

# PROBABILITY AND RANDOM VARIABLES

## Assignment 4

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Download latex-tikz codes from

[https://github.com/VARSHITHAGANJI/AI1103\\_PROBABILITY-AND-RANDOM-VARIABLES/blob/main/Assignment4.tex](https://github.com/VARSHITHAGANJI/AI1103_PROBABILITY-AND-RANDOM-VARIABLES/blob/main/Assignment4.tex)

### PROBLEM

#### ISS Statistics Paper I Question 12

Two cannons  $A_1$  and  $A_2$  fire at the same target. Cannon  $A_1$  fires on an average 9 projectiles in the time in which cannon  $A_2$  fire 10 projectiles. But on an average 7 out of 10 projectiles from cannon  $A_1$  and 6 out of 10 projectiles from cannon  $A_2$  strike the target. If in the course of shooting, the target is struck by one projectile, then the probability that it is struck by projectile from cannon  $A_1$  is

- 1)  $\frac{20}{41}$
- 2)  $\frac{21}{41}$
- 3)  $\frac{6}{19}$
- 4)  $\frac{63}{190}$

### SOLUTION

Let  $S$  represent the event that the target is struck by a projectile. Let  $A_i$  represent the event that cannon  $A_i$  fires a projectile.

We need to calculate the conditional probability  $\Pr(A_1|S)$ . By Bayes Theorem, we get

$$\Pr(A_1|S) = \frac{\Pr(S|A_1) \Pr(A_1)}{\Pr(S|A_1) \Pr(A_1) + \Pr(S|A_2) \Pr(A_2)} \quad (0.0.1)$$

In (0.0.1),

$\Pr(S|A_i)$  represents the conditional probability of cannon  $A_i$  striking the target. Given,

$$\Pr(A_1) = \frac{9}{19} \quad (0.0.2)$$

$$\Pr(A_2) = \frac{10}{19} \quad (0.0.3)$$

$$\Pr(S|A_1) = \frac{7}{10} \quad (0.0.4)$$

$$\Pr(S|A_2) = \frac{6}{10} \quad (0.0.5)$$

Substituting the values, we get

$$\Pr(A_1|S) = \frac{\frac{7}{10} \frac{9}{19}}{\frac{7}{10} \frac{9}{19} + \frac{6}{10} \frac{10}{19}} \quad (0.0.6)$$

$$= \frac{63}{63 + 60} \quad (0.0.7)$$

$$= \frac{21}{41} \quad (0.0.8)$$

$$(0.0.9)$$

Therefore, option 2 is correct.