

## Answer on Question #61185 – Math – Statistics and Probability

### Question

Your favorite team is in the final playoffs. You have assigned a probability of 60% that it will win the championship. Past records indicate that when teams win the championship, they win the first game of the series 70% of the time. When they lose the series, they win the first game 25% of the time. The first game is over; your team has lost. What is the probability that it will win the series?

### Solution

First we will define events. Let  $W$  be the event that your team wins the championship and  $F$  be the event that they win the first game (so  $W^c$  is the event they lose the championship and  $F^c$  is the event that they lose the first game). Given

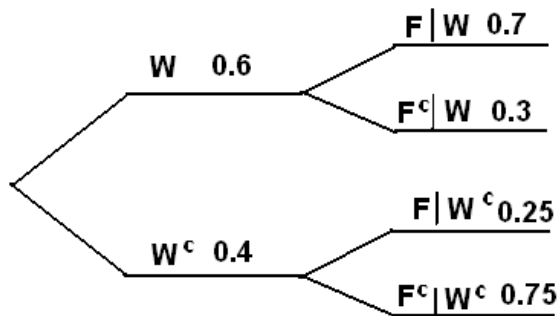
$$P(W) = 0.6, \quad P(F|W) = 0.7, \quad P(F|W^c) = 0.25,$$

and using the formulae  $P(A) + P(A^c) = 1$  and  $P(B^c|A) + P(B|A) = 1$ , we find

$$P(W^c) = 1 - P(W) = 1 - 0.6 = 0.4, \quad P(F^c|W) = 1 - P(F|W) = 1 - 0.7 = 0.3,$$

$$P(F^c|W^c) = 1 - P(F|W^c) = 1 - 0.25 = 0.75,$$

and complete the following probability tree:



Now, since we want to compute  $P(W|F^c) = \frac{P(W \cap F^c)}{P(F^c)}$ , we only need to find  $P(W \cap F^c)$  and  $P(F^c)$ . Next,

$$P(W \cap F^c) = P(F^c|W) P(W) = 0.3 \cdot 0.6 = 0.18.$$

We note that  $P(F^c) = P(W \cap F^c) + P(W^c \cap F^c)$  (the team either loses the first game and wins the series or loses the first game and loses the series, and these are mutually exclusive events).

We already know  $P(W \cap F^c)$ , so we only need to find  $P(W^c \cap F^c)$ :

$$P(W^c \cap F^c) = P(F^c|W^c) P(W^c) = 0.75 \cdot 0.4 = 0.3.$$

So  $P(F^c) = P(W \cap F^c) + P(W^c \cap F^c) = 0.18 + 0.3 = 0.48$ . Thus,

$$P(W|F^c) = \frac{P(W \cap F^c)}{P(F^c)} = \frac{0.18}{0.48} = 0.375.$$

**Answer:** 0.375.