

Exam Optimization of Business Processes

24 August 2011

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 1 sheet of paper (or 2 sheets written on one side) with **hand-written** notes.

The minimal note is 1. Question 1 can give 3 points, the other questions 2 points.

The use of a calculator and a dictionary are allowed.

1. Consider a single-server queue. The arrivals occur according to a Poisson process with rate 0.9. The customers have an expected service time of 1.

a. Compute the expected waiting times for exponential and deterministic service time distribution.

Now the customer consists of two types: exactly half of the customers are of type 1. Type 1 customers have exponential service times, type 2 customers have deterministic service times.

b. Compute the expected waiting times for type 1 and type 2 customers under both priority rules and under FCFS.

2a. Formulate the aggregate production planning model.

b. Allow the possibility of backorders. Formulate again the aggregate production planning model.

- 3a. Explain in words the concepts of booking limits and bid prices.
- b. Which method can best be used in the case of multiple resources (such as multiple flight legs)? Motivate your answer.
- c. Explain the difference between EMSR-a and EMSR-b.

- 4. A maternity ward in a small hospital has 2 beds. Arrivals are approximately Poisson, and patients who find both beds occupied go to another hospital.
 - a. Give a formula for the probability that the ward is full.
 - b. Explain why this probability is equal to the probability that new patients are blocked.
 - c. Let the average length of stay be 2 days. The occupancy is 60%. What are the arrival rate (including blocked patients) and the blocking probability?