



UNIVERSITY
OF SKÖVDE

School of Informatics (IIT)

WRITTEN EXAMINATION

Course **Business Process Management**

Sub-course

Course code **IT378G**

Credits for written examination **4.5**

Date **2025-01-14**

Examination time **8:15-12:30**

Examination responsible **Manfred Jeusfeld, Kristens Gudfinnsson**

Teachers concerned **Manfred Jeusfeld, Kristens Gudfinnsson**

Aid at the exam/appendices

Students are allowed to bring a Swedish-English dictionary to the exam

- Instructions
- ☒ Take a new sheet of paper for each exam part.
 - ☐ Take a new sheet of paper when starting a new question.
 - ☒ Write only on one side of the paper.
 - ☒ Write your name and personal ID No. on all pages you hand in.
 - ☒ Use page numbering.
 - ☒ Don't use a red pen.
 - ☒ Mark answered questions with a cross on the cover sheet.

Grade points: 100

Answer in Swedish or English.

Answer all the questions

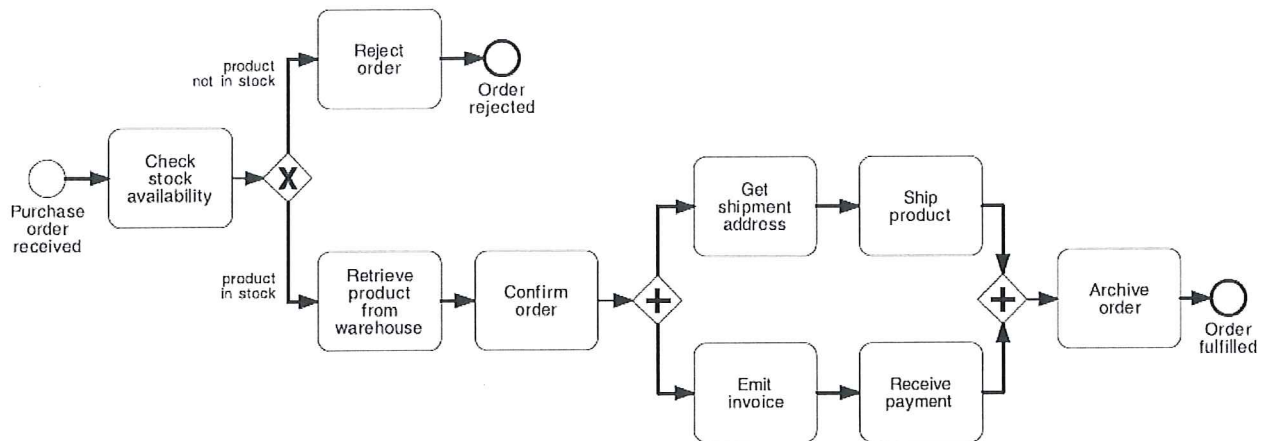
Examination results should be made public within 18 working days

Good luck!

Total number of pages: 6 (incl. this title page)

The maximum number of points is 100. The grade is calculated from the sum of points achieved for the questions. You need 50 points or more to pass the exam.

