Grado en Ciencia, Gestión e Ingeniería de Servicios Semipresencial

Ingeniería de Procesos de Negocio – Ejercicios con soluciones

Índice

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M. Dumas, M. La Rosa, J. Mendling and H. Reijers Fundamentals of Business Process Management, 2nd edition, Springer, 2018. http://fundamentals of bpm.org/supplementary material/

Tema 1: ejercicio 1

BuildIT is a construction company specialized in public works (roads, bridges, pipelines, tunnels, railroads, etc.). Within BuildIT, it often happens that engineers working at a construction site (called site engineers) need a piece of equipment, such as a truck, an excavator, a bulldozer, a water pump, etc. BuildIT owns very little equipment and instead it rents most of its equipment from specialized suppliers.

The existing business process for renting equipment goes as follows: When site engineers need to rent a piece of equipment, they fill in a form called "Equipment Rental Request" and send this request by e-mail to one of the clerks at the company's depot. The clerk at the depot receives the request and, after consulting the catalogs of the equipment suppliers, selects the most cost-effective equipment that complies with the request. Next, the clerk checks the availability of the selected equipment with the supplier via phone or e-mail. Sometimes the selected option is not available and the clerk has to select an alternative piece of equipment and check its availability with the corresponding supplier.

Once the clerk has found a suitable piece of equipment available for rental, the clerk adds the details of the selected equipment to the rental request. Every rental request has to be approved by a works engineer, who also works at the depot. In some cases, the works engineer rejects the equipment rental request. Some rejections lead to the cancellation of the request (no equipment is rented at all). Other rejections are resolved by replacing the selected equipment with another equipment—such as a cheaper piece of equipment or a more appropriate piece of equipment for the job. In the latter case, the clerk needs to perform another availability enquiry.

When a works engineer approves a rental request, the clerk sends a confirmation to the supplier. This confirmation includes a Purchase Order (PO) for renting the equipment. The PO is produced by BuildIT's financial information system using information entered by the clerk. The clerk also records the engagement of the equipment in a spreadsheet that is maintained for the purpose of tracking all equipment rentals.

In the meantime, the site engineer may decide that the equipment is no longer needed. In this case, the engineer asks the clerk to cancel the request for renting the equipment.

In due time, the supplier delivers the rented equipment to the construction site. The site engineer then inspects the equipment. If everything is in order, the engineer accepts the engagement and the equipment is put into use. In some cases, the equipment is sent back because it does not comply with the requirements of the site engineer. In this case, the site engineer has to start the rental process all over again.

When the rental period expires, the supplier comes to pick up the equipment. Sometimes, the site engineer asks for an extension of the rental period by contacting the supplier via e-mail or phone 1–2 days before pick-up. The supplier may accept or reject this request.

A few days after the equipment is picked up, the equipment's supplier sends an invoice to the clerk by e-mail. At this point, the clerk asks the site engineer to confirm that the equipment was indeed rented for the period indicated in the invoice. The clerk also checks if the rental prices indicated in the invoice are in accordance with those in the PO. After these checks, the clerk forwards the invoice to the financial department and the finance department eventually pays the invoice.

Tema 1: ejercicio 2

Consider the following process for the admission of graduate students at a university.

In order to apply for admission, students first fill in an online form. Online applications are recorded in an information system to which all staff members involved in the admissions process have access to. After a student has submitted the online form, a PDF document is generated and the student is requested to download it, sign it, and send it by post together with the required documents, which include:

- Certified copies of previous degree and academic transcripts.
- Results of English language test.
- Curriculum vitae.

When these documents are received by the admissions office, an officer checks the completeness of the documents. If any document is missing, an e-mail is sent to the student. The student has to send the missing documents by post. Assuming the application is complete, the admissions office sends the certified copies of the degrees to an academic recognition agency, which checks the degrees and gives an assessment of their validity and equivalence in terms of local education standards. This agency requires that all documents be sent to it by post, and all documents must be certified copies of the originals. The agency sends back its assessment to the university by post as well. Assuming the degree verification is successful, the English language test results are then checked online by an officer at the admissions office. If the validity of the English language test results cannot be verified, the application is rejected (such notifications of rejection are sent by e-mail).

Once all documents of a given student have been validated, the admission office forwards these documents by internal mail to the corresponding academic committee responsible for deciding whether to offer admission or not. The committee makes its decision based on the academic transcripts and the CV. The committee meets once every 2 to 3 weeks and examines all applications that are ready for academic assessment at the time of the meeting. At the end of the committee meeting, the chair of the committee notifies the admissions office of the selection outcomes. This notification includes a list of admitted and rejected candidates. A few days later, the admission office notifies the outcome to each candidate via e-mail. Additionally, successful candidates are sent a confirmation letter by post.

With respect to the above process, consider the following questions:

1. Who are the actors in this process?
2. Which actors can be considered to be the customer (or customers) in this process?
3. What value does the process deliver to its customer(s)?
4. What are the possible outcomes of this process?

Tema 1: cuestionario

Which of the following is NOT a task?

Seleccione una:

- a. Calculate settlement amount

- b. Determine if customer is liable for damage

- c. Check insurance policy details
- d. Insurance policy does not cover the damage

Which of the following is NOT an event?

Seleccione una:

- a. Notify settlement decision to customer

- b. Claim withdrawn by customer

- c. Purchase order received

- d. Payment delay expired

Which of the following statements refer to a critical (core) process of a company?

Seleccione una:

- ○ a. Customer relationship management

- ○ b. Accounts payable

- ○ c. Human resource management
  Human resource management

- ○ d. Order to cash

A water utility company provides drinking water to residents and businesses in a city of one million inhabitants, as well wastewater treatment services to the city council. Which processes are likely to be core processes of this company.

Seleccione una o más de una:

- ☐ a. Issue-to-resolution

- ☐ b. Infrastructure inspection

- ☐ c. Debt collection

- ☐ d. Bill-to-cash

- ☐ e. Procure-to-pay

The measurement to cash process of an electricity company is the process that starts when the electricity meter of a customer is read at the end of a month and ends (successfully) when the customer pays the electricity bill for that month. In this process, which of the following performance measures are directly related to costs?

Seleccione una o más de una:

- ☐ a. Percentage of over-billing errors
- ☐ b. Cycle time
- ☐ c. Average electricity consumption per customer
- ☐ d. Price per kilowatt-hour (KWh)
- ☐ e. Percentage of under-billing errors

In a process oriented organization, who is directly accountable for poor performance of a process?

Seleccione una:

- ○ a. The executive management team
- ○ b. The process analyst
- ○ c. The process participants
- ○ d. The process owner
- ○ e. The BPM group

Which of the following is NOT a task?

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Quitar mi elección

Consider the following summary of issues reported in a travel agency.

A travel agency has recently lost several medium-sized and large corporate 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. These customers essentially stated that they had found better itineraries and prices on the Web by searching by themselves.

- Which business processes should the travel agency select for improvement?
- For each of the business processes you identified above, indicate which performance measure the travel agency should improve.

Solución

Consider the admission process of a university as described in Exercise 1.1

Discuss their strategic importance, their health, and the feasibility of a potential improvement to these processes.

Further Questions:

- Given all the discussed criteria, does an assessment of the importance, health, and feasibility always point us to the same processes to actively manage?

No, there is no guarantee for that. It may very well be that a strategically important process is also the process that can be expected to be the most difficult one to manage, simply because so many earlier improvement efforts have already failed. An organization may not have a choice in such a situation. If a strategic process cannot be improved, this may turn out to be fatal for an organization as a whole. Think of a situation where the process to come up with new products creates much turmoil and conflicts within an organization: If the issues cannot be sorted out, the company may stop functioning quickly. In other settings, it may be more important to gain credibility with process management activities first. This can be accomplished by first focusing on problematic processes of milder strategic importance but where there is a great desire to change. If successful, an improvement project at such a place may give credibility to the BPM initiative. These are not choices that can be easily prescribed without taking the specific context into consideration. The various evaluation outcomes should be balanced to reach a list of those processes that should receive priority over others.

- Should all processes that are unhealthy, of strategic importance, and feasible to manage be subjected to BPM?

The general answer to this question is that for most organizations this is not doable. Recall again that BPM consumes resources. Even when there is a clear incentive to, for example, redesign various existing business processes, most organizations lack sufficient resources-people, funds, and time—to do so. Only the largest organizations are able to support more than a handful of BPM projects at the same time. A good example is IBM, an organization known to have process improvement projects going on within all its existing business processes on a continuous basis. Another caveat of carrying out many simultaneous BPM effort is that these will create coordination complexity. Remember that processes may be linked to each other in various respects, such that measures taken for one process should be synchronized with those taken for others.

Davenport emphasizes that many companies focus on a small set of critical business processes in order to gain experience with innovation initiatives; each successful initiative can then become a model for future efforts.

Tema 2: ejercicio 2

A university defined four core processes in relation to teaching. An evaluation of strategic importance, health, and feasibility using a survey among the department chairs has resulted in the following assessment:

- Develop and Manage Study Programs: Importance 90%, Health 90%, Feasibility 40%.
- Market Study Programs: Importance 75%, Health 80%, Feasibility 60%.
- Schedule Courses: Importance 95%, Health 30%, Feasibility 50%.
- Deliver Courses: Importance 95%, Health 70%, Feasibility 30%.
- Manage Student Services: Importance 85%, Health 50%, Feasibility 40%.
- Manage Facilities: Importance 40%, Health 35%, Feasibility 70%.

Draw a process portfolio and suggest one process to be selected for process improvement. Justify your choice.

Solución

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Draw a process portfolio and suggest one process to be selected for process improvement. Justify your choice.

Tema 3: ejercicios

Exercise 3.1 - Model the following fragment of a business process for assessing loan applications:

Once a loan application has been approved by the loan provider, an acceptance pack is prepared and sent to the customer.

The acceptance pack includes a repayment schedule which the customer needs to agree upon by sending the signed documents back to the loan provider.

The latter then verifies the repayment agreement: if the applicant disagreed with the repayment schedule, the loan provider cancels the application; if the applicant agreed, the loan provider approves the application.

In either case, the process completes with the loan provider notifying the applicant of the application status.

Exercise 3.2 - Model the following fragment of a business process for assessing loan applications:

A loan application is approved if it passes two checks:

   I.   the applicant's loan risk assessment, done automatically by a system, and
   II.   the appraisal of the property for which the loan has been asked, carried out by a property appraiser.

The risk assessment requires a credit history check on the applicant, which is performed by a financial officer.

Once both the loan risk assessment and the property appraisal have been performed, a loan officer can assess the applicant's eligibility.

If the applicant is not eligible, the application is rejected, otherwise the acceptance pack is prepared and sent to the applicant.

Exercise 3.3 - Model the following fragment of a business process for assessing loan applications:

A loan application may be coupled with a home insurance which is offered at discounted prices.

The applicant may express their interest in a home insurance plan at the time of submitting their loan application to the loan provider.

Based on this information, if the loan application is approved, the loan provider may either only send an acceptance pack to the applicant, or also send a home insurance quote.

The process then continues with the verification of the repayment agreement.

Exercise 3.4 - Model the following fragment of a business process for assessing loan applications:

Once a loan application is received by the loan provider, and before proceeding with its assessment, the application itself needs to be checked for completeness.

If the application is incomplete, it is returned to the applicant, so that they can fill out the missing information and send it back to the loan provider.

This process is repeated until the application is found complete.

Exercise 3.5 - Put together the four fragments of the loan assessment process that you created in Exercises 3.1–3.4.

Hint .-

Look at the labels of the start/end events to understand the order dependencies among the various fragments.

Then extend the resulting model by adding all the required artifacts.

Moreover, attach annotations to specify the business rules behind

- checking an application completeness,
- assessing an application eligibility, and
- verifying a repayment agreement.

Exercise 3.6 - Extend the business process for assessing loan applications that you created in Exercise 3.5 by considering the following resource aspects.

The process for assessing loan applications is executed by four roles within the loan provider:

- a financial officer takes care of checking the applicant's credit history;
- a property appraiser is responsible for appraising the property;
- an insurance sales representative sends the home insurance quote to the applicant if this is required.
- All other activities are performed by the loan officer who is the main point of contact with the applicant.

Exercise 3.7 - Extend the business process for assessing loan applications that you created in Exercise 3.6 by representing the interactions between the loan provider and the applicant.
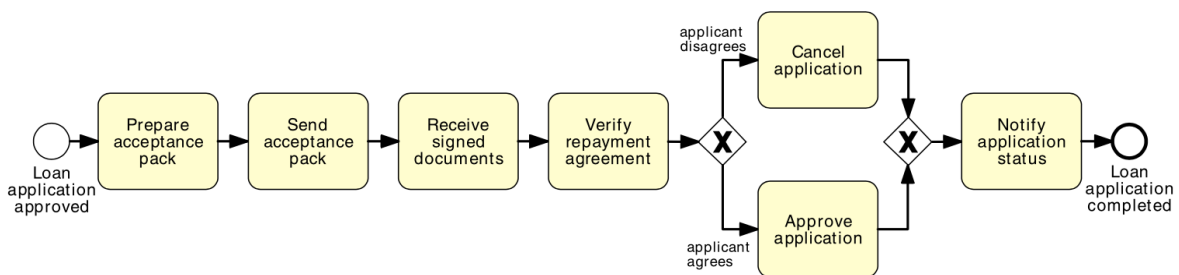
Soluciones

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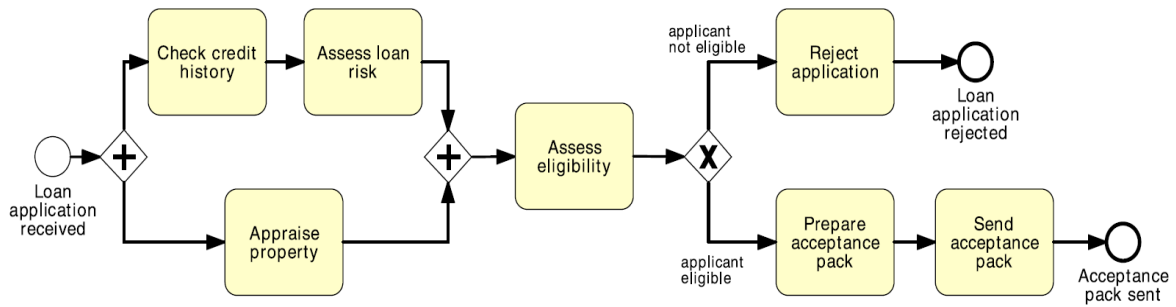Once a loan application has been approved by the loan provider, an acceptance pack is prepared and sent to the customer.

