Assignment 6

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Download all python codes from

https://github.com/adhvik24/AI1103-PROBABILITY-AND-RANDOM-VARIABLES/tree/main/ASSIGNMENT_6/codes

and latex-tikz codes from

https://github.com/adhvik24/AI1103-PROBABILITY-AND-RANDOM-VARIABLES/blob/main/ASSIGNMENT_6/AI1103_Assignment6.tex

1 CSIR UGC NET EXAM (Dec 2015), Q.3

The probability that a ticketless traveler is caught during a trip is 0.1. If the traveler makes 4 trips , the probability that he/she will be caught during at least one of the trips is:

1) $1-(0.9)^4$
2) $(1-0.9)^4$
3) $1-(1-0.9)^4$
4) $(0.9)^4$

2 Solution

Let $X_i \in \{0,1\}$ represent the ith trip where 1 denotes a ticketless traveller is caught.
Given,

$$\Pr(X_i = 1) = p = 0.1 \tag{2.0.1}$$

Let,

$$X = \sum_{i=1}^{n} X_i \tag{2.0.2}$$

where n is the number of trips and X has a binomial distribution.

$$p_X(k) = \begin{cases} {}^{n}\mathrm{C}_k \, p^K (1-p)^{n-k}, & 0 \le k \le n \\ 0, & otherwise \end{cases} \tag{2.0.3}$$

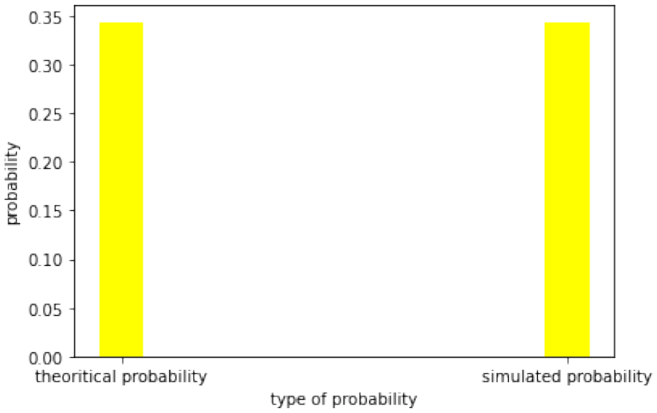

Fig. 1: probability that he/she will be caught during at least one of the trips

As he/she makes 4 trips in total, Using (2.0.1) and (2.0.3),

$$\Pr(X = 0) = p_X(0) \tag{2.0.4}$$
$$= {}^{4}\mathrm{C}_0 \, p^0 (1-p)^4 \tag{2.0.5}$$
$$\Pr(X = 0) = (0.9)^4 \tag{2.0.6}$$

Then probability of being caught in atleast one trip is,(Using (2.0.6))

$$\Pr(X \ge 1) = 1 - \Pr(X < 1) \tag{2.0.7}$$
$$= 1 - \Pr(X = 0) \tag{2.0.8}$$
$$= 1 - (0.9)^4 \tag{2.0.9}$$

Therefore the probability that he/she will be caught during at least one of the trips is $1-(0.9)^4$.
ANSWER : (1)