

# AI1103-Assignment-1

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<https://github.com/VamsiPreetham-21/AI1103-Assignment---1/blob/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. Let  $X \in \{0,1\}$  be a random variable denoting the possible value for each entry.

$$\Pr(X = 0) = \frac{1}{2} \quad (0.0.1)$$

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

For the determinant of the matrix to be positive  $a_{11}a_{22} - a_{12}a_{21} > 0$ . Then the entries  $a_{11}, a_{22}$  must be one and at least one among  $a_{12}, a_{21}$  should be zero.

$$= \Pr(X = 1) \Pr(X = 1) (1 - (\Pr(X = 1) \Pr(X = 1))) \quad (0.0.3)$$

$$= \frac{1}{4} \times \left(1 - \frac{1}{4}\right) \quad (0.0.4)$$

$$= \frac{3}{16} \quad (0.0.5)$$