

## Stochastic Methods in Industry I (WS 07/08)

### Problem Set 10

#### Problem 1

In an  $M/M/1$  cost model, find the optimum service rate  $\mu$  with the following data:

- The cost per served customer per unit service time is 10 Euro
- The cost per customer in the system per unit time is 1 Euro.
- The arrival rate  $\lambda$  is 20 per unit time.

#### Problem 2 (CAS)

In a tool crib facility, requests for tool exchange according to a Poisson distribution with mean 17.5 requests per hour. Each clerk in the facility can handle an average of 10 requests per hour. The cost of adding a new clerk is estimated at 6 Euro per hour. The cost of lost production per waiting machine per hour is estimated at 30 Euro per hour. How many clerks should staff the facility?

#### Problem 3 (CAS)

In problem 2 suppose it is desired to determine the number of clerks such that the expected waiting time until a tool is received remains below 20 minutes. Simultaneously, it shall be required that the percentage of time that the clerks are idle does not exceed 15%. Show that these two aspiration levels cannot be satisfied simultaneously.

#### Problem 4 (CAS)

Two repairmen are being considered for attending 10 machines in a workshop. The first repairman will be paid 30 Euro per hour. He repairs machines according to a Poisson process with rate 5 per hour. The second repairman will be paid 50 Euro per hour and his rate is 8 per hour. Each machines' downtime cost is 80 Euro per hour. The machines break down according to a Poisson process with rate 4 per hour. Which repairman should be hired?

**Due date** Friday, January 18 2008, 14:00 o'clock. Sheets can be turned in right before class. Please put your **name** and **student id number** on each sheet you turn in and staple the sheets. The problems marked (CAS) shall be treated with your favorite computer algebra system. If you are not familiar with any CAS provide the formulas and the way to the solution at least.