that level 1 personnel makes up nearly all of the utilisation, whereas level 2 staff makes up just a fraction of it. We note that in the third scenario, the level 2 personnel is utilised at a rate almost three times higher than that of the level 1 staff. In fact, there is a bottleneck here as well, though it is not as bad as in the scenario.

Exercise 4

In this exercise, our objective is to pinpoint problems within this procedure and structure them in an issue register. Subsequently, we are going to provide a series of modifications to enhance this process. For every alteration, we recognized the Redesign Heuristics applied and provided reasoning for the change. Nevertheless, we decided to split the response for this task into two steps such as A and B to ensure clarity and streamline the process.

A) In order to tackle the first part (A) of the task, our strategy involved assembling all problems into a table functioning as an issue register. Within this register, we systematically examined each issue in a step-by-step analysis. To develop the following table below, we took as an example *the Issue Register Table 6.2 from Chapter 6 (page 231) of the course book.*

Issue register
Issue 1: High waiting time for Level-1 staff and delay in escalating unresolved requests **Priority: 1** **Description**: Requests spend a considerable amount of time waiting for Level-1 staff to check and resolve them. And, Level-1 staff redirect requests to Level-2 employees when the request is unknown. **Data and assumptions**: Two requests are made per hour, with 80% of cases needing to be passed to Level-2 employees. Each Level-1 request costs 6.67€. The total cycle time is 1.16 hours, including a Level-1 processing time of 0.16 hours. Due to the involvement of two levels, requests take an extra hour for processing. **Qualitative impact:** **Decreased Productivity**: Requests spending a significant amount of time waiting for Level-1 staff can lead to decreased overall productivity. Customer Dissatisfaction: Prolonged wait times might result in dissatisfied customers due to delayed service. **Company Reputation**: Suffers due to extended delivery times. Possible Negligence: Level-1 staff might forward requests to Level-2 even when they know the solution, potentially neglecting to handle cases to reduce their workload. **Quantitative impact**: 6.67€ * (2 * 0.8) = 10.672€. 10.672€ is lost when Level-1 transfers requests to Level-2 employees.
Issue 2: Redundant resolution review **Priority: 2** **Description:** Some requests return to Level-1 support despite a Level-2 review, causing inefficiencies **Data and assumptions:** Level-1 employees get one resolution per hour, taking 20.33 hours in total. Level-1's check takes 0.33 hours and costs 13.34€ per request sent by them. **Qualitative impact:** Operational inefficiency arises when requests, after Level-1 review, are redirected back to Level-2 support, resulting in duplicated efforts and time wastage. The increased response time, caused by redundant reviews, significantly impacts overall service quality. This delay in resolution reaching the client, which takes an extra 20 hours due to waiting on Level-1 to send the resolution, adversely affects the company's reputation due to longer delivery times. **Quantitative impact:** 13.34*1 = 13.34€ Level-1 receives 13.34€ for forwarding the email to the client, and each solution developed by Level-2 engineers extends the cycle time by an extra 20 hours.
Issue 3: Delay and time wastage in escalating the unapproved requests. **Priority: 3** **Description:** Level-1 staff transfer client responses to Level-2 employees in cases where the response is not approved. **Data and assumptions:** Two requests are forwarded to Level-2 per hour, with a processing time of 0.03 hours. Approximately 20% of the resolutions are not accepted by the client, incurring a Level-1 forwarding cost of 1.33 for each non-accepted resolution. **Qualitative impact:** Delays in escalating unapproved requests have the potential to impact the service level agreements and the timeliness of issue resolution, thus affecting service quality. Customers, facing extended resolution times due to delays in escalation, might become frustrated while awaiting issue resolution. Moreover, Level-1 engineers performing this task might feel undervalued, and such forwarding activities can disrupt the normal workflow of a Level-1 engineer if they receive a non-approved resolution while already engaged in addressing another request. **Quantitative impact:** 1.33*(2*0.2) = 0.532€. 0.532€ is lost due to excess production by Level-1 employees, which is calculated as 1.33 multiplied by 2 requests per hour and 20% of unaccepted resolutions.
Issue 4: Long processing time in Level-1 and Level-2 **Priority: 4** **Description:** Both Levels staff take considerable time to evaluate and resolve requests. **Data and assumptions:** At a rate of 2 requests per hour, the evaluation cost for Level-2 requests stands at 20€. The overall cycle time is 2.33 hours, with a processing time of 0.33 hours for Level-2 evaluations. Level-2 incurs a cost of 20€ per request for assessment. Additionally, 80% of the requests are initially unknown and therefore need to be redirected to Level-2 employees for reevaluation. **Qualitative impact:** Extended processing time at Level-1 and Level-2 can impact response times, potentially leading to dissatisfaction among customers. The extended evaluation and resolution periods may result in a negative service experience. Additionally, Level-2 employees spend time re-evaluating requests that Level-1 employees have already assessed, which might cause conflicts between engineers of different levels if their evaluations differ. **Quantitative impact:** 20*(2*0.8) = 10.56€ 10.56€ is wasted on Level-2 for re-evaluating the requests, calculated as 20 multiplied by 2 requests per hour and 80% of the requests that need re-assessment.

