

# AI1103 - Assignment - 1

Name : Vamsi Preetham Jumala

Roll No : CS20BTECH11058

Download all python codes from

<https://github.com/VamsiPreetham-21/AI1103-Assignment---1/blob/main/Assignment1.py>

Download all latex codes from

<https://github.com/VamsiPreetham-21/AI1103-Assignment---1/blob/main/Assignment1.tex>

## 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  $X = (0, 1)$  be a random variable denoting the possible value for each entry.

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

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

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 one.

$$= \Pr(X = 1) \Pr(X = 1) (1 - (\Pr(X = 1) \Pr(X = 0))) \quad (3)$$

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

$$= \frac{3}{16} \quad (5)$$