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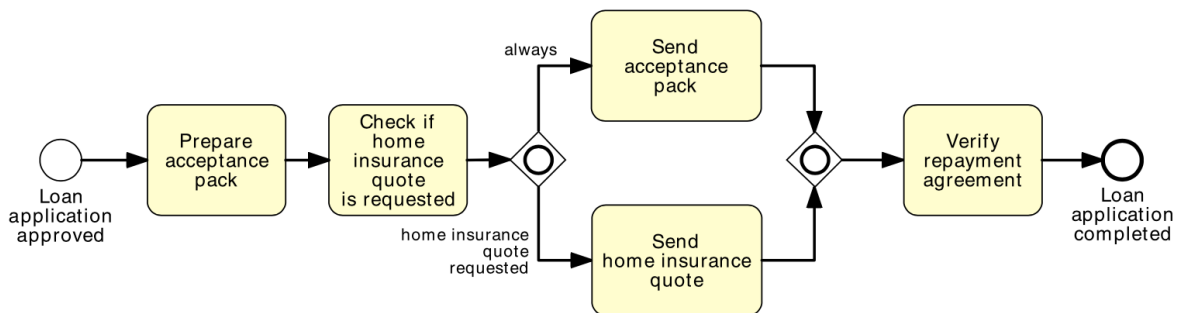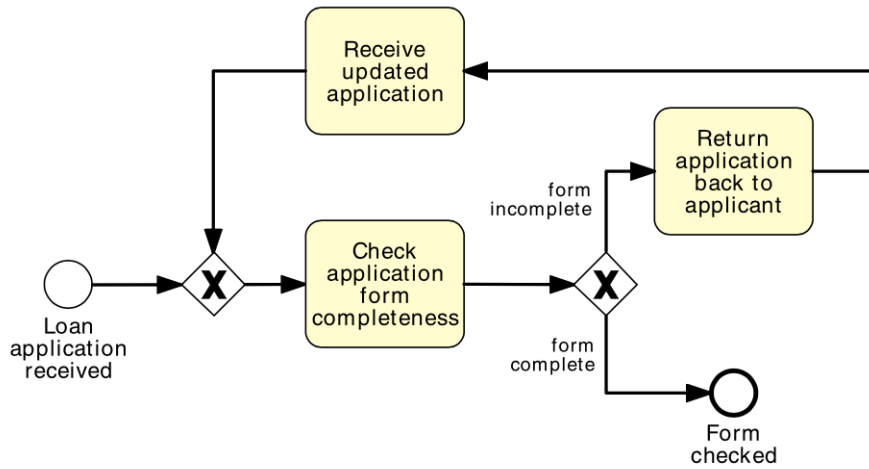
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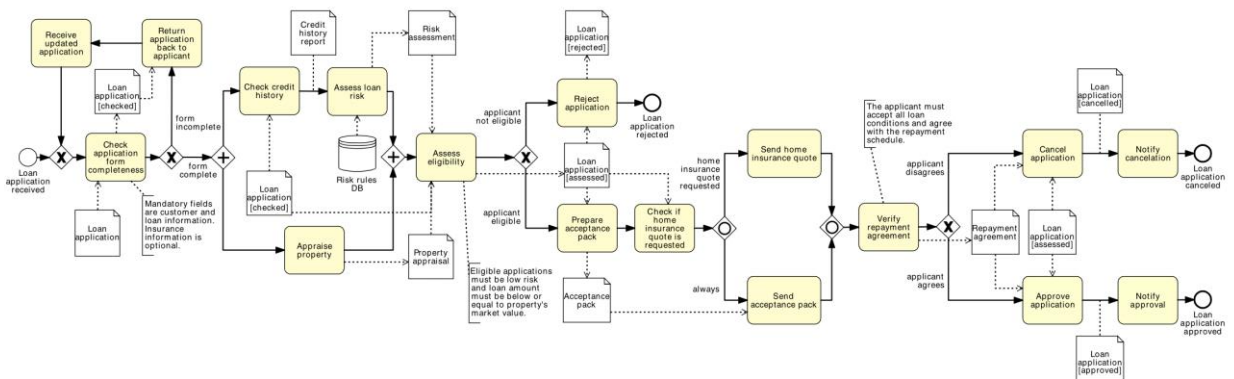
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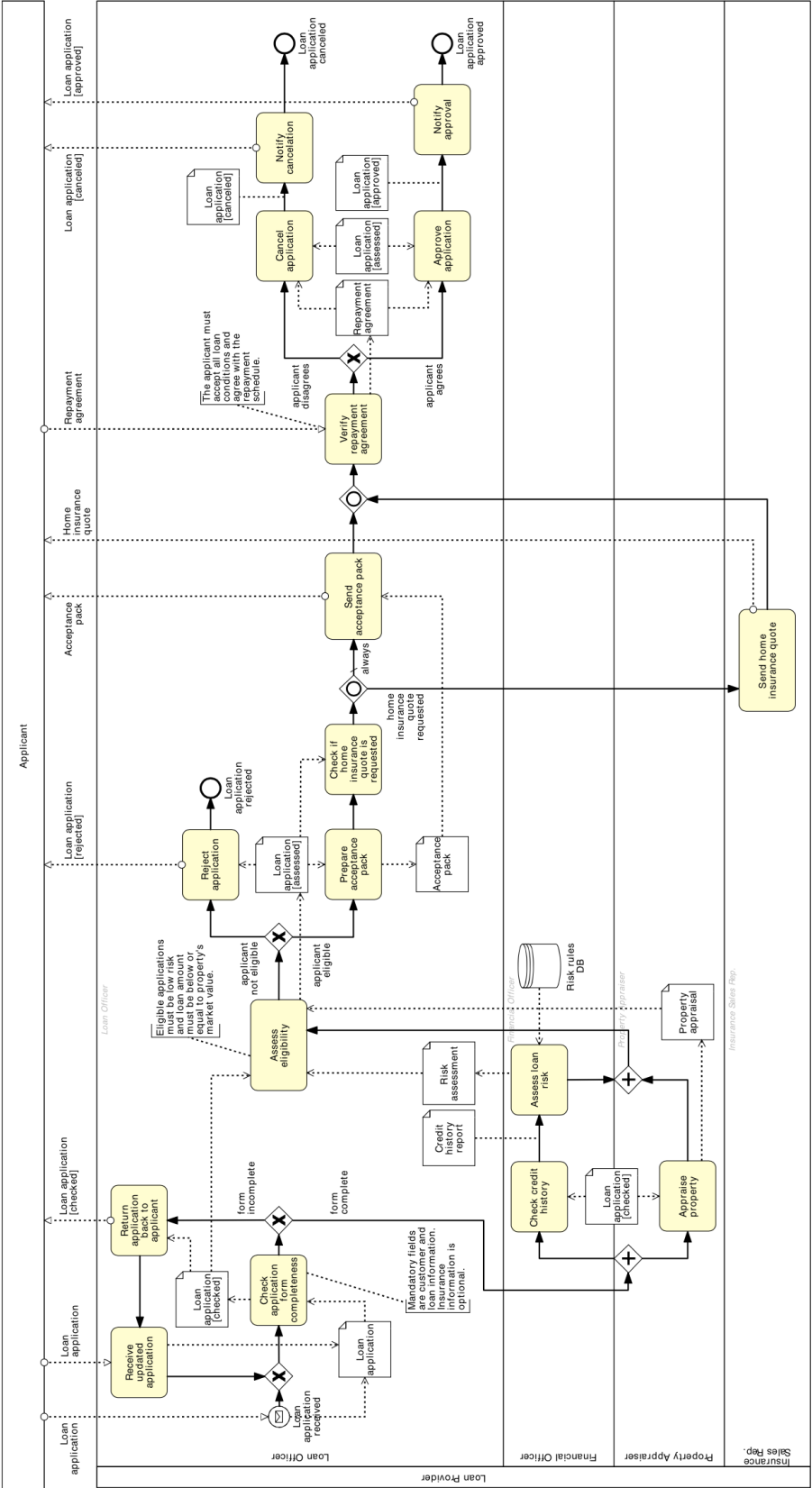- assessing an application eligibility, and
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See the Loan Provider pool in the model of Solution 3.7.

Exercise 3.7 - Extend the business process for assessing loan applications that you created in Exercise 3.6 by representing the interactions between the loan provider and the applicant.

Tema 3: cuestionario

If a task has two output arcs (also called flows), it is the same as if the task was followed by an:

Seleccione una:

○ a. XOR-join

○ b. AND-split

○ c. OR-join

○ d. XOR-split

○ e. OR-split

○ f. AND-join

If a task has two input arcs, it is the same as if the task was preceded by an:

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○ b. XOR-split

○ c. OR-split

○ d. OR-join

○ e. XOR-join

○ f. AND-join

Which type of gateway moves each token it receives in one of its input arcs to its output arc?

Seleccione una:

○ a.   XOR-join

○ b.   AND-join

○ c.   AND-split

○ d.   OR-join

○ e.   XOR-split

○ f.   OR-split

The following BPMN diagram contains an incorrect gateway. Which one?

Seleccione una:

○ a.   The XOR gateway following task D

○ b.   The XOR gateway following task F

○ c.   The AND gateway following task A
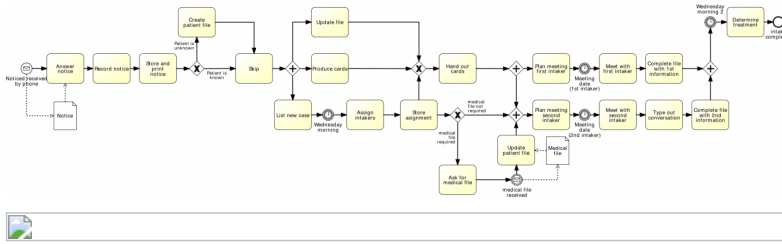
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The following BPMN diagram contains two incorrect gateways. Which ones?

Seleccione una o más de una:

☐ a.   The AND gateway before task "Plan meeting second intaker"

☐ b.   The AND gateway preceding event "Wednesday morning 2"

☐ c.   The XOR gateway after task "Store and print notice"

☐ d.   The XOR gateway preceding task "Hand out cards"

☐ e.   The AND split after task "Hand out cards"

An IT hardware store provides a Web front-end allowing its customers to purchase IT equipment online (e.g. tablets, laptops, accessories, printers). In the context of the order-to-cash process of this company, which of the following is likely to be modeled as a data store?

Seleccione una o más de una:

☐ a.   An invoice

☐ b.   The history of a customer's past purchases

☐ c.   The shopping cart of a customer purchasing via the Web front-end

☐ d.   The Customer Relationship Management (CRM) system

☐ e.   The store's product catalog

Let us consider the order-to-cash process of a company called CoolIT that sells air conditioning systems. Which of the following is likely to be modeled as a pool?

Seleccione una o más de una:

- ☐ a. The customer
- ☐ b. A subcontractor of CoolIT
- ☐ c.   A salesperson at CoolIT
- ☐ d. The accounts receivable department of CoolIT
- ☐ e. A clerk at the accounts payable department of CoolIT

Which of the following statement(s) do NOT hold?

Seleccione una o más de una:

- ☐ a. A message flow may lead to the creation of a data object by the task that receives the message
- ☐ b. The source of a message flow may be a task
- ☐ c. A message flow can connect a task in a pool to another task in the same pool
- ☐ d. The target of a message flow may be a task
- ☐ e. A message flow can connect a task in a pool to the boundary of another pool

If a task has two output arcs (also called flows), it is the same as if the task was followed by an:

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- ○ a. XOR-join
- ● b. AND-split
- ○ c. OR-join
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    Quitar mi elección

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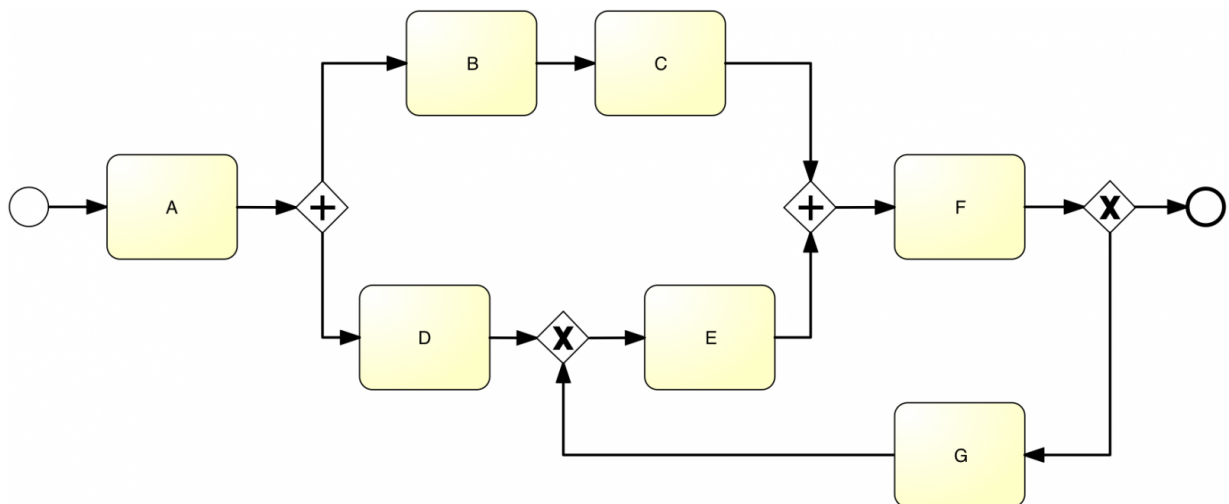- ○ c. AND-split
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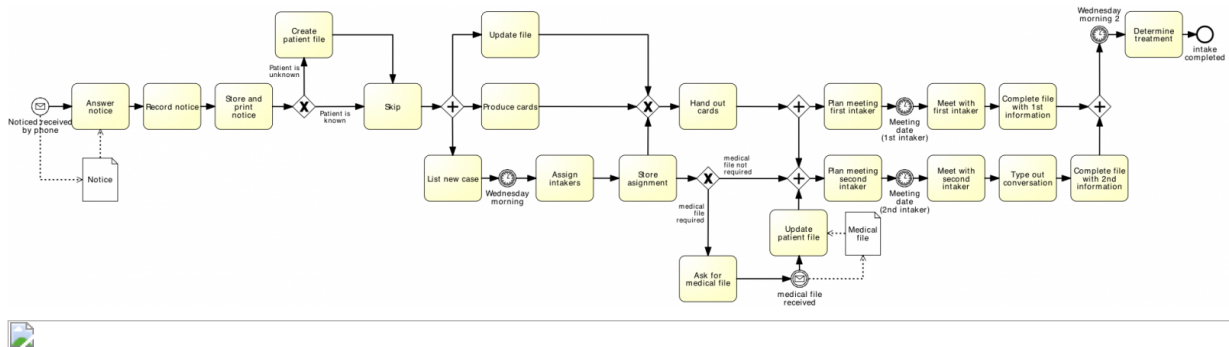- ⦿ d. The AND gateway preceding task F

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- ☐ e.   A message flow can connect a task in a pool to the boundary of another pool

Tema 4: ejercicios

Exercise 4.0.1 - Identify suitable sub-processes in the process for assessing loan applications modeled in Exercise 3.5:

Hint: Use the building blocks that you created throughout Exercises 3.1–3.4.

Exercise 4.0.2 - Consider the following process at a company of around 800 employees:

A purchase request is initiated when an employee at the company fills in and signs a form on paper. The purchase request includes information about the good to be purchased, the quantity, the desired delivery date, the approximate cost. The employee can also nominate a specific vendor. Employees often request quotes from vendors in order to get the required information. Completing the entire form can take a few days as the requestor often does not have the required data. The quote is attached to the purchase request. This completed request is signed by two supervisors. One supervisor has to provide a financial approval, while the other supervisor has to approve the necessity of the purchase and its conformance with company's policy (e.g. does a requested software form part of the standard operating environment?). Collecting the signatures from the two supervisors takes on average five days. If it is urgent, the employee can hand-deliver the form, otherwise it is circulated via internal mail. A rejected purchase request is returned to the employee. Some employees make some minor modifications and try in a second attempt other supervisors in order to get approval.

Once a purchase request is approved, it is returned to the employee who initiated the purchase requisition. The employee then forwards the form to the Purchasing Department. Many employees make a copy of the form for their own record, in case the form gets lost. The central purchasing Department checks the completeness of the purchase request and returns it to the employee if it is incomplete.

Based on attached quotes and other information, the purchasing Department enters the ap- proved purchase request into the company's Enterprise System. If the employee has not nominated any vendors, a clerk at the purchasing Department will select one based either on the quotes attached to the purchase requisition, or based on the list of vendors (also called Master Vendor List) available in the company's Enterprise System.

Sometimes the quote attached to the request has expired in the meantime. In this case, an updated quote is requested from the corresponding vendor.

Other times, the vendor who submitted the quote is not recorded in the company's Enterprise System. In this case, the purchasing Department should give preference to other vendors who are registered in the Enterprise System. If no such vendors are available or if the registered vendors offer higher prices than the one in the submitted quote, the purchasing Department can add the new vendor into the Enterprise System.

When a vendor is selected, a purchase order is automatically generated by the Enterprise System. Then, a fax is generated and sent to the vendor. A copy of the purchase order is sent to Accounts Payable Office, which is part of the Financial

Department, which uses an accounting system that is not integrated with the Enterprise System.

The goods are always delivered to the Goods Receipt Department. When a good is received, a clerk at this Department selects the corresponding purchase order in the Enterprise System. The clerk checks the quantity and quality and (in the positive case) generates a document called goods receipt form from the purchase order stored in the Enterprise System. The goods are then forwarded to the employee who initiated the purchase requisition. A print- out of the goods receipt form is sent to the Accounts Payable Office. If there are any issues with the good, it is returned to the vendor and a paper-based note is sent to the Purchasing Department and to the Accounts Payable Office.

The vendor eventually sends the invoice directly to the Accounts Payable Office. A clerk at this office compares the purchase order, the goods receipt and the invoice—a task that is usually called "three-way matching". Three-way matching can be quite time-consuming. If there are any discrepancies as it has to be investigated, if it was an error of the vendor or a data entry error. The duration of the payment process unfortunately takes sometimes so long that the discount for paying in a certain period expires.

A bank transfer is finally triggered and a payment notice is sent to the vendor. Some vendors explicitly indicate in their invoice the bank account number where they want the transfer to occur. It may happen that the bank account number and name indicated in the invoice differs from the one recorded in the vendor database. Sometimes payments bounce back, in which case the vendor is contacted by phone, e-mail or postal mail. If new bank details are given, the transfer is attempted again. If the issue is still not resolved, the Accounts Payable Office has to contact again the vendor in order to trace the cause of the bounced payment.

1. What type of process is the above one: order-to-cash, procure-to-pay or issue-to- resolution?
2. Who are the actors in this process? Who is/are the customer(s)?
3. What value does the process deliver to its customer(s)?
4. What are the possible outcomes of this process?
5. Taking the perspective of the customer, what performance measures can be attached to this process?
6. What potential issues do you foresee this process might have? What information would you need to collect in order to analyze these issues?
7. What possible changes do you think could be made to this process in order to address the above issues?

- Identify suitable sub-processes in the business process modelled.
- Among these sub-processes, identify those that are specific to this business process versus those that can potentially be shared with other business processes of the same company.

Exercise 4.1 - Identify the entry and exit points that delimit the unstructured cycles in the process models shown below:

- What are the repetition blocks?
- Model the first business process using a loop activity.

The applicant may express their interest in a home insurance plan at the time of submitting their loan application to the loan provider.

Based on this information, if the loan application is approved, the loan provider may either only send an acceptance pack to the applicant, or also send a home insurance quote.