Table 4.1: Logical and Data Design

B) In part B, we are supposed to suggest a series of modifications to enhance this process. For each adjustment, we should specify the Redesign Heuristics applied and provide a rationale for implementing the change. By taking into account the issues from the Table 4, the following redesigning heuristics have been developed:

Business Process Operation Heuristics: *Case-Type Principle*

1. Developing a comprehensive request form including test cases could preempt common inquiries and reduce the non-acceptance ratio of resolutions from clients. To address these issues we decided to add a database where the Level-1 employees can search for frequently resolved issues and reduce the amount of rejected solutions. Also, these changes will increase the responsibilities of Level-1 staff and enable them to handle more requests without escalation to Level-2.

Business Process Operation Heuristics: *Activity-Composition Principle*

1.Transferring resolution responsibilities from Level-1 to Level-2 employees and consolidating tasks can streamline the resolution process. 2. Combining the activities of "Solve request" and "Write resolution" into a unified activity can further streamline workflow and efficiency. 3. Combining "Check request" and "Evaluate request" into a single task handled by a Level-2 employee can further enhance efficiency.

Business Process Behavior Heuristics: *Parallelism Principle*

1. Conducting evaluation by Level-2 before Level-1 checks requests and simultaneously checking and evaluating requests can prevent double assessments and enhance efficiency. 2. Putting the activities of "Receive response" and "Forward response to Level-2" into parallel allow the business process to carry out faster and improve the efficiency of the process.

Exercise 5

To formulate **the TO-BE procedure**, we have incorporated concepts from the preceding task. Consequently, the ultimate diagram below has been constructed utilizing principles and heuristics outlined in the answer to *Exercise 4*.

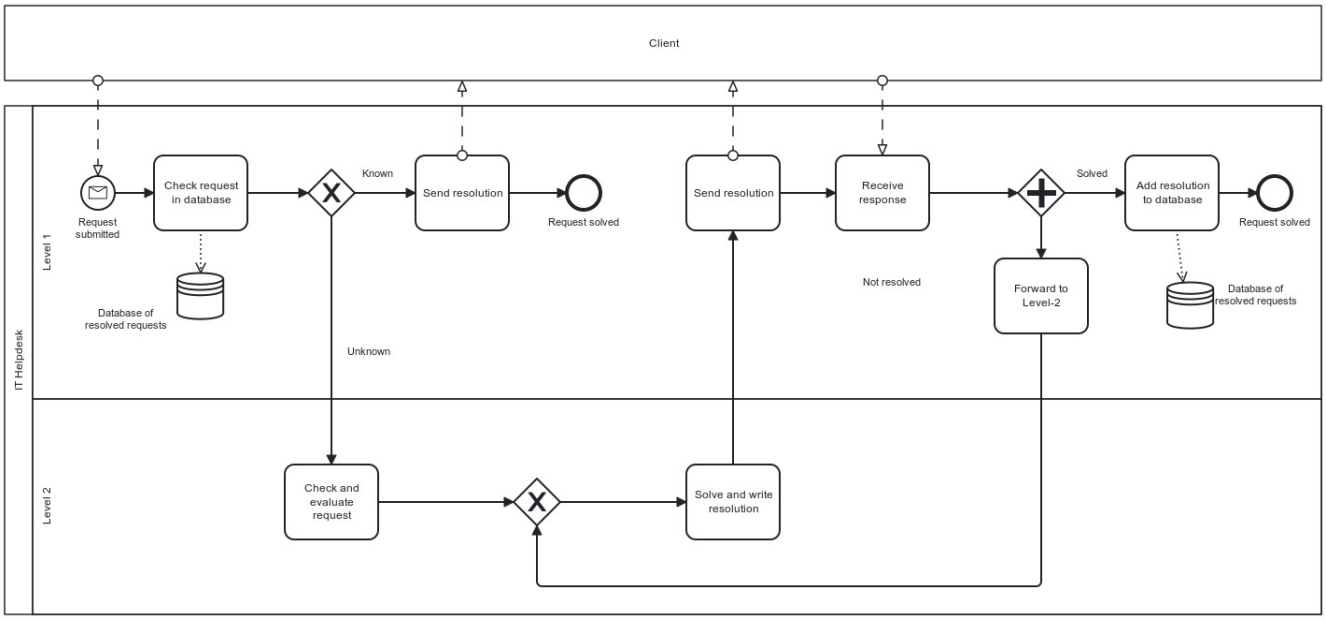


Figure 5.1: Resigned Process