You've made it to the $1 million question, but it's a tough one. Out of the four choices, A, B, C and D, you're 70 percent sure the answer is B, and none of the remaining choices looks more plausible than another. You decide to use your final lifeline, the 50:50, which leaves you with two possible answers, one of them correct. Lo and behold, B remains an option! How confident are you now that B is the correct answer?

Since there is no difference relevant to this problem between A, C, and D, let us for convenience assume that after we invoke our 50:50, the possible answers remaining are A and B. The 50:50 has given us the information that either A or B is the right answer. We then want to find the probability that, given that A or B is correct, B is correct. We can invoke Bayes' Theorem to see that that probability is equal to

$$P(B|A \cup B) = \frac{P(A \cup B|B)P(B)}{P(A \cup B)}.$$

The probability that either A or B is correct given that B is correct is clearly 1, so the $P(A \cup B|B)$ disappears from our equation, leaving us with

$$P(B|A \cup B) = \frac{P(B)}{P(A \cup B)}.$$

This we can determine from the probabilities we knew before invoking the 50:50. $P(B) = .7$, and the remaining .3 of probability was divided evenly between A, C, and D, so $P(A) = .1$. Thus $P(A \cup B) = .8$, and therefore

$$P(B|A \cup B) = \frac{.7}{.8} = .875.$$

Hence, you can now be 87.5 percent confident that B is the correct answer.

■