The process then continues with the verification of the repayment agreement.
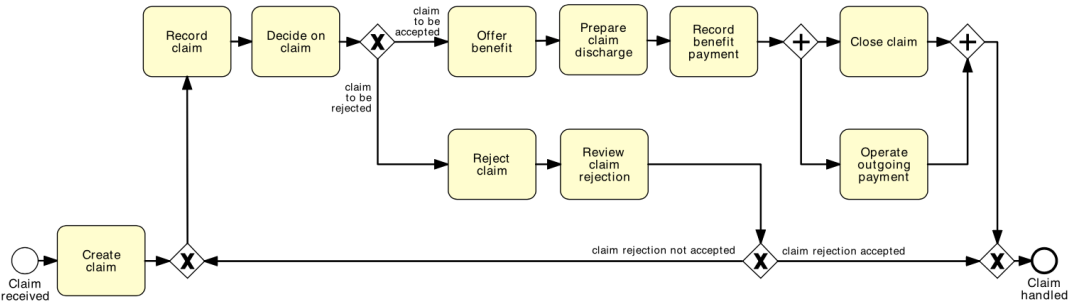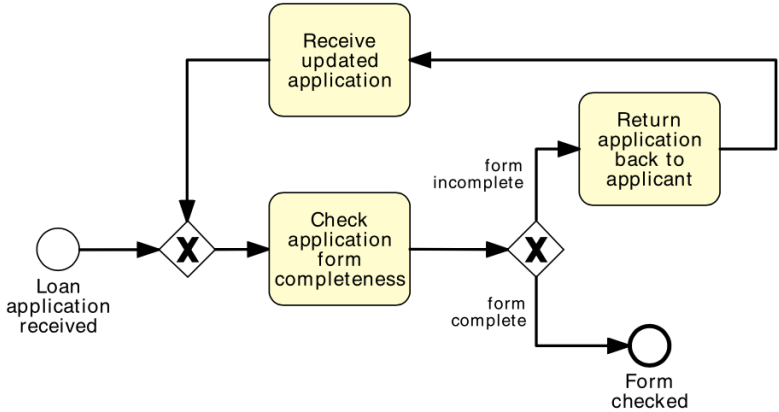
Exercise 4.2 - Model the following process fragment:

After a car accident, a statement is sought from two witnesses out of the five that were present, in order to lodge the insurance claim.

As soon as the first two statements are received, the claim can be lodged with the insurance company without waiting for the other statements.

Exercise 4.3 - Model the following process snippet.

A typical army recruitment process starts by shortlisting all candidates' applications. Those shortlisted are then called to sit the following tests: drug and alcohol, eye, color vision, hearing, blood, urine, weight, fingerprinting and doctor examination.

The color vision can only be done after the eye test, while the doctor examination can only be done after color vision, hearing, blood, urine and weight have been tested.

Moreover, it may be required for some candidates to repeat some of these tests multiple times in order to get a correct assessment, e.g. the blood test may need to be repeated if the candidate has taken too much sugar in the previous 24 hours.

The candidates that pass all tests are asked to sit a mental exam and a physical exam, followed by an interview. Only those that also pass these two exams and perform well in the interview can be recruited in the army.

Exercise 4.4 - Is there any other activity in the loan assessment model below that can be replaced by a message event?
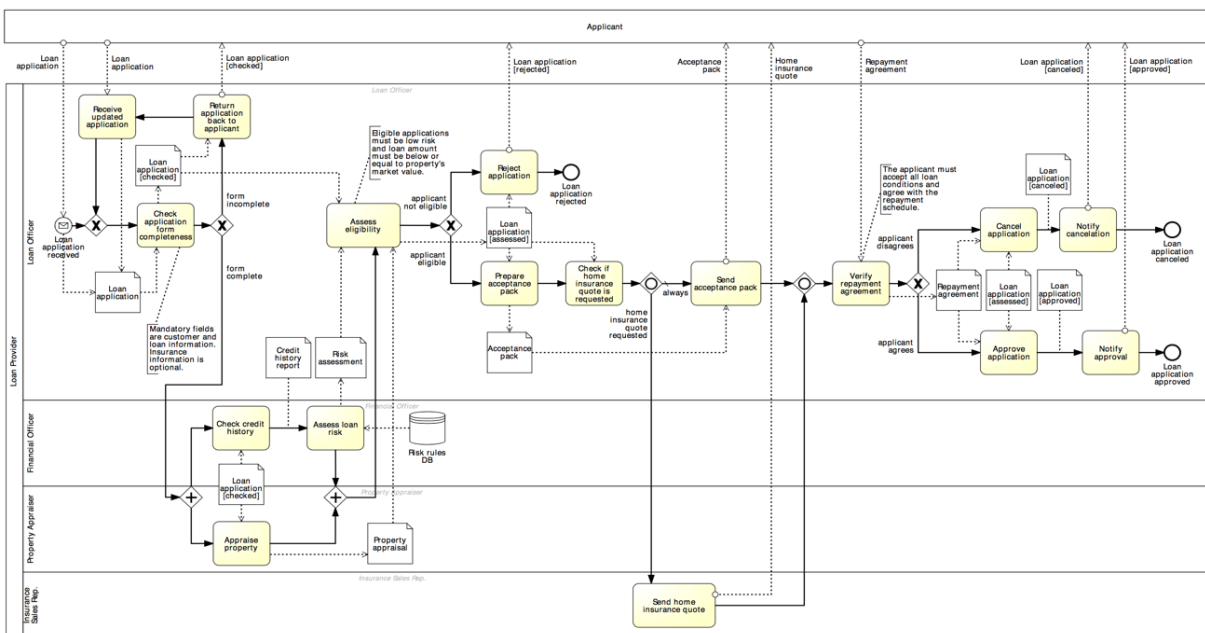
Exercise 4.5 - Model the billing process of an Internet Service Provider (ISP).

The ISP sends an invoice by email to the customer on the first working day of each month (Day 1).

On Day 7, the customer has the full outstanding amount automatically debited from their bank account.

If an automatic transaction fails for any reason, the customer is notified on Day 8.

On Day 9, the transaction that failed on Day 7 is re-attempted. If it fails again, on Day 10 a late fee is charged to the customer's bank account.

At this stage, the automatic payment is no longer attempted.

On Day 14, the Internet service is suspended until payment is received.

If on Day 30 the payment is still outstanding, the account is closed and a disconnection fee is applied. A debt-recovery procedure is then started.

Exercise 4.6.- Model the following process.

A restaurant chain submits a purchase order (PO) to replenish its warehouses every Thursday.

The restaurant chain's procurement system expects to receive either a "PO Response" or an error message.

However, it may also happen that no response is received at all due to system errors or due to delays in handling the PO on the supplier's side.

If no response is received by Friday afternoon or if an error message is received, a purchasing officer at the restaurant chain's headquarters should be notified.

Otherwise, the PO Response is processed normally.

Exercise 4.7.- Fix the following collaboration diagram between a client, a travel agency and an airline.
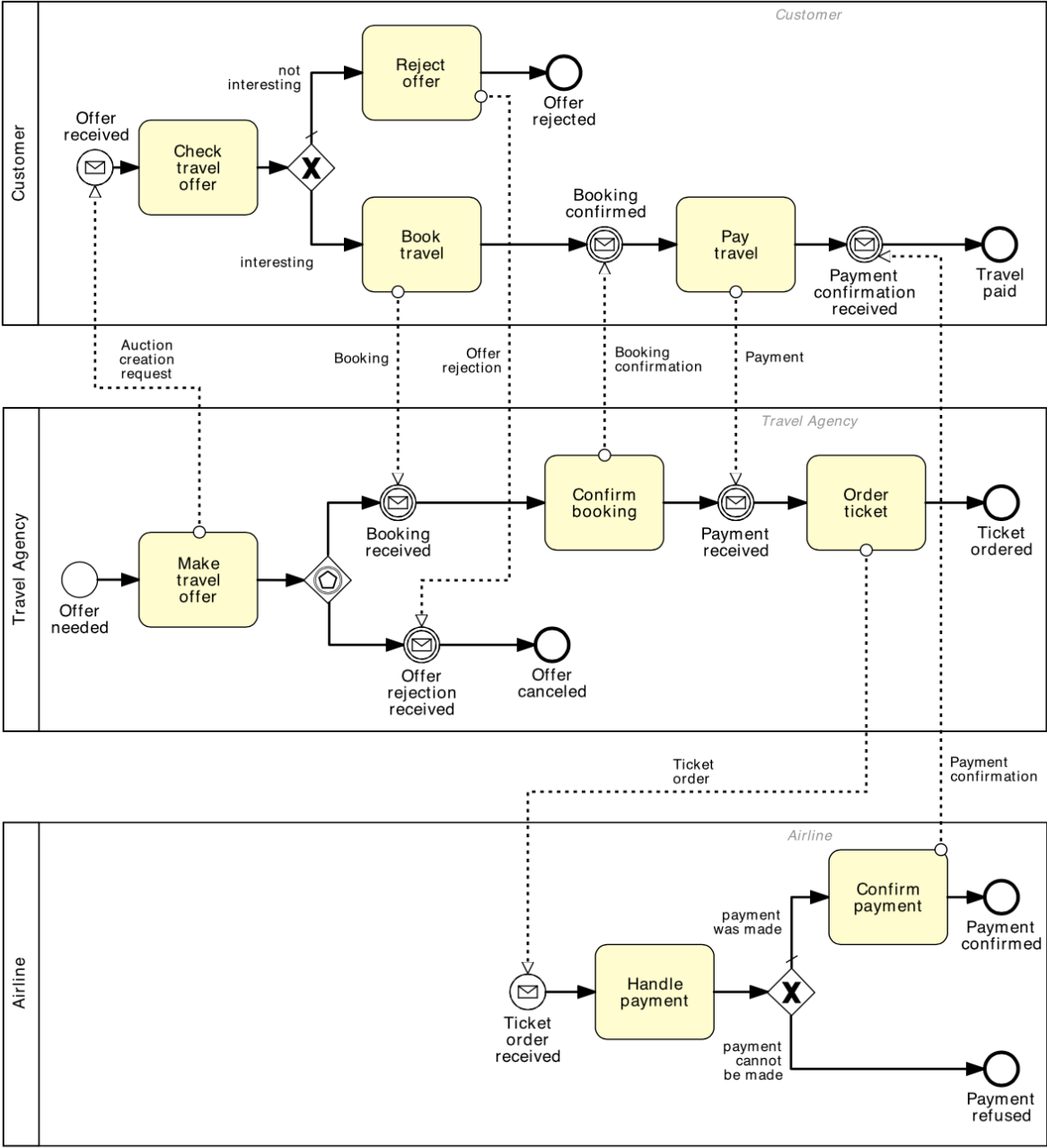
Exercise 4.9.- Model the following routine for logging into an Internet bank account.

The routine for logging into an Internet bank account starts once the credentials entered from the user have been retrieved.

First, the username is validated. If the username is not valid, the routine is interrupted and the invalid username is logged. If the username is valid, the number of password trials is set to zero.

Then the password is validated. If this is not valid, the counter for the number of trials is incremented and if lower than three, the user is asked to enter the password again, this time together with a CAPTCHA test to increase the security level.

If the number of failed attempts reaches three times, the routine is interrupted and the account is frozen.

Moreover, the username and password validation may be interrupted should the validation server not be available.

Similarly, the server to test the CAPTCHA may not be available at the time of log in. In these cases, the procedure is interrupted after notifying the user to try again later.

At any time during the log in routine, the customer may close the web-page, resulting in the interruption of the routine.

Exercise 4.10.- Model the following process fragment.

Once a wholesale order has been confirmed, the supplier transmits this order to the carrier for the preparation of the transportation quote.
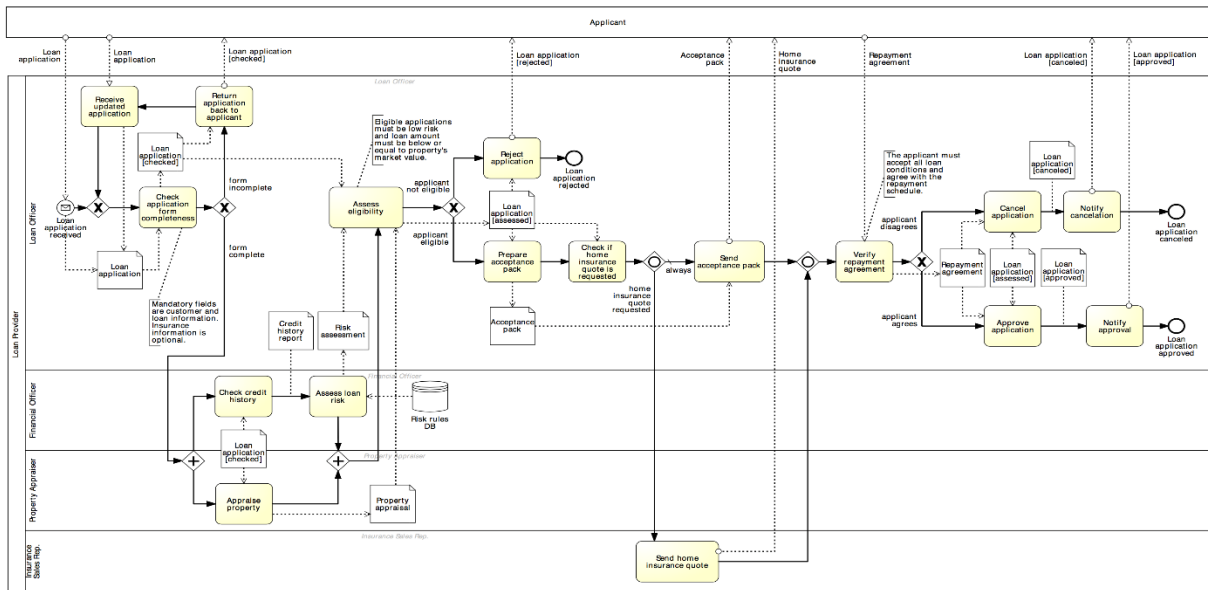
In order to prepare the quote, the carrier needs to compute the route plan (including all track points that need to be traversed during the travel) and estimate the trailer usage (e.g. whether it is a full track-load, half track-load or a single package).

By contract, wholesale orders have to be dispatched within four days from the receipt of the order. This implies that transportation quotes have to be prepared within 48 hours from the receipt of the order to remain within the terms of the contract.

Exercise 4.11.- Extend the process below as follows.

An applicant who has decided not to combine their loan with a home insurance plan may change their mind any time before the eligibility assessment has been completed.

If a request for adding an insurance plan is received during this period, the loan provider will simply update the loan application with this request.

Exercise 4.12.- Model the following business process for reimbursing expenses.

After an expense report is received from an employee, the employee is notified of the receipt of the report.

Next, a new account must be created if the employee does not already have one. The report is then reviewed for automatic approval. Amounts under EUR 1,000 are automatically approved while amounts equal to or over EUR 1,000 require manual approval.

In case of rejection, the employee must receive a rejection notice by email. In case of approval, the reimbursement is deposited directly to the employee's bank account and an approval notice is sent to the employee via email, with the details of the money transfer.

At any time during the review, the employee can send a request for amount rectification. In that case the rectification is registered and the report needs to be reviewed again. Moreover, if the report is not handled within 30 days, the process is stopped and the employee receives a cancelation notice email so that he can resubmit the expense report from scratch.

Exercise 4.13.- Modify the model created in Exercise 4.12 as follows.

If the report is not handled within 30 days, the process is stopped, the employee receives a cancelation notice email and must resubmit the expense report.

However, if the reimbursement for the employee's expenses had already been made, a money recall needs to be made, to get the money back from the employee, before sending the cancelation notice email.

Exercise 4.14.- Model the following business process snippet.

In a stock exchange, stock price variations are continuously monitored during the day. A day starts when the opening bell rings and concludes when the closing bell rings.

Between the two bells, every time the stock price changes by more than 10%, the entity of the change is first determined. Next, if the change is high, a "high stock price" alert is sent, otherwise a "low stock price" alert is sent.

Exercise 4.15.- Model collaboration diagram from choreography

The choreography below illustrates the interactions that may occur among a seller, a customer and a carrier after the freight has been delivered by the carrier to the client.

Use this diagram as a template to build the corresponding collaboration diagram.

