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Mean and Variance

(Haf 2005)

3. The weights, X kg, of male students in a hall of residence are normally distributed with mean 70 kg and standard deviation 6 kg.

(a) Find the probability that the weight of a randomly chosen male student lies between 67 kg and 79 kg. [5]

The weights, Y kg, of female students in the hall of residence are normally distributed with mean 50 kg and standard deviation 5 kg.

(b) Find the mean and variance of the random variable $2Y - X$. Hence find the probability that the weight of a randomly chosen male student is more that twice the weight of a randomly chosen female student. [6]

(c) The hall of residence has a lift installed with a maximum recommended load of 500 kg. On one occasion, there are 3 male students and 6 female students in the lift. Find the probability that their combined weight exceeds the recommended maximum. [6]

(Haf 2006)

8. *(a)* State the Central Limit Theorem. [1]

(b) When a cubical die is thrown, the score obtained has a mean of $\frac{7}{2}$ and a variance of $\frac{35}{12}$. Such a die is thrown 50 times. Find, approximately, the probability that the mean of the 50 scores obtained exceeds 3. [5]

(Haf 2007)

2. The independent random variables X and Y are Poisson distributed with means 2 and 3 respectively.

(a) (i) Show that $E(X^2) = 6$ and evaluate $E(Y^2)$.

(ii) Deduce the value of $E(X^2Y^2)$. [5]

(b) The random variable U is defined by

$$U = XY.$$

Determine the standard deviation of U. [4]

(Haf 2008)

2. The random variable X has the binomial distribution B(10, 0·4) and, independently, the random variable Y has the binomial distribution B(30, 0·3).

(a) Show that $E(X^2) = 18{\cdot}4$ and evaluate $E(Y^2)$. [5]

(b) The random variable U is defined by

$$U = XY.$$

Determine the mean and variance of U. [4]

(Haf 2009)

5. *(a)* The random variable X has the binomial distribution B $(20, 0{\cdot}4)$. Find the value of

(i) $E(X)$,

(ii) $E(X^2)$. [4]

(b) The random variable Y has a Poisson distribution with mean μ. Given that $E(Y^2) = 9{\cdot}36$, determine the value of μ. [4]

(c) The random variables X and Y are independent and $U = XY$. Determine the variance of U. [4]

(Haf 2010)

4. *(a)* The random variable X has the binomial distribution $B(n, p)$. Given that $E(X) = 3$ and $E(X^2) = 11{\cdot}1$, find the values of n and p. [6]

(b) The independent random variable Y has the binomial distribution $B(15, 0{\cdot}4)$ and $U = XY$. Find the mean and variance of U. [8]

(Haf 2012)

1. The random variables X and Y are independent, X with mean 5 and variance 2 and Y with mean 6 and variance 3.

(a) Determine the values of $E(X^2)$ and $E(Y^2)$. [3]

(b) Given that $U = XY$, find the mean and variance of U. [5]

(Haf 2014)

5. The random variables X and Y are independent observations from the binomial distribution B(6, 0·2). Given that $U = XY$, determine the value of

(a) E(U), [2]

(b) Var(U). [6]

(Haf 2015)

5. A fair dice with faces numbered 1, 2, 3, 4, 5 and 6 respectively is thrown 100 times. Use the Central Limit Theorem to calculate, approximately, the probability that the mean of the 100 scores obtained is at least 3·75. [9]

(Haf 2016)

1. The independent random variables X, Y are such that X has a Poisson distribution with mean 2 and Y has a Poisson distribution with mean 3. Given that $W = XY$, determine

(a) the mean and the variance of W, [6]

(b) $P(W = 4)$. [4]

(Haf 2017)

1. The independent random variables X, Y are distributed such that X is B(5, 0·4) and Y is B(8, 0·2). Given that the random variable W is defined by $W = XY$, determine

(a) the mean and the variance of W, [9]

(b) $P(W = 0)$. [4]

(Haf 2018)

1. The random variable X has the binomial distribution B(4, 0·25) and the random variable Y has the Poisson distribution with mean 3. The random variables X and Y are independent. The random variable U is defined by $U = XY$.

(a) Evaluate $P(U = 2)$. [7]

(b) Determine the mean and the variance of U. [8]