

**Subject:** Re: Communication prelim questions  
**From:** Alex Dimakis <adim@eecs.berkeley.edu>  
**Date:** Wed, 05 Jan 2005 06:58:40 -0800  
**To:** Ruth Gjerde <ruthg@eecs.berkeley.edu>

Hi Ruth,

There were three questions as usual. I will give you brief outlines of the problems as I remember them.

The first was a signals and systems question that involved a wireless communication system. There were multiple paths and each path was characterized by a time delay and an amplitude gain. The first part was to determine if this is an LTI system. The answer was yes because the final signal can be seen as a convolution with an impulse response that completely characterized the communication system. We were asked to find this impulse response and find the maximum number of bits that can go through this channel given a bandwidth constraint. The main things tested were sampling, discrete time processing of analog signals and basic communication systems. (at the level of 120).

The second question was a probability problem. It involved a car monitoring system that was recorded arrival and departure times of cars and had some stochastic errors. The first part was a short discussion on stochastic modeling. We were asked to find a reasonable model for the errors of the monitoring system. We finally modeled the errors as uniform random variables. Then, we were asked to find an estimator for the speed of the cars and then we were asked to find if this estimator is biased. Then we were asked to determine if the bias is positive or negative. For this last part we needed to use Jensen's inequality on the convex function  $1/x$ .

The third question was about a discrete time Markov chain that modeled TCP/IP connections. The first part required to determine the limit of an expected value. To solve this one needed to use conditional expectations. Then there were some questions about the classification of the Markov chain. What complicated thing was that there was an infinite number of states and we needed to ensure that the state space was countable and find if the chain was positive recurrent or null recurrent. The whole question tested discrete time Markov chain material at the level of 126 and 226.

There are probably parts that I forget, I hope this helps 😊

-Alex

Ruth Gjerde wrote:

Alex,

Congratulations on passing the prelim! I wonder if you might do me (and future students) a favor. The Comm. prelim committee did not submit their questions for the recent exam. That is unfortunate because I know students find the previous questions helpful in preparing for prelims. Would you please write up the questions as you remember them and submit them to me? This will be appreciated by future students!

Thanks,  
Ruth