Observe the use of the terminate event in this example. In a choreography this event can only be used to denote a negative outcome and not to forcefully terminate the choreography, since the parties not involved in the interaction preceding the terminate event would not know that the terminate event has been reached..
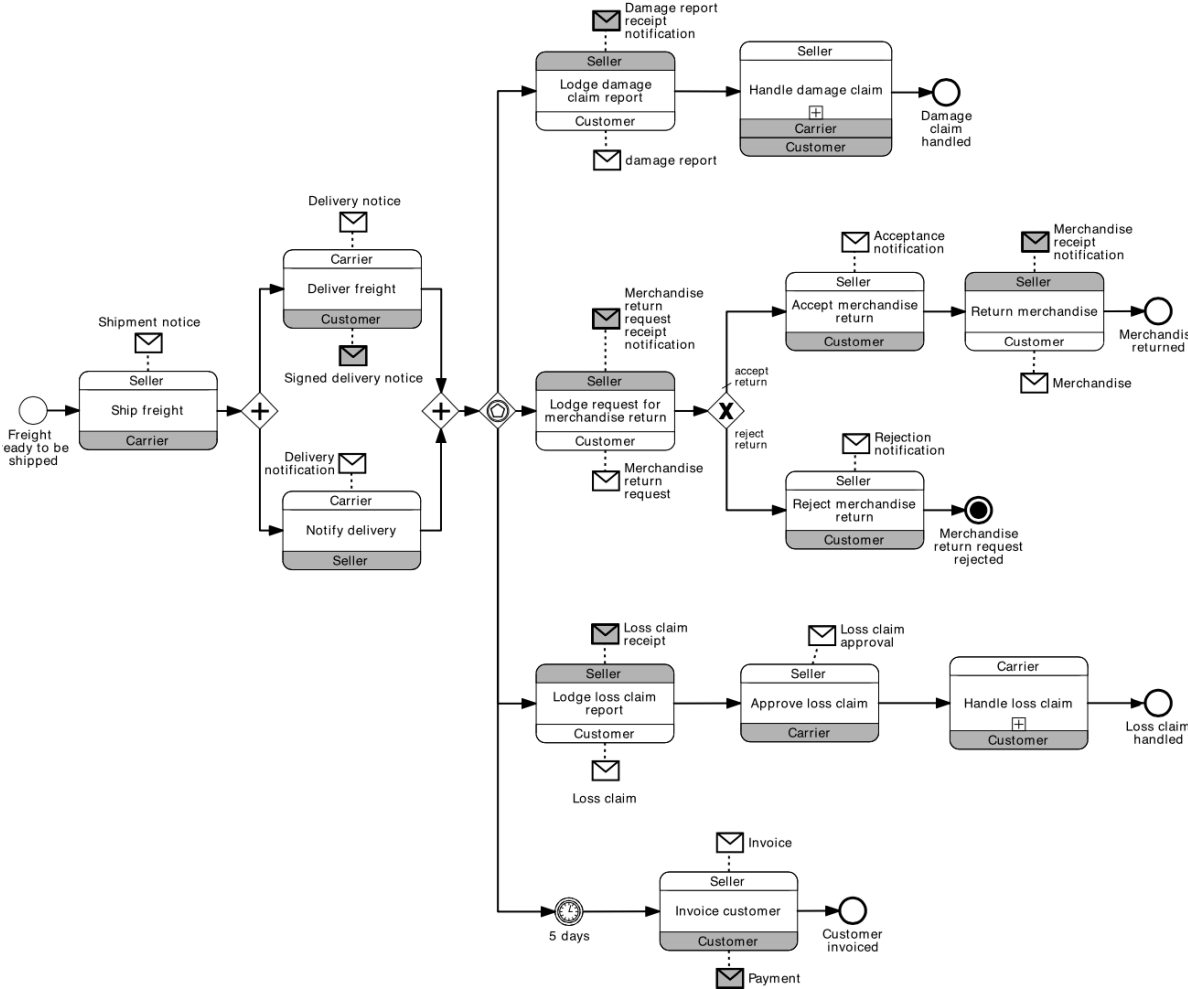
Exercise 4.16.- Model the choreography and collaboration diagrams for the following mortgage application process at BestLoans

The mortgage application process starts with the receipt of a mortgage application from a client. When an application is sent in by the client to the broker, the broker may either deal with the application themselves, if the amount of the mortgage loan is within the mandate the broker has been given by BestLoans, or forward the application to BestLoans. If the broker deals with the application themselves, this results in either a rejection or an approval letter being sent back to the client. If the broker sends an approval letter, then it forwards the details of this application to BestLoans so that from there on the client can interact directly with BestLoans for the sake of disbursing the loan. In this case, BestLoans registers the application and sends an acknowledgment to the client.

The broker can only handle a given number of clients at a time. If the broker is not able to reply within one week, the client must contact BestLoans directly. In this case, a reduction on the interest rate is applied should the application be approved.
If BestLoans deals with the application directly, its mortgage department checks the credit of the client with the Bureau of Credit Registration. Moreover, if the loan amount is more than 90 % of the total cost of the house being purchased by the client, the mortgage department must request a mortgage insurance offer from the insurance department. After these interactions BestLoans either sends an approval letter or a rejection to the broker, which the broker then forwards to the client (this interaction may also happen directly between the mortgage department and the client if no broker is involved).

After an approval letter has been submitted to the client, the client may either accept or reject the offer by notifying this directly to the mortgage department. If the mortgage department receives an acceptance notification, it writes a deed and sends it to an external notary for signature. The notary sends a copy of the signed deed to the mortgage department. Next, the insurance department starts an insurance contract for the mortgage. Finally, the mortgage department submits a disbursement request to the financial department. When this request has been handled, the financial department notifies the client directly.

Any time during the application process, the client may inquire about the status of their application with the mortgage department or with the broker, depending on which entity is dealing with the client. Moreover, the client may request the cancellation of the application. In this case the mortgage department or the broker computes the application processing fees, which depend on how far the application process is, and communicates these to the client. The client may reply within two days with a cancellation confirmation, in which case the process is canceled, or with a cancellation withdrawal, in which case the process continues. If the process has to be canceled, BestLoans may need to first recall the loan (if the disbursement has been done), then annul the insurance contract (if an insurance contract has been drawn) and finally annul the deed (if a deed has been drawn).

Tema 4: soluciones

Exercise 4.1 - Identify suitable sub-processes in the process for assessing loan applications modeled in Exercise 3.5:

Hint Use the building blocks that you created throughout Exercises 3.1–3.4.
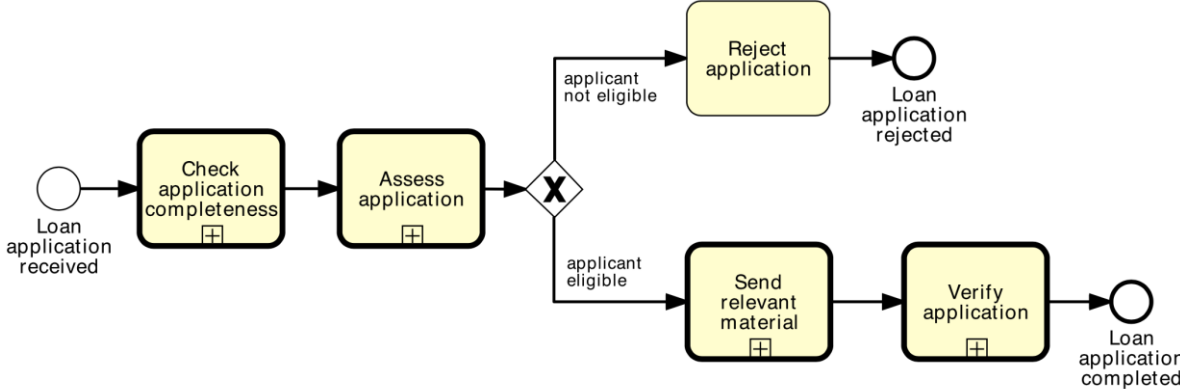
Exercise 4.2 - Consider the following process at a company of around 800 employees:

A purchase request is initiated when an employee at the company fills in and signs a form on paper. The purchase request includes information about the good to be purchased, the quantity, the desired delivery date, the approximate cost. The employee can also nominate a specific vendor. Employees often request quotes from vendors in order to get the required information. Completing the entire form can take a few days as the requestor often does not have the required data. The quote is attached to the purchase request. This completed request is signed by two supervisors. One supervisor has to provide a financial approval, while the other supervisor has to approve the necessity of the purchase and its conformance with company's policy (e.g. does a requested software form part of the standard operating environment?). Collecting the signatures from the two supervisors takes on average five days. If it is urgent, the employee can hand-deliver the form, otherwise it is circulated via internal mail. A rejected purchase request is returned to the employee. Some employees make some minor modifications and try in a second attempt other supervisors in order to get approval.

Once a purchase request is approved, it is returned to the employee who initiated the purchase requisition. The employee then forwards the form to the Purchasing Department. Many employees make a copy of the form for their own record, in case the form gets lost. The central purchasing Department checks the completeness of the purchase request and returns it to the employee if it is incomplete.

Based on attached quotes and other information, the purchasing Department enters the ap- proved purchase request into the company's Enterprise System. If the employee has not nominated any vendors, a clerk at the purchasing Department will select one based either on the quotes attached to the purchase requisition, or based on the list of vendors (also called Master Vendor List) available in the company's Enterprise System.

Sometimes the quote attached to the request has expired in the meantime. In this case, an updated quote is requested from the corresponding vendor.

Other times, the vendor who submitted the quote is not recorded in the company's Enterprise System. In this case, the purchasing Department should give preference to other vendors who are registered in the Enterprise System. If no such vendors are available or if the registered vendors offer higher prices than the one in the submitted quote, the purchasing Department can add the new vendor into the Enterprise System.

When a vendor is selected, a purchase order is automatically generated by the Enterprise System. Then, a fax is generated and sent to the vendor. A copy of the purchase order is sent to Accounts Payable Office, which is part of the Financial Department, which uses an accounting system that is not integrated with the Enterprise System.

The goods are always delivered to the Goods Receipt Department. When a good is received, a clerk at this Department selects the corresponding purchase order in the Enterprise System. The clerk checks the quantity and quality and (in the positive case) generates a document called goods receipt form from the purchase order stored in the Enterprise System. The goods are then forwarded to the employee who initiated the purchase requisition. A print- out of the goods receipt form is sent to the Accounts

Payable Office. If there are any issues with the good, it is returned to the vendor and a paper-based note is sent to the Purchasing Department and to the Accounts Payable Office.

The vendor eventually sends the invoice directly to the Accounts Payable Office. A clerk at this office compares the purchase order, the goods receipt and the invoice—a task that is usually called "three-way matching". Three-way matching can be quite time-consuming. If there are any discrepancies as it has to be investigated, if it was an error of the vendor or a data entry error. The duration of the payment process unfortunately takes sometimes so long that the discount for paying in a certain period expires.

A bank transfer is finally triggered and a payment notice is sent to the vendor. Some vendors explicitly indicate in their invoice the bank account number where they want the transfer to occur. It may happen that the bank account number and name indicated in the invoice differs from the one recorded in the vendor database. Sometimes payments bounce back, in which case the vendor is contacted by phone, e-mail or postal mail. If new bank details are given, the transfer is attempted again. If the issue is still not resolved, the Accounts Payable Office has to contact again the vendor in order to trace the cause of the bounced payment.

8. What type of process is the above one: order-to-cash, procure-to-pay or issue-to- resolution?
9. Who are the actors in this process? Who is/are the customer(s)?
10. What value does the process deliver to its customer(s)?
11. What are the possible outcomes of this process?
12. Taking the perspective of the customer, what performance measures can be attached to this process?
13. What potential issues do you foresee this process might have? What information would you need to collect in order to analyze these issues?
14. What possible changes do you think could be made to this process in order to address the above issues?

- Identify suitable sub-processes in the business process modelled.
- Among these sub-processes, identify those that are specific to this business process versus those that can potentially be shared with other business processes of the same company.

Possible sub-processes are "Request purchase", "Issue purchase or- der", "Receive goods" and "Handle invoice". Of these, "Handle invoice" could be shared with other procure-to-pay processes of the same company, e.g. with that de- scribed in Example 1.1 for BuildIT. The first three sub-processes are internal to this procure-to-pay process, because they are specific to the enterprise system that supports this process.

Exercise 4.3 - Identify the entry and exit points that delimit the unstructured cycles in the process models shown below:

- What are the repetition blocks?
- Model the first business process using a loop activity.

The applicant may express their interest in a home insurance plan at the time of submitting their loan application to the loan provider.

Based on this information, if the loan application is approved, the loan provider may either only send an acceptance pack to the applicant, or also send a home insurance quote.

The process then continues with the verification of the repayment agreement.
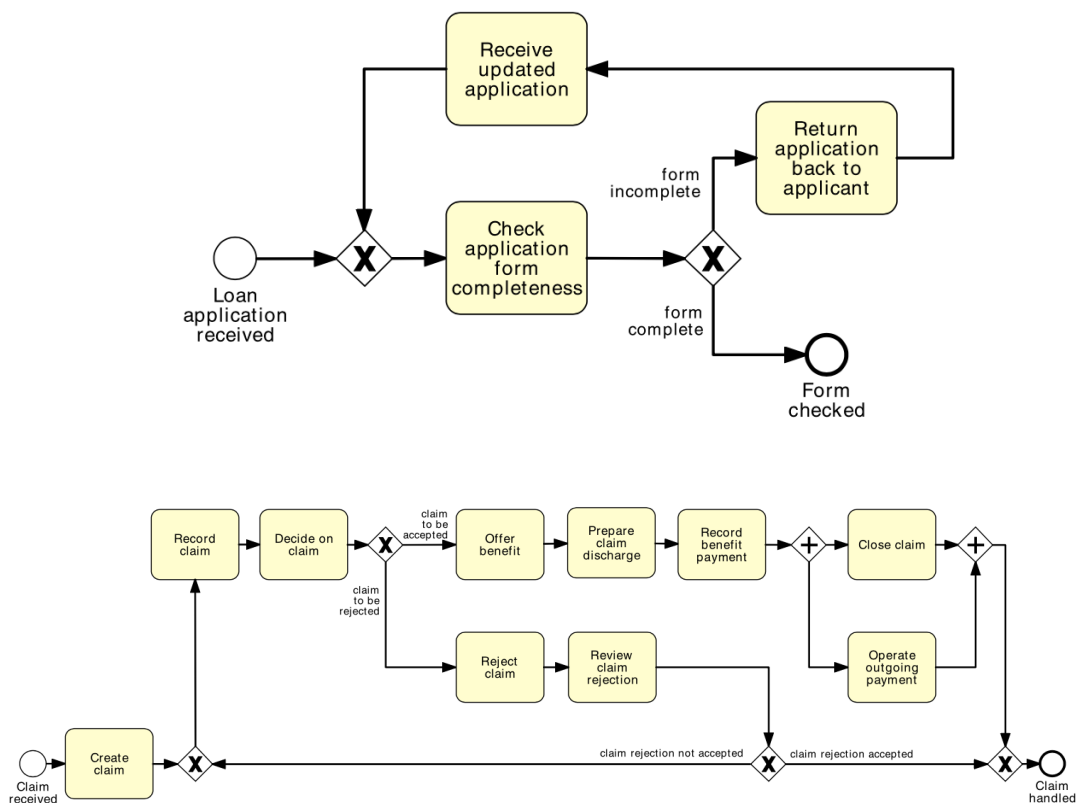
- The repetition block is made up of activities "Check application form completeness", "Return application back to applicant" and "Receive updated application". The entry point to the cycle is the outgoing arc of the XORsplit, while the exit point is the arc "form complete" which is inside the repetition block. To model this cycle with a loop activity, we need to repeat activity "Check application form completeness" outside the loop activity, as shown below
- The repetition block goes from activity "Record claim" to activity "Review claim rejection". The entry point to the cycle is the input arc of activity "Record claim"; the exit points are arcs "claim to be accepted" and "claim rejection accepted", the former being inside the repetition block.

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Exercise 4.4 - Model the following process fragment:

After a car accident, a statement is sought from two witnesses out of the five that were present, in order to lodge the insurance claim.

