

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Department of Electrical Engineering and Computer Science
Department of Mechanical Engineering

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Information and Entropy

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Homework 9

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Problem 1

Write a MATLAB program to simulate the evolution of a one dimensional vector with 12 elements each capable of having a state of a 1 or a 0. Place 4 1's on the lefthand side which will be the initial state of the system (entropy is 0). On each iteration, randomly choose any adjacent pair of elements and swap them. Treat the elements on the ends of the vector as a pair (circular vector).

Run this for 100,000 time iterations. What is the probability that an element contains a 1? What would you expect to happen if the elements on the ends are not treated as a pair (the vector is not circular)?

Problem 2

To convince you that adding more variables to a system of equations can actually help solve them, use Lagrange Multipliers to solve the following problem.

What is the maximum volume of a rectangular solid which can be placed inside a sphere of radius $r=a$? (Hint: Use the equation of a sphere as your constraint and apply it to the volume of the rectangular solid.)