

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	

Required probability = how many of men have grey

$$\text{hair} = \frac{\text{Men with grey hair}}{\text{total grey haired persons}}$$

$$= \frac{2.5}{2.5+0.125}$$

$$= \frac{2.5}{2.625}$$

$$= \mathbf{0.95238}$$

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,

$$P(M|G) = \frac{P(M,G)}{P(G)} = \frac{P(G|M)P(M)}{P(G)} =$$

$$\frac{P(G|M)P(M)}{P(G|M)P(M)+P(G|W)P(W)} \text{by total probability theorem}$$

$$= \frac{0.05*0.5}{0.05*0.5+0.0025*0.5} = \frac{0.025}{0.02625} =$$

0.95238 is the required probability