As soon as the first two statements are received, the claim can be lodged with the insurance company without waiting for the other statements.
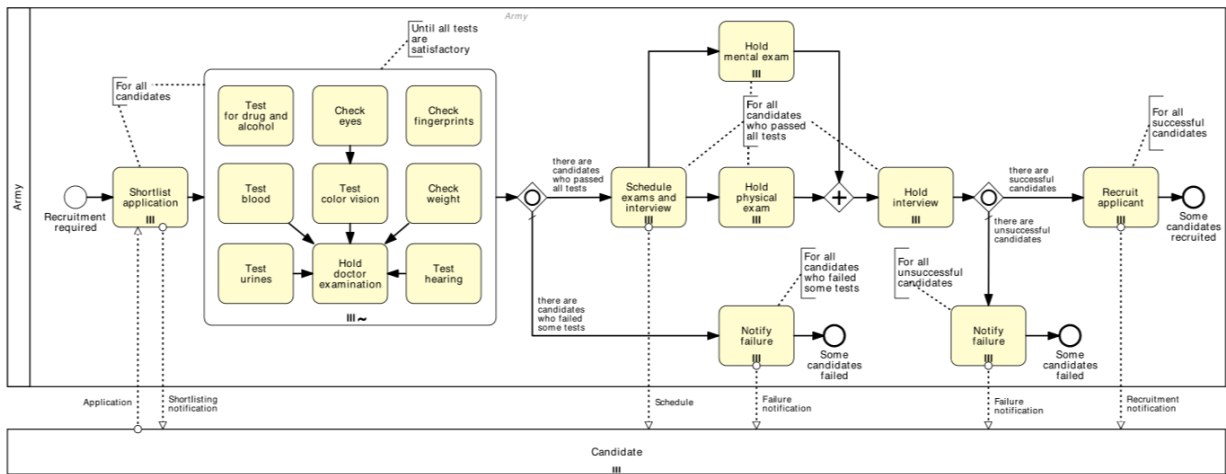
Solution: multi-instance activity
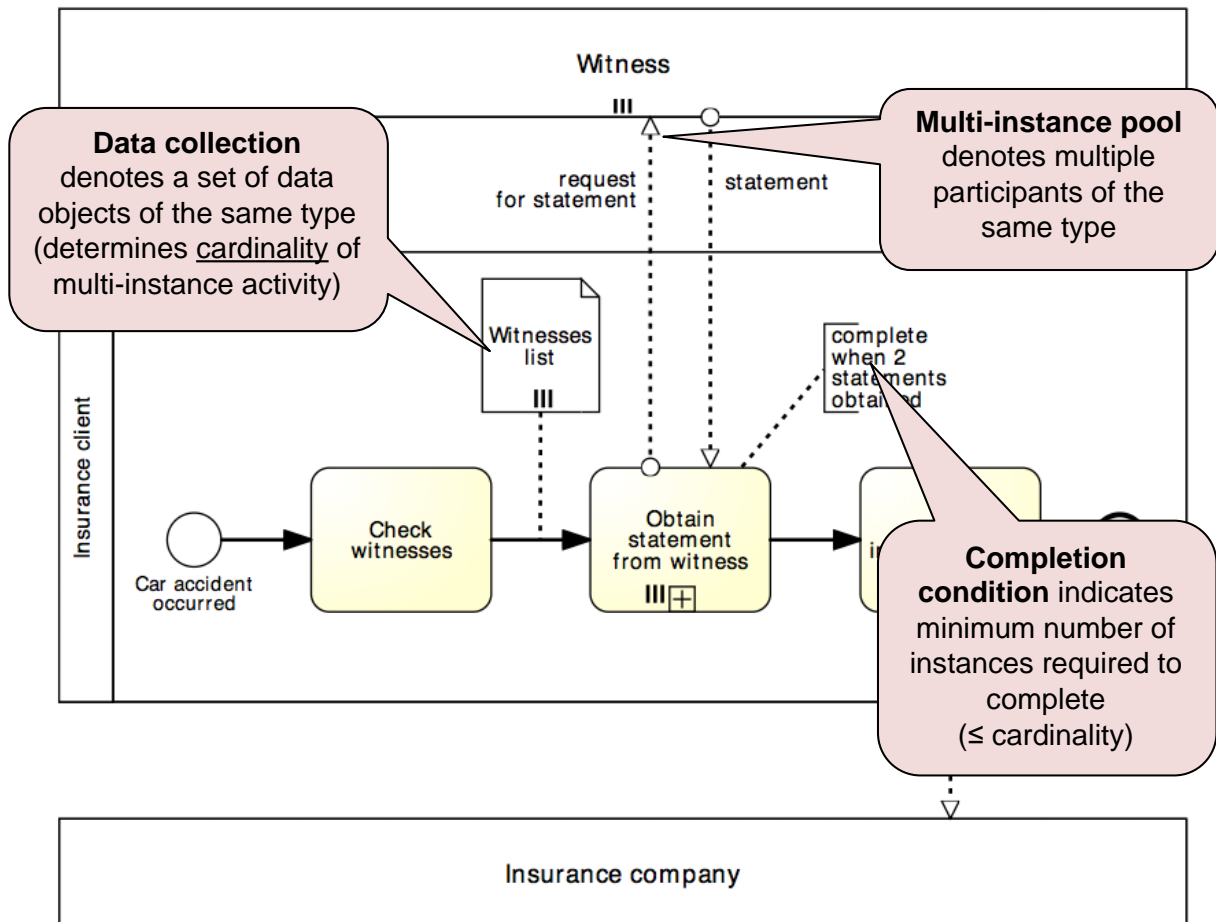
Exercise 4.5 - Model the following process snippet.

A typical army recruitment process starts by shortlisting all candidates' applications. Those shortlisted are then called to sit the following tests: drug and alcohol, eye, color vision, hearing, blood, urine, weight, fingerprinting and doctor examination.

The color vision can only be done after the eye test, while the doctor examination can only be done after color vision, hearing, blood, urine and weight have been tested.

Moreover, it may be required for some candidates to repeat some of these tests multiple times in order to get a correct assessment, e.g. the blood test may need to be repeated if the candidate has taken too much sugar in the previous 24 hours.

The candidates that pass all tests are asked to sit a mental exam and a physical exam, followed by an interview. Only those that also pass these two exams and perform well in the interview can be recruited in the army.

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Exercise 4.6 - Is there any other activity in the loan assessment model below that can be replaced by a message event?
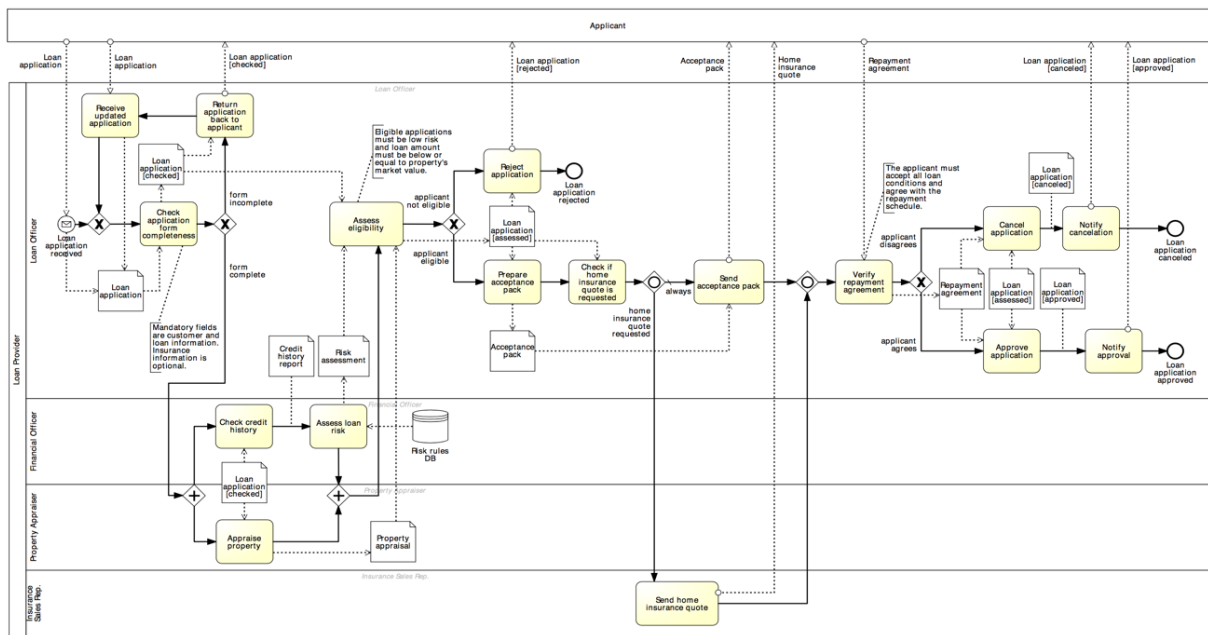
Activity "Send acceptance pack" can be replaced by an intermediate send message event; activities "Notify cancelation" and "Notify approval" can each be replaced by an end message event, thus removing the last XOR-join and the un- typed end event altogether. Note that activity "Send home insurance quote" cannot be replaced by a message event since it subsumes the preparation of the quote. In fact, a more appropriate label for this activity would be "Prepare home insurance quote". Similarly, we cannot get rid of activity "Reject application" as this activity changes the status of the application before sending the latter out.

Exercise 4.7 - Model the billing process of an Internet Service Provider (ISP).

The ISP sends an invoice by email to the customer on the first working day of each month (Day 1).

On Day 7, the customer has the full outstanding amount automatically debited from their bank account.

If an automatic transaction fails for any reason, the customer is notified on Day 8.

On Day 9, the transaction that failed on Day 7 is re-attempted. If it fails again, on Day 10 a late fee is charged to the customer's bank account.

At this stage, the automatic payment is no longer attempted.

On Day 14, the Internet service is suspended until payment is received.

If on Day 30 the payment is still outstanding, the account is closed and a disconnection fee is applied. A debt-recovery procedure is then started.

Exercise 4.8.- Model the following process.

A restaurant chain submits a purchase order (PO) to replenish its warehouses every Thursday.

The restaurant chain's procurement system expects to receive either a "PO Response" or an error message.

However, it may also happen that no response is received at all due to system errors or due to delays in handling the PO on the supplier's side.

If no response is received by Friday afternoon or if an error message is received, a purchasing officer at the restaurant chain's headquarters should be notified.

Otherwise, the PO Response is processed normally.
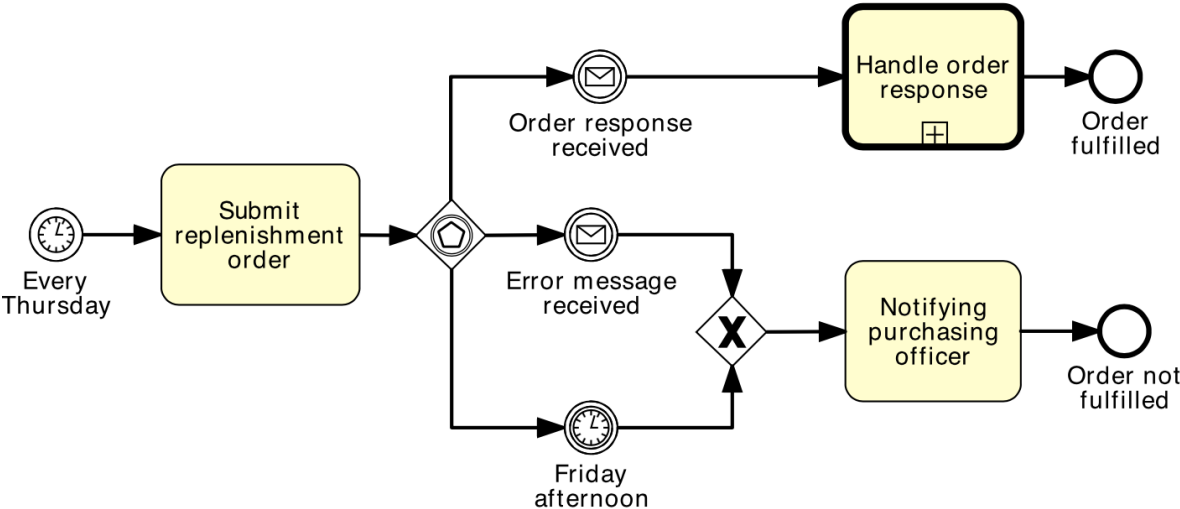
Exercise 4.9.- Fix the following collaboration diagram between a client, a travel agency and an airline.
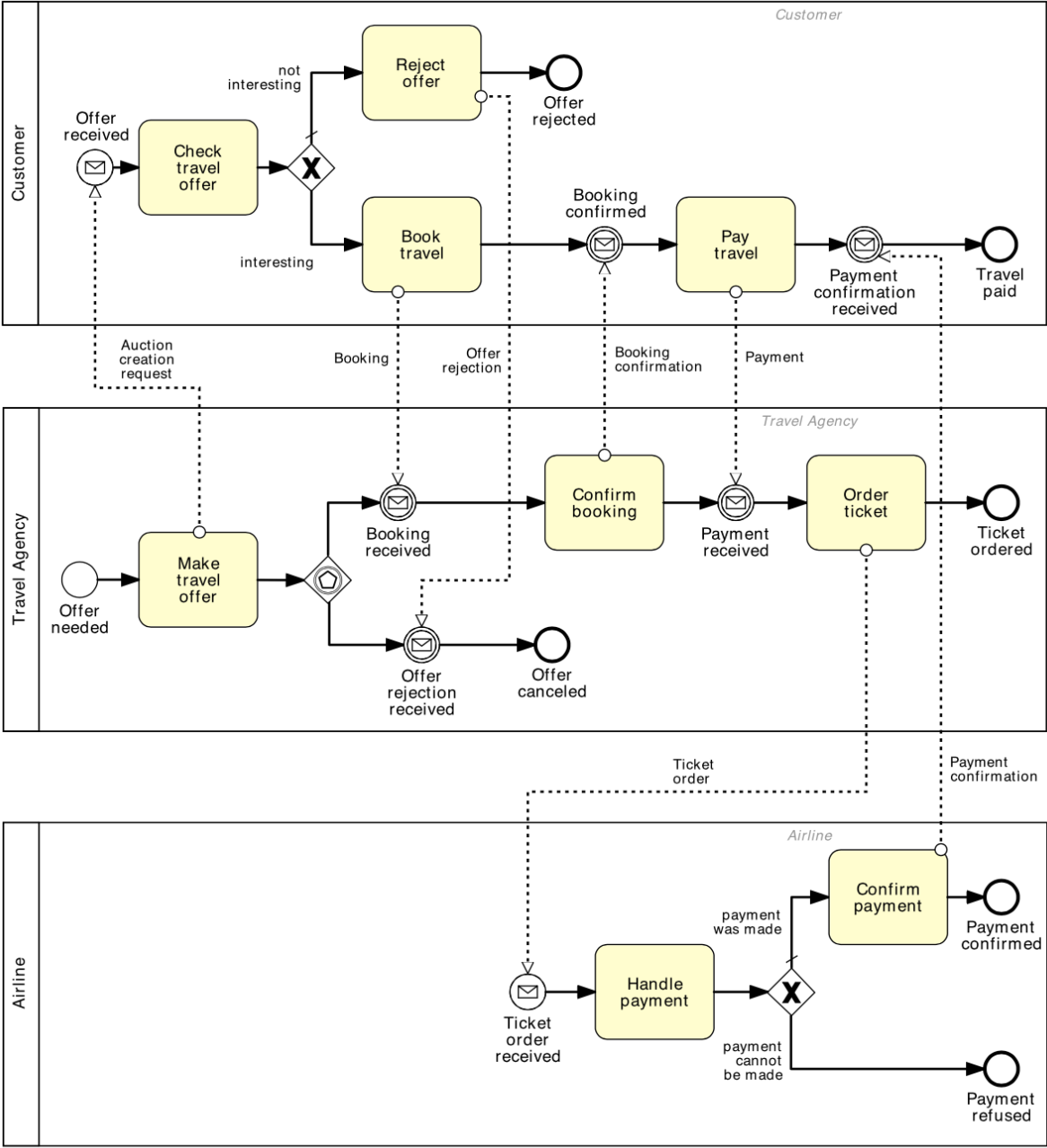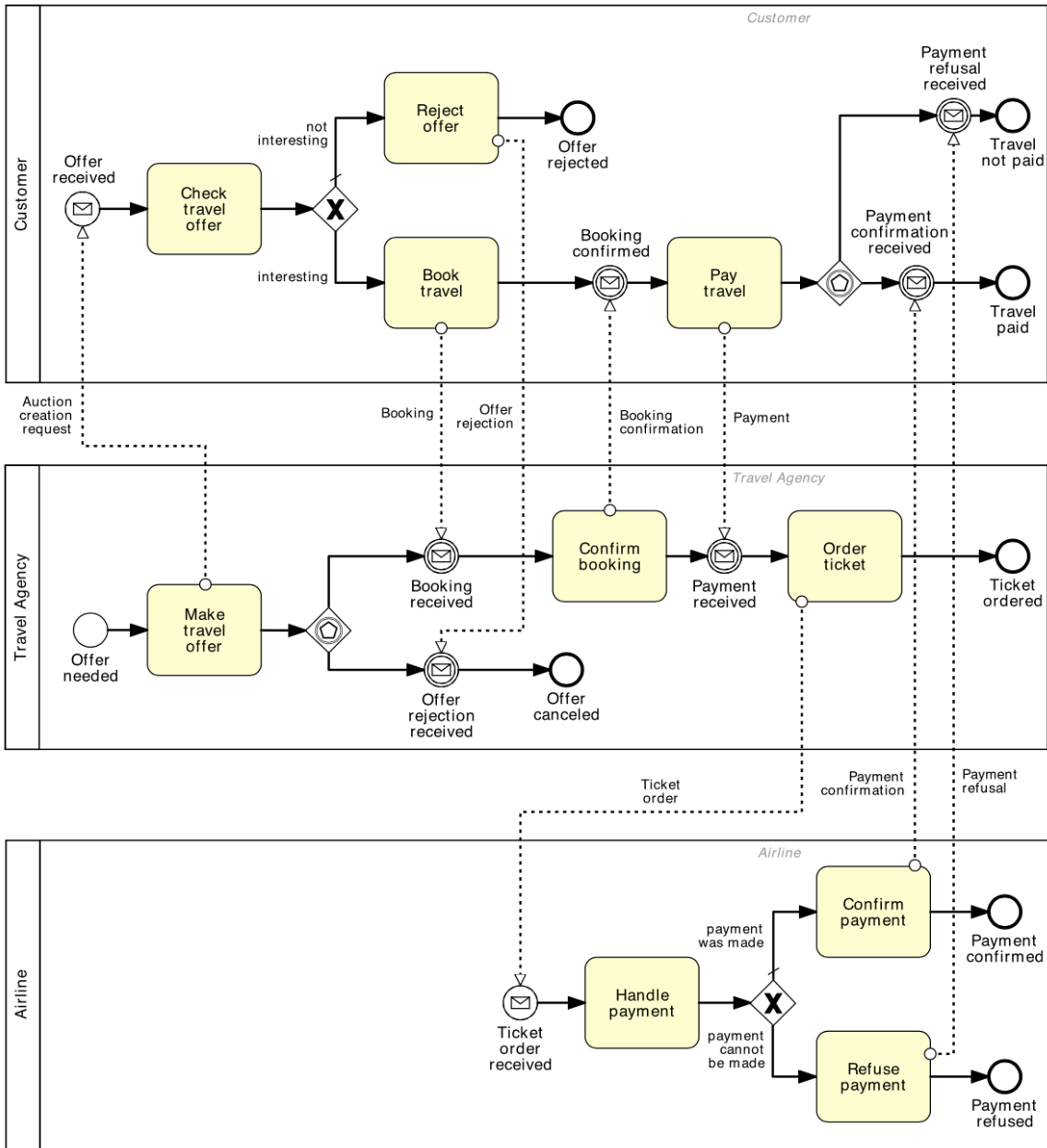
Exercise 4.11.- Model the following routine for logging into an Internet bank account.

