Assignment 1

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1 PROBLEM(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.

2 SOLUTION(2.4)

Let A=0,1 represent the random variable for being male or female and G=0,1 represent having grey hair or not.Then,

$$P(A = 0) = 50\% = \frac{1}{2} \tag{2.0.1}$$

$$P(A = 1) = 50\% = \frac{1}{2} \tag{2.0.2}$$

$$P(G = 1|A = 0) = 5\% = \frac{1}{20} \tag{2.0.3}$$

$$P(G = 1|A = 1) = 0.25\% = \frac{1}{400} \tag{2.0.4}$$

By Bayes rules,

$$P(A = 0|G = 1) = \frac{P(0) \times P(G = 1|0)}{\sum_{i=0}^{1} \Pr(G)} \tag{2.0.5}$$

$$\because \sum_{i=0}^{1} \Pr(G) = P(0) \times P(G = 1|0) + P(1) \times P(G = 1|1) \tag{2.0.6}$$

$$P(A = 0|G = 1) = \frac{\frac{1}{2} \times \frac{1}{20}}{\frac{1}{2} \times \frac{1}{20} + \frac{1}{2} \times \frac{1}{400}} \tag{2.0.7}$$

$$P(A = 0|G = 1) = \frac{20}{21} \tag{2.0.8}$$

Probability that the grey haired person selected at random is male is 0.952380952.