

STEP II, 2004, Q14 MS

Q14 The introductory result may be explained by means of a diagram. Alternatively, replacing B by $B \cup C$ in $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ will lead to the displayed result almost immediately.

- $P_r = P(\text{at least one pudding contains no sixpence}) = 3 \left[\left(\frac{2}{3}\right)^r - \left(\frac{1}{3}\right)^r \right]$.
- $P_5 = 31/81 > 1/3$, $P_6 = 7/27 < 1/3 \Rightarrow \min(r) = 6$.
- With $r = 6$, let A be the event that each pudding contains ≥ 1 sixpences and let B be the event that each pudding contains 2 sixpences. Then,

$$P(A) = 1 - 7/27 = 20/27,$$

$$P(A \cap B) = P(B) = \dots = 10/81,$$

$$P(B|A) = (10/81)/(20/27) = 1/6.$$



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