The routine for logging into an Internet bank account starts once the credentials entered from the user have been retrieved.

First, the username is validated. If the username is not valid, the routine is interrupted and the invalid username is logged. If the username is valid, the number of password trials is set to zero.

Then the password is validated. If this is not valid, the counter for the number of trials is incremented and if lower than three, the user is asked to enter the password again, this time together with a CAPTCHA test to increase the security level.

If the number of failed attempts reaches three times, the routine is interrupted and the account is frozen.

Moreover, the username and password validation may be interrupted should the validation server not be available.

Similarly, the server to test the CAPTCHA may not be available at the time of log in. In these cases, the procedure is interrupted after notifying the user to try again later.

At any time during the log in routine, the customer may close the web-page, resulting in the interruption of the routine.
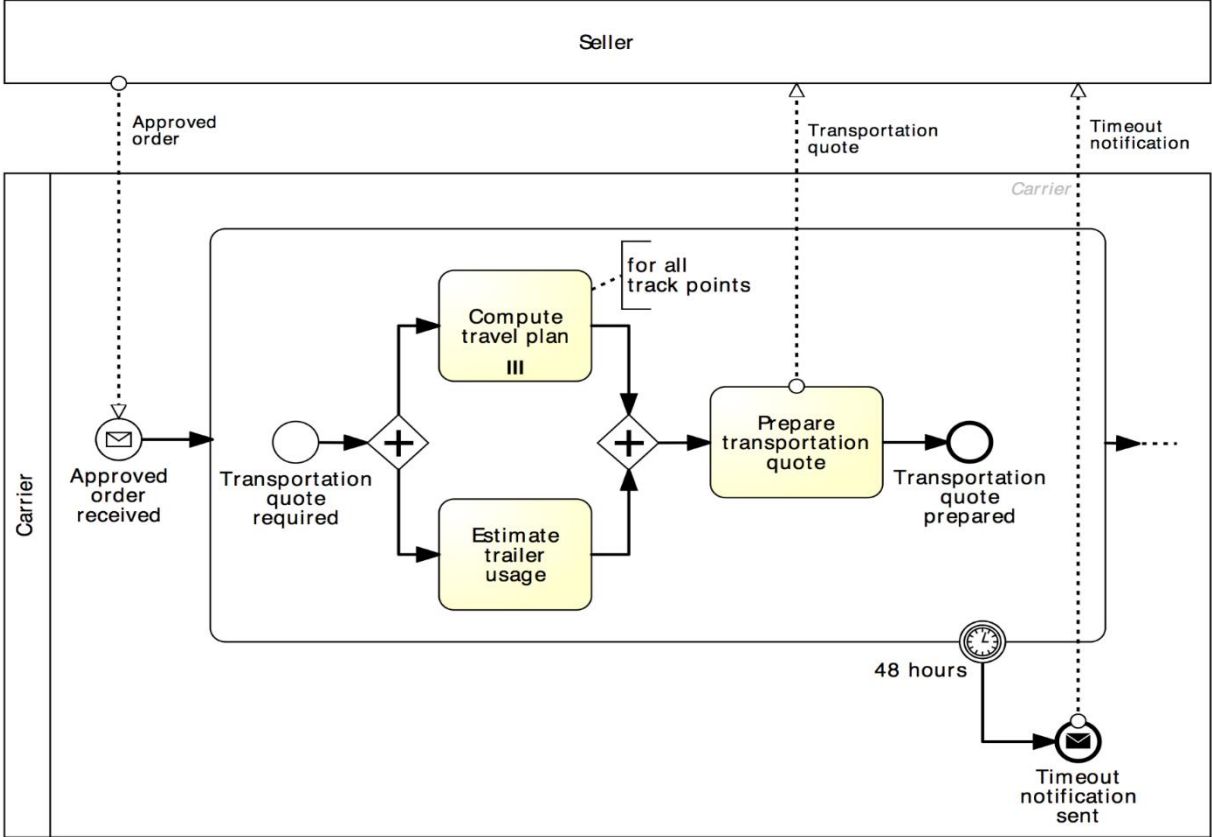
Exercise 4.12.- Model the following process fragment.

Once a wholesale order has been confirmed, the supplier transmits this order to the carrier for the preparation of the transportation quote.

In order to prepare the quote, the carrier needs to compute the route plan (including all track points that need to be traversed during the travel) and estimate the trailer usage (e.g. whether it is a full track-load, half track-load or a single package).

By contract, wholesale orders have to be dispatched within four days from the receipt of the order. This implies that transportation quotes have to be prepared within 48 hours from the receipt of the order to remain within the terms of the contract.

Exercise 4.13.- Extend the process below as follows.

An applicant who has decided not to combine their loan with a home insurance plan may change their mind any time before the eligibility assessment has been completed. If a request for adding an insurance plan is received during this period, the loan provider will simply update the loan application with this request.
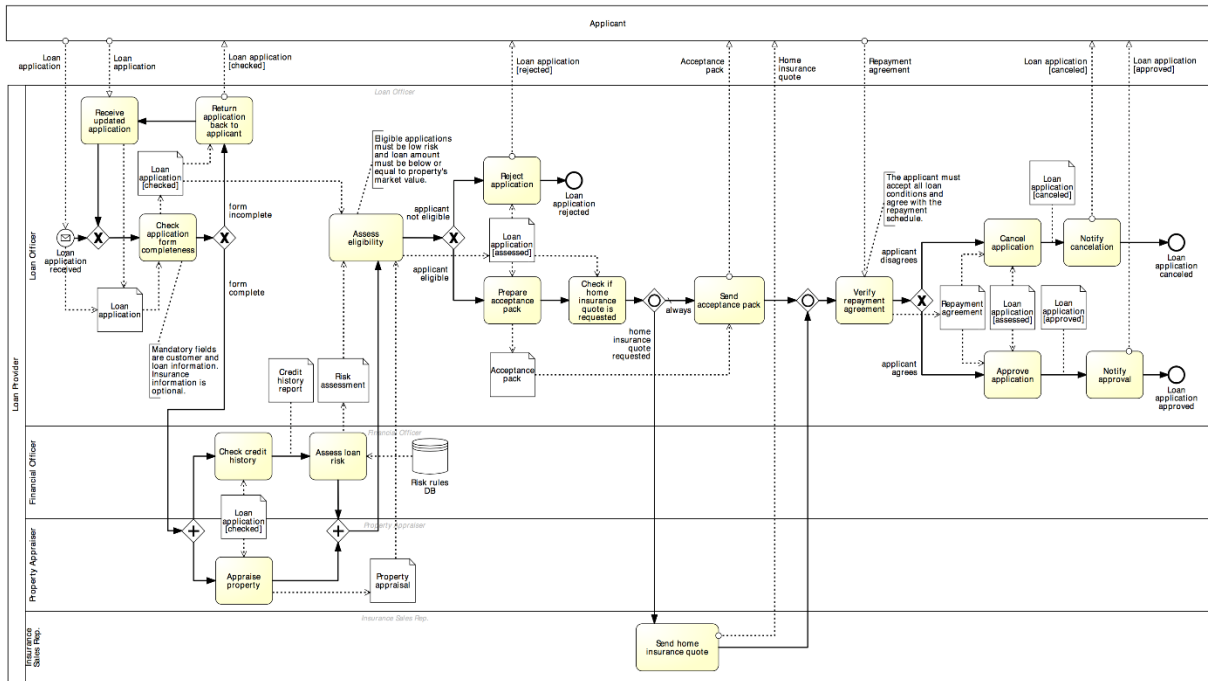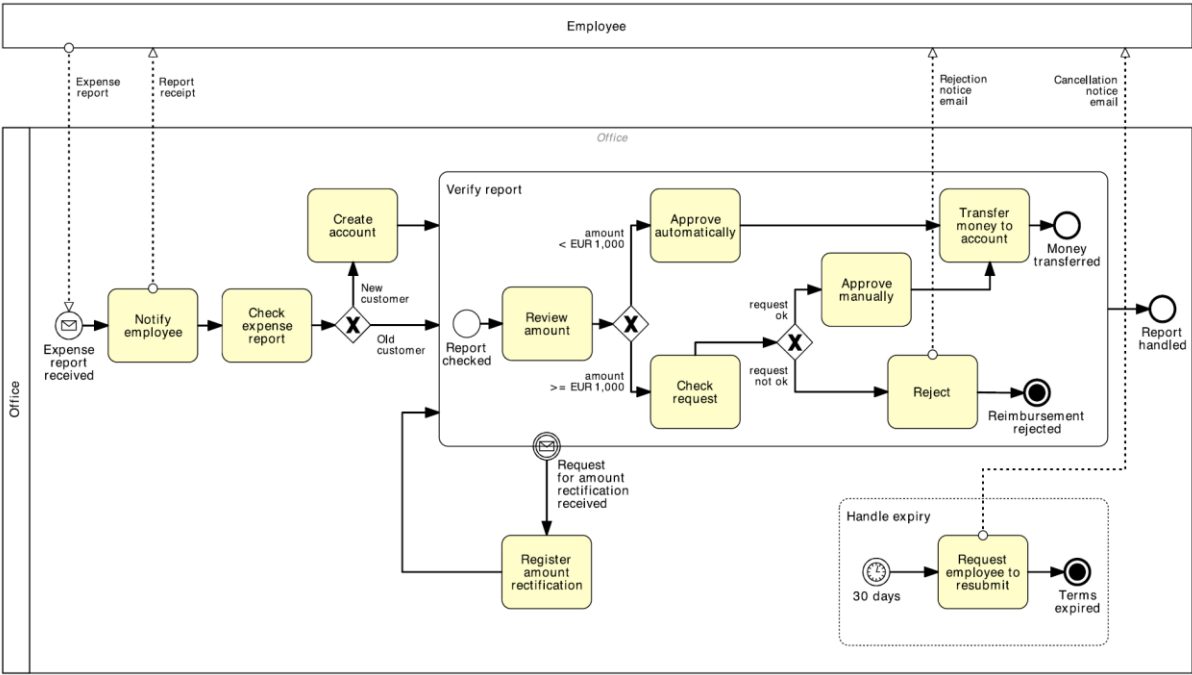

Observe that in the "Assess application" sub-process, the Loan application can have two possible states: "checked" or "unchecked". In order to use the Loan application in any such state as input of activity "Add insurance request to loan application", we do not specify any state for this data object in the above model

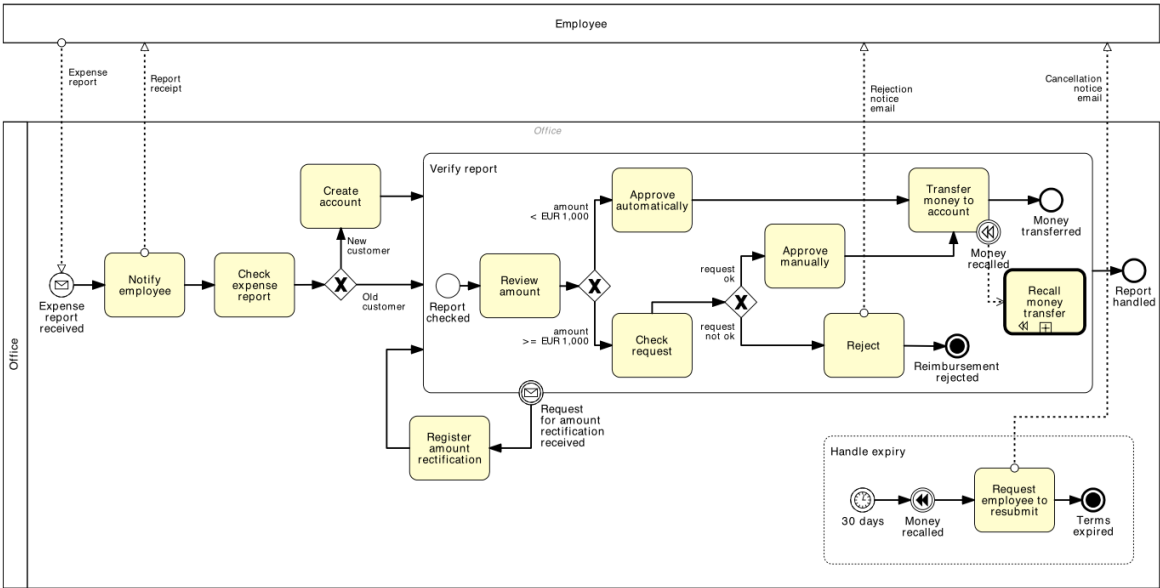**Exercise 4.14.-** Model the following business process for reimbursing expenses.

After an expense report is received from an employee, the employee is notified of the receipt of the report. Next, a new account must be created if the employee does not already have one. The report is then reviewed for automatic approval. Amounts under EUR 1,000 are automatically approved while amounts equal to or over EUR 1,000 require manual approval. In case of rejection, the employee must receive a rejection notice by email. In case of approval, the reimbursement is deposited directly to the employee's bank account and an approval notice is sent to the employee via email, with the details of the money transfer. At any time during the review, the employee can send a request for amount rectification. In that case the rectification is registered and the report needs to be reviewed again. Moreover, if the report is not handled within 30 days, the process is stopped and the employee receives a cancelation notice email so that he can resubmit the expense report from scratch.

Exercise 4.15.- Model the following business process for reimbursing expenses.

If the report is not handled within 30 days, the process is stopped, the employee receives a cancelation notice email and must resubmit the expense report.

However, if the reimbursement for the employee's expenses had already been made, a money recall needs to be made, to get the money back from the employee, before sending the cancelation notice email.

Exercise 4.16.- Model the following business process snippet.

In a stock exchange, stock price variations are continuously monitored during the day. A day starts when the opening bell rings and concludes when the closing bell rings.

Between the two bells, every time the stock price changes by more than 10%, the entity of the change is first determined. Next, if the change is high, a "high stock price" alert is sent, otherwise a "low stock price" alert is sent.
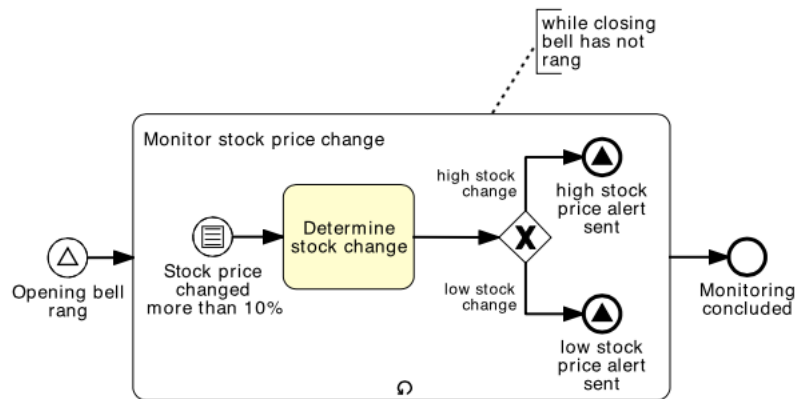

In this solution we did not use a boundary event to stop the sub-process for monitoring stock price changes since this way, the sub-process would only stop because of an exception. Rather, we used the loop condition to allow the sub-process to complete normally, i.e. without being interrupted.

