

AI 1103 - Assignment 2

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Download all python codes from

https://github.com/rohanthota/Assignment_2/codes/Assignment_2.py

and latex codes from

https://github.com/rohanthota/Assignment_2/Assignment_2.tex

Question

A box contains 5 red marbles, 8 white marbles and 4 green marbles. One marble is taken out of the box at random. What is the probability that the marble taken out will be

- 1) red ?
- 2) white ?
- 3) not green?

Solution

Total number of marbles = 5 + 8 + 4 = 17 marbles.

Here, we define random variable $X \in \{0, 1, 2\}$

Where,

$X = 0$ refers to the case of picking a red marble

$X = 1$ refers to the case of picking a white marble

$X = 2$ refers to the case of picking a green marble

- 1) The probability that a red marble was picked, can also be written as $\Pr(X = 0)$

$$\Pr(X = 0) = \frac{\text{number of red marbles}}{\text{total number of marbles}} = \frac{5}{17}$$

$$\therefore \Pr(X = 0) = \frac{5}{17} = 0.294118$$

- 2) The probability that a white marble was picked, can be written as $\Pr(X = 1)$

$$\Pr(X = 1) = \frac{\text{number of white marbles}}{\text{total number of marbles}} = \frac{8}{17}$$

$$\therefore \Pr(X = 1) = \frac{8}{17} = 0.470589$$

- 3) The probability that the marble picked was not green can be written as $\Pr(X \neq 2)$.

We know that $\Pr(X \neq 2) + \Pr(X = 2) = 1$.
(because they are complimentary events.)

$$\Pr(X = 2) = \frac{\text{number of green marbles}}{\text{total number of marbles}} = \frac{4}{17}$$

$$\Rightarrow \Pr(X = 2) = \frac{4}{17} = 0.235294$$

$$\Rightarrow \Pr(X \neq 2) = 1 - \Pr(X = 2) = 0.764706$$

$$\therefore \Pr(X \neq 2) = 0.764706$$

TABLES AND GRAPHS

- 1) Table representing probabilities of the different situations (theoretical values).

Conditions	$X = 0$	$X = 1$	$X \neq 2$
Theor. Prob.	$\frac{5}{17}$	$\frac{8}{17}$	$\frac{13}{17}$

Table representing probabilities of the different situations after simulations in python.

Conditions	$X = 0$	$X = 1$	$X \neq 2$
Simulated Prob.	0.293678	0.471032	0.76471

- 2) Drawing the comparison graph with ages on x-axis, probabilities on y-axis, blue bar representing simulations and orange bar representing theoretical value, we get

Comparison plot between simulated and theoretical estimations.

