

Mathematical Modelling for Computer Networks

Spring 2013

Exercise 1: Due on 15th March 2013.

Write your answers to the questions briefly and clearly. Please bring a printout (or a handwritten copy) of your answers to the class.

1. Kindly go through the two math appendices on linear algebra and calculus that are in the course page. List any questions that you want to discuss in the exercise class.
2. By using L' Hôpital rule, show that

$$\lim_{\alpha \rightarrow 1} \frac{x^{1-\alpha} - 1}{1 - \alpha} = \log x$$

3. Give two non-zero 2x2 matrices such that their product is the zero matrix.
4. Use the theory of linear maps to argue that if the number of variables is greater than the number of equations in a given homogeneous linear system (equations like $x + 2y + 3z = 0$ which have zero on the right hand side), there always exists a non-zero solution to the equations.
5. Describe the TCP Congestion Control algorithms TCP Tahoe and TCP Reno.
6. Read the Section 1.3 (Experiments) of the lecture notes on Chiu-Jain Model of Congestion Control. Show the rate evolution of two users using the Chiu-Jain algorithm when they share a link of capacity 1. The initial rates of user 1 and user 2 are 0.2 and 0.4 respectively. You can use the sample code of the MATLAB given there or you can use any programming tool to simulate the Chiu-Jain algorithm.