Faculty of Engineering

Department of Engineering Mathematics

EM 509 Stochastic Processes
Problems for Projects

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1. The following are stochastic processes which can be modeled as a Markov process. Each of you need to pick one model and do the following.

   (i) Interpret the process as a Markov process by clearly showing the following.

      (a) Justify why the Markov property is applicable.
      (b) Describe the states and and interpret it graphically.
      (c) Classify the states such as recurrent, transient and determine whether the process is irreducible.
      (d) Find stationary distributions if any.

   (ii) Pick an application from your field of study that fits into this process.

   Stochastic Processes

   (a) Random walk with or without barriers. The barriers may be reflecting, absorbing, or neither[Cryptography, Network]
   (b) Branching processes[spread of infectious diseases, cloud computing, data structures]
   (c) Birth death processes[demography, queueing theory, performance engineering, epidemiology, biology]
   (d) Queueing theory[communication networks and computer operations, transportation, manufacturing, and the service industry]
   (e) Hidden Markov models[bioinformatics]
   (f) Reliability theory[computer networks]
   (g) Markov random fields[image analysis]
   (h) Poisson process[Computer networks]

2. If you are interested in Gaussian processes you can work on the following.
   Correlated Gaussian stochastic processes:

   (a) Gaussian wave model
   (b) stochastic Lagrange model

You need to define correlated Gaussian stochastic processes, special features of them(as we did for Markov processes). Then pick one of the above models and explain why is the model a correlated Gaussian stochastic process. Also pick an application from your field of study that fits into this process.