

Exercise sheet 2  
**Energy Informatics**  
 Winter 2016

**Exercise 3**

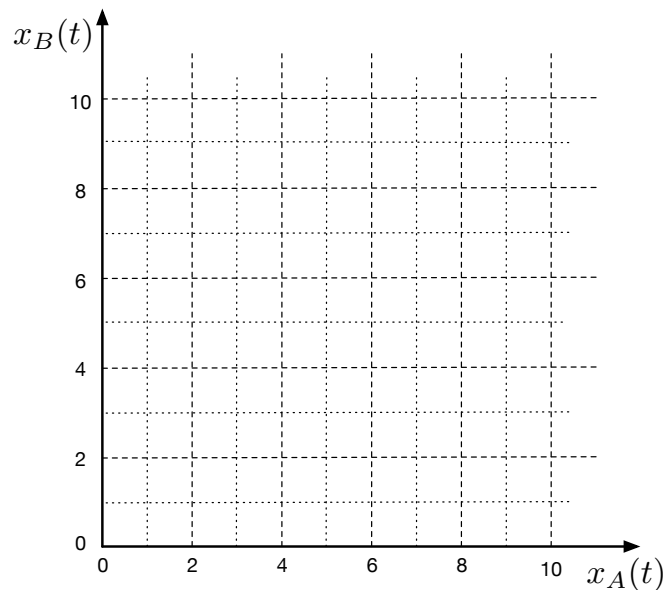
Consider two senders  $A$  and  $B$  using TCP AIMD. For simplicity, let  $x_A(t)$  be the data rate of  $A$  and  $x_B(t)$  be the data rate of  $B$ .

If the sum of the data rates  $x_A(t) + x_B(t)$  in a round is larger than 10, then

Otherwise we have

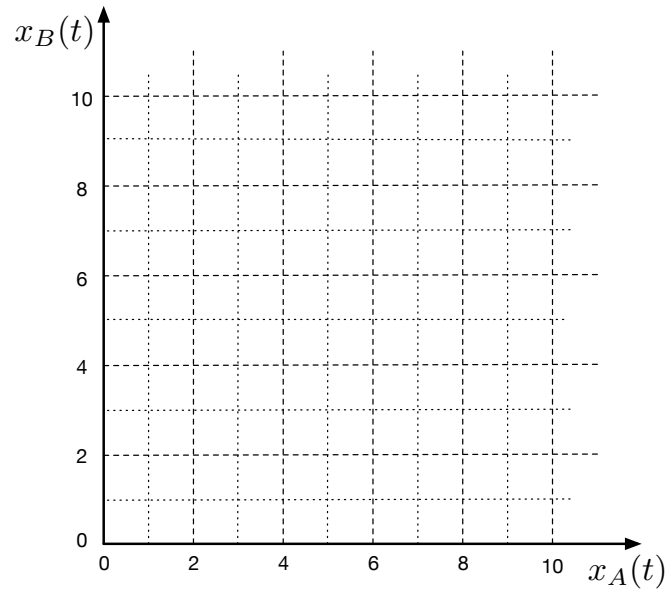
$$\begin{aligned} x_A(t+1) &= \frac{1}{2}x_A(t) \\ x_B(t+1) &= \frac{1}{2}x_B(t) \end{aligned}$$

$$\begin{aligned} x_A(t+1) &= x_A(t) + 1 \\ x_B(t+1) &= x_B(t) + 1 \end{aligned}$$



1. Add the fairness and efficiency lines to the diagrams. 2 P
2. Assume  $A$  starts in round 0 and  $B$  at round 5, i.e.  $x_B(t) = 0$  for all  $t \leq 5$ . Compute the first 15 values of  $A$  and  $B$  and add the behavior to the diagram above. 2 P
3. Now  $A$  leaves in round 15, such that  $x_A(t) = 0$  for  $t \geq 15$ . Compute the next 10 rounds. 2 P

4. In a different scenario assumes that  $A$  uses AIMD, but  $B$  has constant data rate 8, i.e. 2 P



$x_B(t) = 8$ . What happens?

5. In a last scenario assume that  $A$  changes its behavior to AIAD (additive increase/additive decrease), i.e. replacing  $x_A(t+1) = \frac{1}{2}x_A(t)$  by  $x_A(t+1) = x_A(t) - 1$ . Simulate 15 rounds where  $A$  and  $B$  start at the same time with bandwidth 0. 2 P

