

## STEP II, 2006, Q12 MS

**Q12** In (i), the probability that one wicket is taken is

$$p(A1 \cap B0 \cap C0) + p(A0 \cap B1 \cap C0) + p(A0 \cap B0 \cap C1),$$

each of which is a product of three terms from a binomial distribution. The probability that it was Arthur who took the wicket is then the conditional probability

$$\frac{p(1,0,0)}{p(1,0,0) + p(0,1,0) + p(0,0,1)}.$$

Although this looks a pretty ferocious creature with all its terms in it, in fact almost all of them cancel in the fraction, and you are left with a few products to deal with (most involving further cancellable terms).

Part (ii) is a “quickie” –  $30 \times \left( \frac{1}{36} + \frac{1}{25} + \frac{1}{41} \right)$  – to point you towards the use of the simple value of 3 in the next part. In (iii), since  $n$  is large and  $p$  is small, the Binomial can be approximated by the Poisson; and  $p(W \geq 5) = 1 - \{p_0 + p_1 + p_2 + p_3 + p_4\}$ . From here, you can use either the approximation  $e^3 = 20$  (as given) and work with Poisson terms directly, or just resort to the use of the Poisson tables in your formula books.

**Answers:** (i)  $\frac{3}{10}$  .



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