Exam Modeling of Business Processes
16 April 2002

This exam consists of **4** problems, each consisting of several questions.
All answers should be motivated, including calculations, formulas used, etc.
It is allowed to use 2 sheets of paper (or 4 sheets written on one side) with **hand-written** notes.
The minimal note is 1. Questions 1, 2, 3, and 4 all give 2.5 points when correctly answered.
The answers may be written in English or in Dutch.

1. An Erlang calculator can calculate the service level, defined as the percentage of callers that waits longer than t seconds, based on the arrival rate λ, the average service time β, and the number of servers s.
In a call center there are on average 10 calls per minute, that require each on average 3 minutes to answer. The acceptable waiting time is 20 seconds, and the time between the moment a call is assigned to an agent and the moment it is answered by the agent is around 3 seconds.
a. Give the parameter values for the Erlang calculator by which you can calculate the service level in the call center.
b. To obtain a service level of around 80% 35 agents are needed. Define productivity and calculate it.
c. A model is not an exact description of reality. Give 3 aspects in which the Erlang system does not model the call center exactly.
d. The arrival rate doubles to 20. The manager decides to double the number of agents. What do you expect to be the consequences for the costs and the service level? Motivate your answer!
e. Estimate without using the Erlang formula how many agents need to be scheduled to obtain a 80% service level. Motivate your answer.