

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

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) $\frac{63}{190}$

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

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

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

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

$$(0.0.9)$$

Therefore, option 2 is correct.

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

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