

This problem is taken from Pitman (1993) Probability: Suppose a fair coin is tossed n times. Find a simple formula in terms of n and k for the following probability: $Pr(k \text{ heads} | k-1 \text{ heads or } k \text{ heads})$. Please pay close attention to the formula, particularly what event is conditioned on what events. Ch. 2.1, Problem 10 b) (p. 91)

Hint 1: Use the binomial distribution to model this.

Hint 2: Because those events are mutually exclusive, calculate the following:

$$\frac{Pr(k \text{ heads})}{Pr(k \text{ heads}) + Pr(k-1 \text{ heads})}$$

This is true because: $Pr(A|B) = \frac{Pr(A \cap B)}{Pr(B)}$

The intersection of events A and B in this case, $Pr(k \text{ heads} \cap (k \text{ heads} \cup k-1 \text{ heads}))$, reduces to $Pr(k \text{ heads})$ because the two events are mutually exclusive.