

Assignment 2 -Probability and Random Variable

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Problem Statement prob 2.4-Suppose that 5% of men and 0.25% of women have grey hair. A grey haired person is selected at random. What is the probability of this person being male? Assume that there are equal number of males and females.

Solutions:

Say there are 100 people. Half of them men and half of them women. 5% of men have grey hair(2.5 men) and 0.25% of women have grey hair(0.125 women)

	Men	Women	Total
	50	50	100
Greyhair	2.5	0.125	

$$\begin{aligned}
 \text{Required probability} &= \frac{\text{Men with grey hair}}{\text{total grey haired persons}} \\
 \text{grey hair} &= \frac{2.5}{2.5+0.125} \\
 &= \frac{2.5}{2.625} \\
 &= \mathbf{0.95238}
 \end{aligned}$$

Another way using Bayes theorem:

M - of men, W = of women , G = of grey persons $P(M) = 0.5 = P(W)$

$$P(G|M) = 0.05$$

$$P(G|W) = 0.0025$$

$P(M|G)$ is what we need to find

By bayes theorem,

$$\begin{aligned}
 P(M|G) &= \frac{P(M, G)}{P(G)} \\
 &= \frac{P(G|M)P(M)}{P(G)} \\
 &= \frac{P(G|M)P(M)}{P(G|M)P(M) + P(G|W)P(W)} \\
 &= \frac{0.05 * 0.5}{0.05 * 0.5 + 0.0025 * 0.5} \\
 &= \frac{0.025}{0.02625} \\
 &= \mathbf{0.95238}
 \end{aligned}$$