Exercise 4.17.-

Use the process model diagram of page 89 as a template to build the corresponding collaboration diagram.
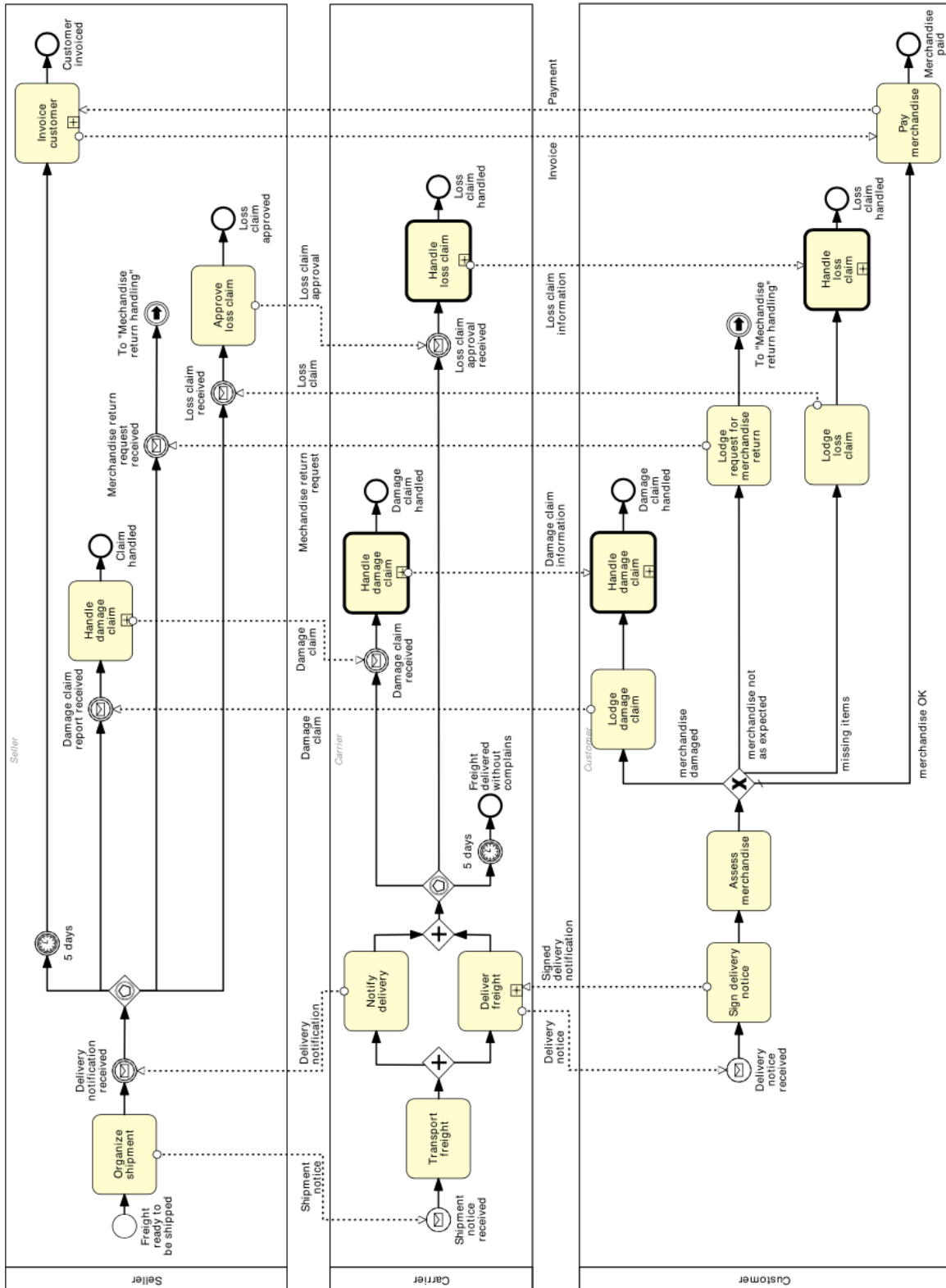
Fig. 4.28 Collaboration diagram—part 1/2 (Freight shipment fragment)
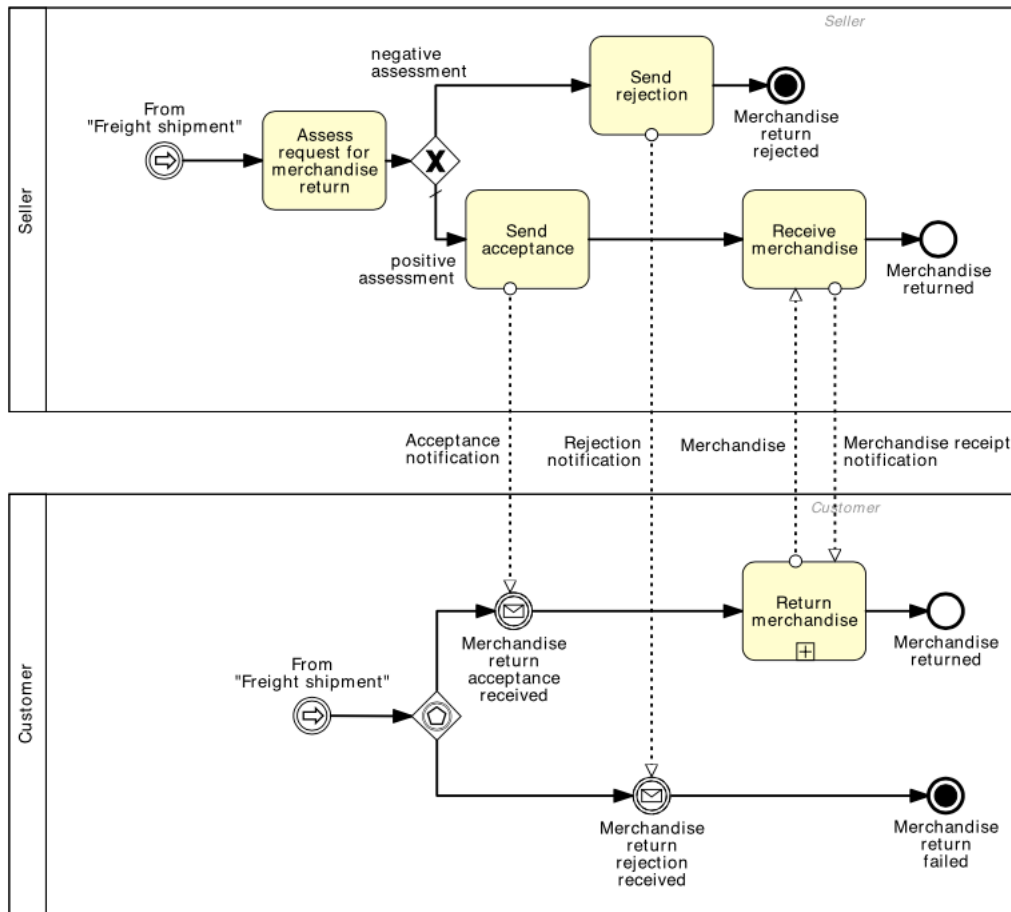
Fig. 4.29 Collaboration diagram—part 2/2 (Merchandise return handling fragment)

In Solution 4.17 we used the *link event* to lay the diagram over two pages, since the model was too large to fit in one page. The link event does not have any se- mantics: it is purely a notational expedient to break a diagram over multiple pages. An intermediate throwing link event (marked with a full arrow) breaks the process flow and provides a link to the diagram where the flow continues; an intermediate catching link event (marked with an empty arrow) resumes the flow and indicates the diagram where this flow is resumed from.

Exercise 4.18.- Model the choreography and collaboration diagrams for the following mortgage application process at BestLoans

The mortgage application process starts with the receipt of a mortgage application from a client. When an application is sent in by the client to the broker, the broker may either deal with the application themselves, if the amount of the mortgage loan is within the mandate the broker has been given by BestLoans, or forward the application to BestLoans. If the broker deals with the application themselves, this results in either a rejection or an approval letter being sent back to the client. If the broker sends an approval letter, then it forwards the details of this application to BestLoans so that from there on the client can interact directly with BestLoans for the sake of disbursing the loan. In this case, BestLoans registers the application and sends an acknowledgment to the client.

The broker can only handle a given number of clients at a time. If the broker is not able to reply within one week, the client must contact BestLoans directly. In this case, a reduction on the interest rate is applied should the application be approved.
If BestLoans deals with the application directly, its mortgage department checks the credit of the client with the Bureau of Credit Registration. Moreover, if the loan amount is more than 90 % of the total cost of the house being purchased by the client, the mortgage depart- ment must request a mortgage insurance offer from the insurance department. After these interactions BestLoans either sends an approval letter or a rejection to the broker, which the broker then forwards to the client (this interaction may also happen directly between the mortgage department and the client if no broker is involved).

After an approval letter has been submitted to the client, the client may either accept or reject the offer by notifying this directly to the mortgage department. If the mortgage department receives an acceptance notification, it writes a deed and sends it to an external notary for signature. The notary sends a copy of the signed deed to the mortgage department. Next, the insurance department starts an insurance contract for the mortgage. Finally, the mortgage department submits a disbursement request to the financial department. When this request has been handled, the financial department notifies the client directly.

Any time during the application process, the client may inquire about the status of their application with the mortgage department or with the broker, depending on which entity is dealing with the client. Moreover, the client may request the cancellation of the application. In this case the mortgage department or the broker computes the application processing fees, which depend on how far the application process is, and communicates these to the client. The client may reply within two days with a cancellation confirmation, in which case the process is canceled, or with a cancellation withdrawal, in which case the process continues. If the process has to be canceled, BestLoans may need to first recall the loan (if the disbursement has been done), then annul the insurance contract (if an insurance contract has been drawn) and finally annul the deed (if a deed has been drawn).
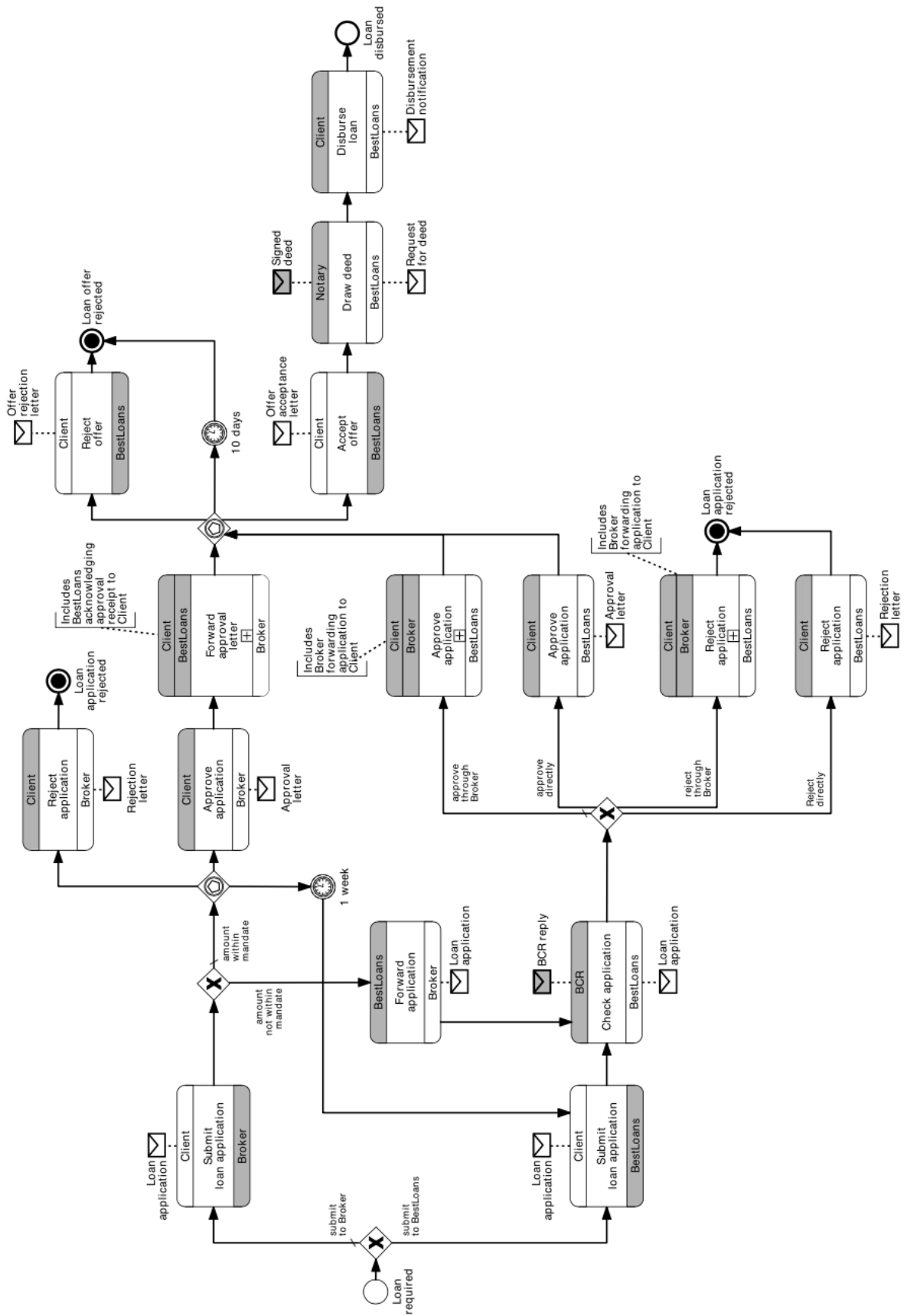
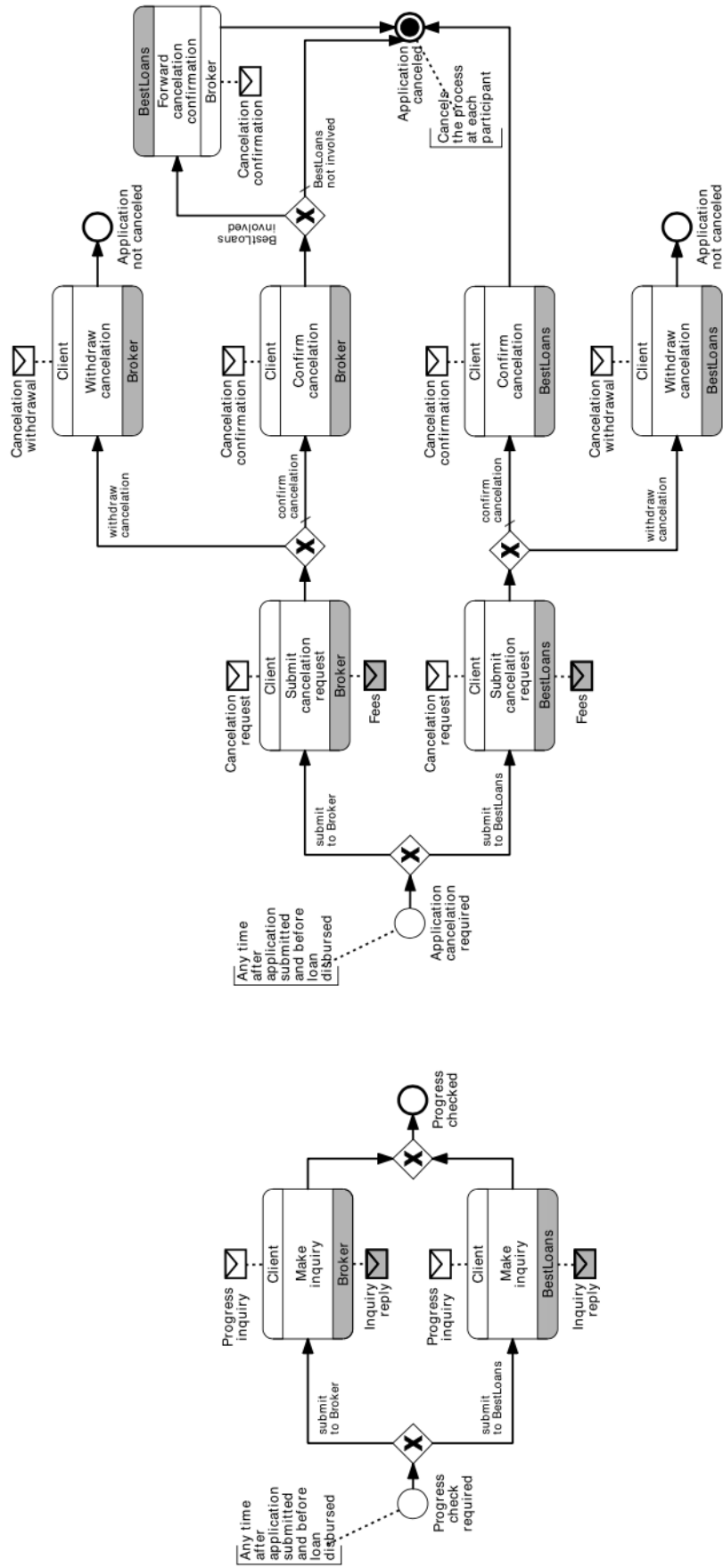**Fig. 4.30** Choreography diagram—part 1/2

Fig. 4.31 Choreography diagram—part 2/2

Tema 4: cuestionario

Which of the following are possible reasons for decomposing a process model into sub-process models?

