

AI1103: Assignment 1

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Download all python codes from

<https://github.com/Geetha495/AI1103/blob/main/Assignment1/Assignment1.py>

and latex-tikz codes from

<https://github.com/Geetha495/AI1103/blob/main/Assignment1/Assignment1.tex>

1 PROBLEM

Determine $\Pr(E|F)$, if a coin is tossed three times

- i E : head on third toss , F : heads on first two tosses
- ii E : at least two heads , F : at most two heads
- iii E : at most two tails , F : at least one tail

2 SOLUTION

In an experiment of tossing a coin $n(=3)$ times, random variable $X \in \{0, 1, 2, 3\}$ follows binomial distribution.

The binomial distribution formula is:

$$\Pr(X = k) = {}^nC_k \times p^k \times (1 - p)^{n-k}$$

Where:

k	total number of “successes”
p	probability of a success on an individual trial
n	number of trials = 3

TABLE 3: The binomial distribution formula

- (i) From table 3, $\Pr(E|F) = 0.5$
- (ii) X denotes number of heads. From table 3, $\Pr(E|F) = 0.428$
- (iii) X denotes number of tails. From table 3, $\Pr(E|F) = 0.857$

Pr(Event)	Calculation
$\Pr(F)$	From product rule , $= \frac{1}{2} \times \frac{1}{2}$ $= 0.25$
$\Pr(EF)$	From product rule, $= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$ $= 0.125$
$\Pr(E F)$	$= \frac{\Pr(EF)}{\Pr(F)}$ $= 0.5$

TABLE 3: Part(i)

Pr(Event)	Calculation
$\Pr(F)$	$= \Pr(X \leq 2)$ $= \Pr(X = 0) + \Pr(X = 1) + \Pr(X = 2)$ $= {}^3C_0 \left(\frac{1}{2}\right)^3 + {}^3C_1 \left(\frac{1}{2}\right)^3 + {}^3C_2 \left(\frac{1}{2}\right)^3$ $= 0.875$
$\Pr(EF)$	$= \Pr(X = 2)$ $= 0.375$
$\Pr(E F)$	$= \frac{\Pr(EF)}{\Pr(F)}$ $= 0.428$

TABLE 3: Part(ii)

Pr(Event)	Calculation
$\Pr(F)$	$= \Pr(X \geq 1)$ $= 1 - \Pr(0)$ $= 0.875$
$\Pr(EF)$	$= \Pr(X = 1) + \Pr(X = 2)$ $= 0.75$
$\Pr(E F)$	$= \frac{\Pr(EF)}{\Pr(F)}$ $= 0.857$

TABLE 3: Part(iii)