

STEP III, 1999, Q12

12 In the game of endless cricket the scores X and Y of the two sides are such that

$$P(X = j, Y = k) = e^{-1} \frac{(j+k)\lambda^{j+k}}{j!k!},$$

for some positive constant λ , where $j, k = 0, 1, 2, \dots$.

- (i) Find $P(X + Y = n)$ for each $n > 0$.
- (ii) Show that $2\lambda e^{2\lambda-1} = 1$.
- (iii) Show that $2xe^{2x-1}$ is an increasing function of x for $x > 0$ and deduce that the equation in (ii) has at most one solution and hence determine λ .
- (iv) Calculate the expectation $E(2^{X+Y})$.



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