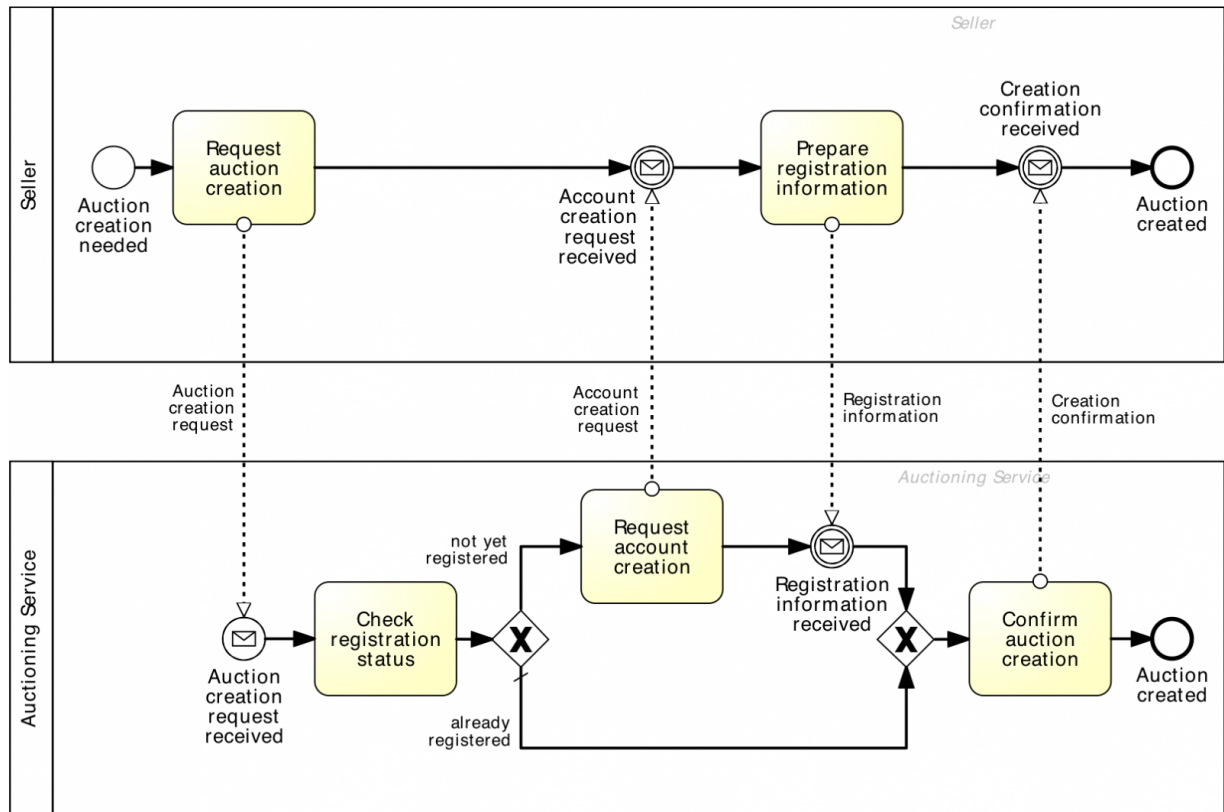Seleccione una o más de una:

- ☐ a. When the process model is getting too large to understand and maintain
- ☐ b. When there are too many crossing arcs in the model
- ☐ c. When there are too many end events in a process model and we wish to reduce their number
- ☐ d. When we want to avoid redundancies between multiple process models that share common parts
- ☐ e. When two events of the same type cannot be linked by a sequence flow

What is wrong with this collaboration diagram?

Seleccione una o más de una:

- a. The intermediate message flow in the Auctioning Service pool should be replaced by a receive task
- b. This collaboration can be fixed by replacing the XOR-split with an event-based gateway
- c. The XOR-join needs to be replaced by an OR-join
- d. This collaboration may deadlock if the seller is already registered
- e. An internal decision in one party must be matched by an XOR-join in the other party

Which of the following modeling elements can immediately follow an event-based gateway?

Seleccione una o más de una:

- a. Any start message event
- b. Any send task
- c. Any intermediate catching event
- d. Any receive task
- e. Any timer event

Which of the following events can be used as a boundary event?
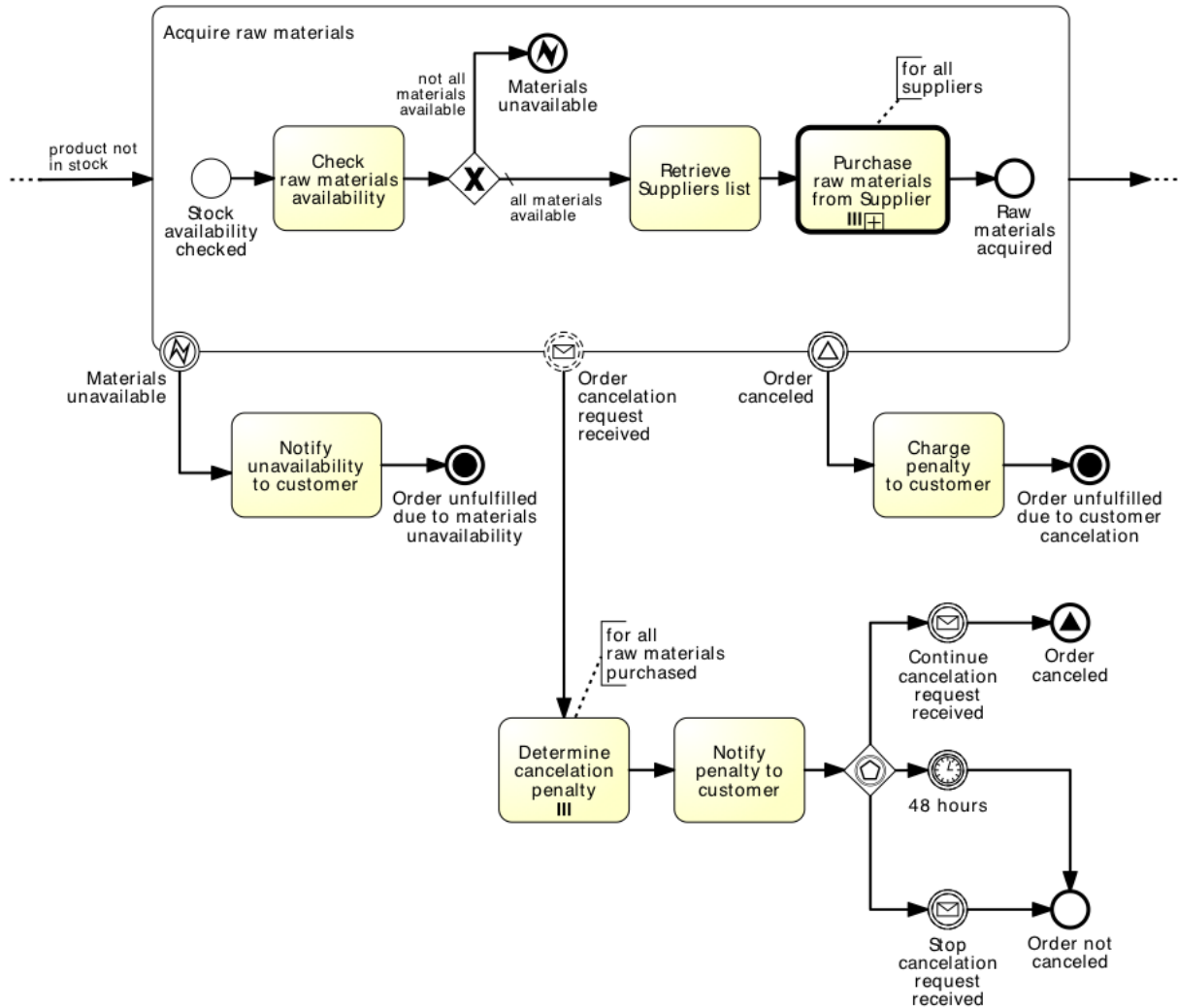
Seleccione una o más de una:

- [ ] a. An end error event
- [ ] b. An intermediate timer event
- [ ] c. An end timer event
- [ ] d. An intermediate error event
- [ ] e. An intermediate message event

Consider the following model.

Which of the following statements is true?

Seleccione una o más de una:

- a. If a cancelation request is received after raw materials have been acquired, the request is not considered

- b. Task "Purchase raw materials from Supplier" is always executed

- c. An order may still be canceled even if a customer sends a "Stop cancelation request"

- d. The interruption of the raw materials acquisition sub-process may be triggered from within the process, but outside the activity itself

- e. An order may be cancelled either if a cancelation request is made by the customer, or if materials are unavailable

Which of the following stateements are true about a choreography activity?

Seleccione una o más de una:

- [ ] a.   A choreography activity captures a unit of work
- [ ] b.   A choreography activity represents an interaction between two parties
- [ ] c.   A choreography activity may involve more than two parties
- [ ] d.   A choreography activity can be one-way or two-way
- [ ] e.   A choreography activity can only follow another activity if the former involves the initiation of the latter activity

Which of the following are possible reasons for decomposing a process model into sub-process models?
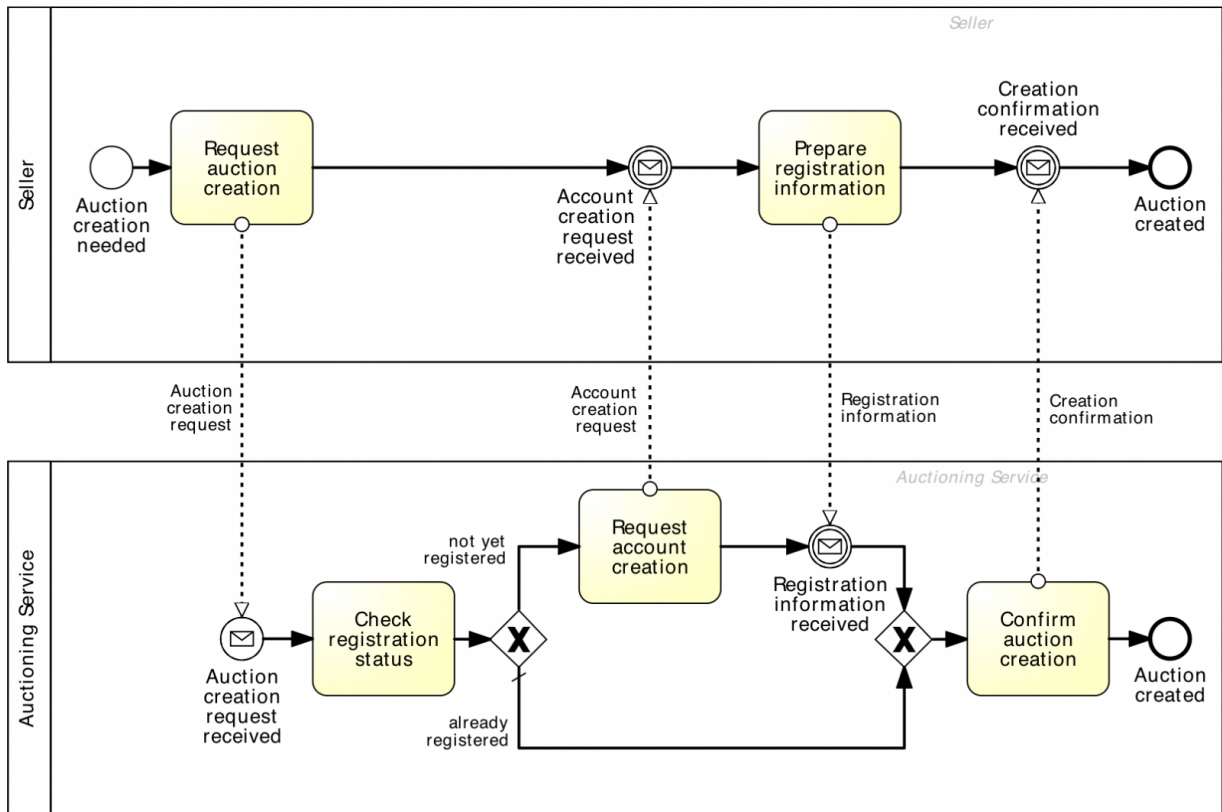
Seleccione una o más de una:

- ☑ a. When the process model is getting too large to understand and maintain
- ☐ b. When there are too many crossing arcs in the model
- ☐ c. When there are too many end events in a process model and we wish to reduce their number
- ☑ d. When we want to avoid redundancies between multiple process models that share common parts
- ☐ e. When two events of the same type cannot be linked by a sequence flow

What is wrong with this collaboration diagram?

Seleccione una o más de una:

- [ ] a. The intermediate message flow in the Auctioning Service pool should be replaced by a receive task
- [x] b. This collaboration can be fixed by replacing the XOR-split with an event-based gateway
- [ ] c. The XOR-join needs to be replaced by an OR-join
- [ ] d. This collaboration may deadlock if the seller is already registered
- [ ] e. An internal decision in one party must be matched by an XOR-join in the other party

Which of the following modeling elements can immediately follow an event-based gateway?

Seleccione una o más de una:

- [ ] a. Any start message event
- [ ] b. Any send task
- [x] c. Any intermediate catching event
- [x] d. Any receive task
- [ ] e. Any timer event

Which of the following events can be used as a boundary event?
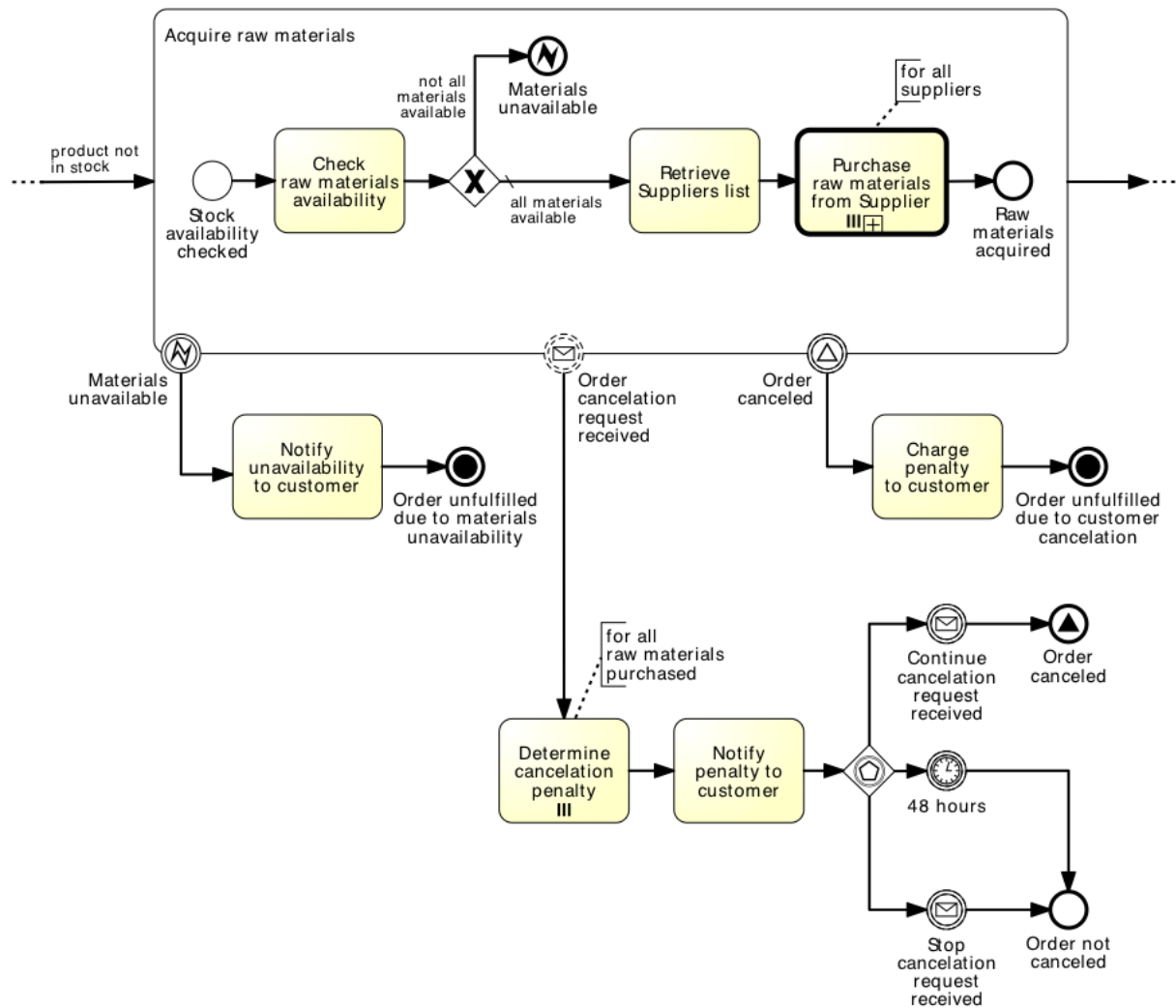
Seleccione una o más de una:

- ☐ a. An end error event
- ☑ b. An intermediate timer event
- ☐ c. An end timer event
- ☑ d. An intermediate error event
- ☑ e. An intermediate message event

Consider the following model.

Which of the following statements is true?

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☐ b. Task "Purchase raw materials from Supplier" is always executed

☑ c. An order may still be canceled even if a customer sends a "Stop cancelation request"

☑ d. The interruption of the raw materials acquisition sub-process may be triggered from within the process, but outside the activity itself

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- ☑ d. A choreography activity can be one-way or two-way
- ☑ e. A choreography activity can only follow another activity if the former involves the initiation of the latter activity