



STEP III, 2002 Q14

- 14 Prove that, for any two discrete random variables X and Y ,

$$\text{Var}[X + Y] = \text{Var}[X] + \text{Var}[Y] + 2 \text{Cov}[X, Y],$$

where $\text{Var}[X]$ is the variance of X and $\text{Cov}[X, Y]$ is the covariance of X and Y .

When a Grandmaster plays a sequence of m games of chess, she is, independently, equally likely to win, lose or draw each game. If the values of the random variables W , L and D are the numbers of her wins, losses and draws respectively, justify briefly the following claims:

- (i) $W + L + D$ has variance 0;
- (ii) $W + L$ has a binomial distribution.

Find the value of $\frac{\text{Cov}[W, L]}{\sqrt{\text{Var}[W] \text{Var}[L]}}$.



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