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MAT 330/681 (Spring 2020)
Quiz 2

A public health researcher examines the medical records of a group of 937 men who died in 1999 and discovers that 210 of the men died from causes related to heart disease. Moreover, 312 of the 937 men had at least one parent who suffered from heart disease, and, of these 312 men, 102 died from causes related to heart disease.

Determine the probability that a man randomly selected from this group died of causes related to heart disease, given that neither of his parents suffered from heart disease.

(Disclaimer: The above problem is a reproduction of a copyrighted sample question from the *P Exam* of the Society of Actuaries.)

H = die from heart disease

F = family history (at least 1 parent) w/ heart disease

From the problem, we infer:

$$P(H) = \frac{210}{937}, \quad P(F) = \frac{312}{937}, \quad P(H|F) = \frac{102}{312}$$

$$\text{Thus: } P(F^c) = 1 - \frac{312}{937} = \frac{937 - 312}{937} = \frac{625}{937}$$

Want: $P(H|F^c)$.

$$P(H) = P(H|F^c)P(F^c) + P(H|F)P(F)$$

$$\frac{210}{937} = P(H|F^c) \cdot \frac{625}{937} + \frac{102}{312} \cdot \frac{312}{937}$$

$$210 = P(H|F^c) \cdot 625 + 102 \Rightarrow P(H|F^c) = \frac{108}{625}$$