Question 2

Suppose that women who live beyond the age of 80 outnumber men in the same age group by three to one. How much information, in bits, is gained by learning that a person who lives beyond 80 is male?

Solution

Let

$$\mathbb{P}(W) := \text{probability of being a woman beyond the age of 80}$$
$$\mathbb{P}(M) := \text{probability of being a man beyond the age of 80}$$

Then we have

$$\mathbb{P}(W) = \frac{3}{4}$$
$$\mathbb{P}(M) = \frac{1}{4}$$

So that

$$I(X) = -log_2(\mathbb{P}(M)) = 2\text{bits}$$

Answer

$$\boxed{I(X) = 2\text{bits}}$$