AI1103-Assignment-1

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https://github.com/VamsiPreetham−21/AI1103−Assignment−−−1/blog/main/Assignment1.py

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Question - 5.5
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 are chosen independently each value being assumed with probability 1/2)
Solution :
Total number of entries in the matrix are 4.Let the entries be $(a_{11}, a_{12}, a_{21}, a_{22})$ where the suffixes represent their row and column number respectively.Matrix

$$\mathbf{M} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}. \tag{0.0.1}$$

Let X∈{0,1} be a random variable denoting the possible value for each entry.

$$\Pr(X = 0) = \frac{1}{2} \tag{0.0.2}$$

$$\Pr(X = 1) = \frac{1}{2} \tag{0.0.3}$$

For the determinant of the matrix to be positive

$$a_{11}a_{22} - a_{12}a_{21} > 0 \tag{0.0.4}$$

Then the entries a_{11}, a_{22} must be one and at least one among a_{12}, a_{21} should be zero.

$$= \Pr(X = 1)\Pr(X = 1)(1 - (\Pr(X = 1)\Pr(X = 1))) \tag{0.0.5}$$

$$= \frac{1}{4} \times \left(1 - \frac{1}{4}\right) \tag{0.0.6}$$

$$= \frac{3}{16} \tag{0.0.7}$$