

# Home assignment set 3: Congestion Control and Rate Control

September 14, 2018

## Problem 1

Consider an AIMD (additive increase multiplicative decrease) scheme, similar to the one addressed in the lecture, with additive increase parameter  $b$  and multiplicative increase parameter  $a$ . Consider constant  $rtt$  and  $p$ , and assume that packet loss happens always at the same window size, as we assumed in the model presented on the lecture. Express the throughput as a function of parameters  $a = (0, 1)$ , and  $b = (0, 1)$ , and evaluate the effect of these parameters on the throughput. Prepare plots if that helps understanding.

What are the advantages and drawbacks to select large (or small) values for  $a$  and  $b$ ? Consider the case when our assumptions on the loss process hold, as well as the case when the loss process is more random.

## Problem 2

Consider the TCP paper you have read at home. It contains three, increasingly complex models of TCP throughput. Assume you need to use a TCP model for some analysis. How can you decide which one of the models to select?

## Problem 3

a) Consider a traffic flow that is rate controlled with a Leaky Bucket (LB) controller. The controller is designed to limit the average transmission rate and the maximum burst size. Assume, that packets are of one unit, and the rate controller controls the number of packets to be transmitted. Consider LB parameters  $b = 3$ ,  $r = 0.25$ . Give the traffic envelope of the LB. Assume, that at time zero, the token buffer is full (stores 3 tokens), and the source generates 6 packets to transmit. When are these packets sent to the transmit buffer of the rate controller? When are they transmitted if the link capacity is one packet per time unit?

b) When are the same 6 packets transmitted, if the LB controls the peak and the average rate, the peak rate is 0.5 and the average rate is 0.25. Draw the traffic envelope of the LB and give the point of times when the packets are sent to the transmit buffer and when they are transmitted on the output link.