Assignment 6
Probability and Random Variables

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I. Problem

If each element of a second order determinant is either zero or one, what is the probability that the value of the determinant is positive? (Assume that the individual entries of the determinant are chosen independently, each value being assumed with probability $\frac{1}{2}$).

II. Solution

P(1) = P(0) = p = $\frac{1}{2}$ = 0.5

X_i denote the random variable of each element in the matrix being 0 or 1. $\implies$ $P(X_i)$=0.5

The elements of the matrix can be arranged in 2^4 = 16 ways. The favourable arrangements for determinant to be positive are: $\begin{bmatrix}1 & 0\\0 & 1\end{bmatrix}$, $\begin{bmatrix}1 & 0\\1 & 1\end{bmatrix}$, $\begin{bmatrix}1 & 1\\0 & 1\end{bmatrix}$

Probability of positive determinant = $\frac{3}{16}$ = 0.187

The probabilities were simulated using the python code.

Download python code from here

https://github.com/Swati-Mohanty/AI5002/blob/main/Assignment_6/codes/detmatrix.py

Download latex code from here-

https://github.com/Swati-Mohanty/AI5002/blob/main/Assignment_6/codes/assignment6.tex