

# List with final homeworks

Stochastic Processes

Deadline April, 2013

## Markov Chains

1. Let us consider the random walk on a cycle on  $N + 1$  vertices,  $N \geq 1$ , labelled  $0, 1, 2, \dots, N$ . Let the walk be started at 0 and allow it to run until all vertices have been visited and then the walk has returned to 0.  
Study the behavior of the expected number of visits to all other vertices  $1, 2, \dots, N$  in the cycle during this journey of the random walk.
2. A random walk starts at the origin and moves up-right or down-right with equal probability. Study the behavior of the expected value of the first time that the walk is  $k$  steps below its then-current all time high. For instance, with the walk UDDUUUDDUDD..., the walk is three steps below its maximum-so-far on step 12.
3. Study cases on the stability of  $n$ -player evolutionary games, according to my draft with Professor Cuesta.<sup>1</sup>

## Poisson Process and Renewals

4. Simulation of 3D-*Random Sewings* for the sphere. If you like problems related to image reconstruction and nonparametric statistics this is your homework. The homework involves programming based on MatLab library, Delaunay diagram, and spatial Binomial and Poisson stochastic process.<sup>2</sup>
5. A review on collective risk theory, providing the last results in research and development on the topic.
6. Brief tutorial on queues in MatLab. Providing study cases and lot of simulations.

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<sup>1</sup>This homework may be a starting point for a future research work on an interdisciplinary problem related with evolutionary games and applied probability.

<sup>2</sup>This homework would be the starting point of a joint research with the Digital Image Lab of the Gregorio Marañón Hospital