Discrete Random Variables Q2 [Practice/E](9/6/21)

The random variables X_i , for $i = 1$ to 100, are independent, and $P(X_i = 1) = P(X_i = -1) = \frac{1}{2}$

Find:

(i) $Var(X_1)$

(ii) $Var(X_1 + X_2 + \cdots + X_{100})$

(iii) $Var(100X_1)$

(iv) $Var(X_1 - X_2)$

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Solution

(i) $Var(X_1) = E\left({X_1}^2\right) - (E(X_1))^2$

$= \left\{\frac{1}{2} .1 + \frac{1}{2}.1\right\} - 0 = 1$

(ii) $Var(X_1 + X_2 + \cdots + X_{100})$

$= Var(X_1) + Var(X_2) + \cdots + Var(X_{100})$

(as the X_i are independent)

$= 100(1) = 100$

(iii) $Var(100X_1) = 100^2 Var(X_1) = 10000$

(iv) $Var(X_1 - X_2) = 1^2 Var(X_1) + (-1)^2 Var(X_2)$

$= 1 + 1 = 2$