Question 1: (20 points) Consider the following BPMN process model



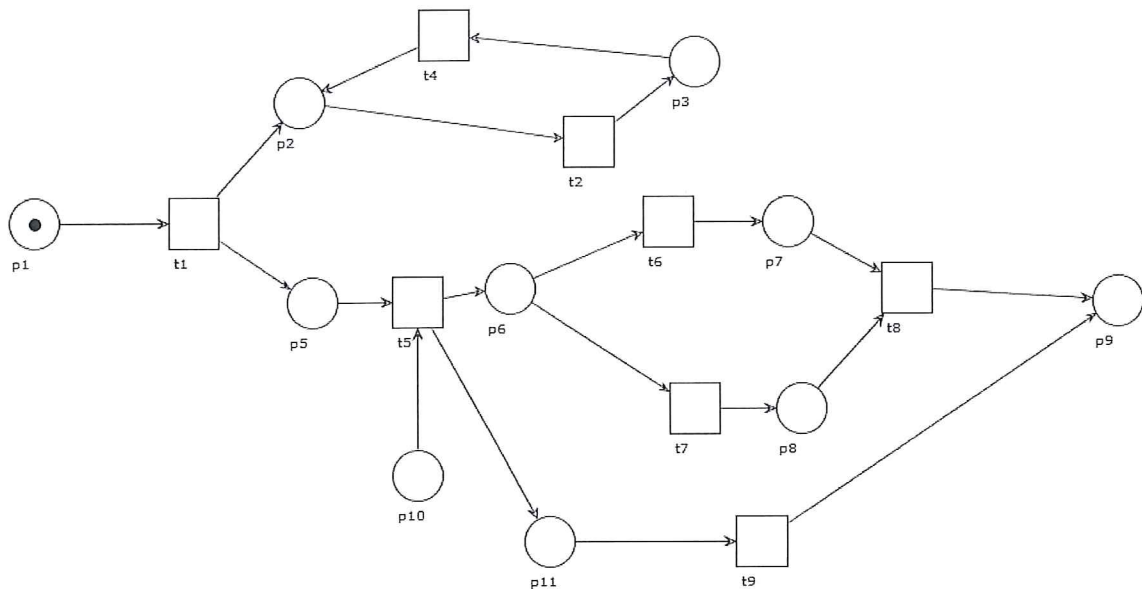
- (10 points) Transform this BPMN model into an equivalent workflow net (WF-net: petri net with a single start and end place).
- (5 points) Is your WF-net sound? What criteria need to be fulfilled. Can you check manually whether your WF-net is sound?
- (2 points) What is the difference between a message flow and a sequence flow? Does the above BPMN model have a message flow?
- (3 points) Give an example of a message flow between in a small BPMN model. Can such a message flows be mapped to a petri net? How would the petri net look like for your example message flow?



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Question 2 (15 points)

Consider the following un-sound petri net



a) (9 points) Identify and describe the flaws in the above petri net that prevent it to be a sound WF-net!

b) (6 points) Define the following terms

- sound WF-net
- boundedness
- liveness



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Question 3 (20 points)

Consider the following example from the banking industry: A customer may ask for different types of credits: a consumer credit (to buy consumer products or services), a car credit (to buy a car), and a mortgage credit (to buy a house). For a consumer credit, the customer needs to have an income above 15000 SEK a month. Moreover, there may not be existing credits whose monthly payments exceed 1500 SEK. This is being checked by the credit assessment department, while the salary details are checked based on documents provided by the customer. For a car credit, the bank submits the car documents to an external expert who assesses the value of the car. The credit may not exceed 60% of the value of the car. Finally, for the mortgage credit, the monthly available income (=income minus monthly costs of the customer) must exceed 5000 SEK. The bank shall also check the value of the house. It must have a value above the mortgage credit.

- Write a BPMN model for this example. Use message flows, pools, lanes, and event-based gateways when appropriate.



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Question 4 (15 points)

Process mining analyzes so-called event logs.

- (a) (5 points) What is an event log? Which fields are *mandatory* in an event log?
- (b) (5 points) What is a so-called process map?
- (c) (5 points) Give an example of an event log with 5 different activities for the same case. Construct a process map for your example event log.

Each answer should be about 1/3 page long. Use your own examples where appropriate!

Question 5 (15 points)

- (a) (5 points) In waiting queue theory, we demand that a process must be *stable*. What is meant by a “stable” process.
- (b) (5 points) Explain what is understood by “Little's Law” in waiting queue theory? What is the formula for Little's Law?
- (c) (5 points) Why can resource utilization not be optimized independently from the cycle time? Explain!

Each answer should be about 1/3 page long. Use your own examples where appropriate!



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Question 6 (15 points)

Provide characteristic curves for the so-called density function of the following distributions:

- exponential distribution
- gamma distribution
- uniform distribution
- triangular distribution
- fixed distribution

By which parameters are these distributions specified?

Give arguments when to use which distribution for *interarrival times* and *task times*.